UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

NOV 14 2013

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act (NEPA), the National Oceanic and Atmospheric Administration (NOAA) intends to adopt the U.S. Navy's *Final Environmental Impact Statement/ Overseas Environmental Impact Statement for Atlantic Fleet Training and Testing (FEIS/OEIS)* to comply with NEPA and for agency decision-making purposes. NOAA's proposed action is to issue a 5-year rulemaking and two associated Letters of Authorization (LOAs) to the Navy to take marine mammals incidental to training and testing activities, respectively, in areas of the Atlantic Ocean and the Gulf of Mexico and is related to the Navy's proposed action to conduct military readiness activities in the in areas of the Atlantic Ocean and the Gulf of Mexico. NOAA has determined that this FEIS/OEIS adequately analyzes and discloses the environmental impacts associated with this project. Therefore, we enclose this FEIS/OEIS for your review.

This FEIS/OEIS is prepared pursuant to NEPA to assess the environmental impacts associated with NOAA proceeding with issuing the rulemaking and LOAs. The National Marine Fisheries Service (NMFS) proposed action (issuance of regulations and LOAs) would authorize take of marine mammals incidental to a subset of the activities analyzed in the FEIS/OEIS that are anticipated to result in the take of marine mammals, i.e., those activities that involve the use of active sonar and explosive detonations. Thus, these components of the Navy's proposed action are interrelated as they are the subject of NMFS' Marine Mammal Protection Act (MMPA) regulatory action.

NOAA is not required to respond to comments received as a result of issuance of the FEIS/OEIS. The Navy made the FEIS/OEIS available on August 30, 2013 (78 FR 53754) and received no public comments during the FEIS/OEIS wait period. However, comments will be reviewed and considered for their impact on issuance of a record of decision (ROD). Please send comments to the responsible official identified below. The ROD will be made available publicly following final agency action on or after November 14th, 2013.

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Responsible Official: Samuel D. Rauch III
Deputy Assistant Administrator
for Regulatory Programs,
performing the functions and duties of the
Assistant Administrator for Fisheries
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
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Silver Spring, Maryland 20910
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Sincerely,

Patricia A. Montanio
NOAA NEPA Coordinator

Enclosure

Atlantic Fleet Training and Testing
Final Environmental Impact Statement / Overseas Environmental Impact Statement

Volume 1
August 2013

Lead Agency
Department of the Navy

Cooperating Agency
National Marine Fisheries Service

Action Proponents
United States Fleet Forces
Naval Air Systems Command
Naval Sea Systems Command
Office of Naval Research

For Additional Information
NAVFAC Atlantic
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FINAL ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT for ATLANTIC FLEET TRAINING AND TESTING

Lead Agency:	United States Department of the Navy
Cooperating Agency:	National Marine Fisheries Service
Title of the Proposed Action:	Atlantic Fleet Training and Testing
Designation:	Final Environmental Impact Statement/Overseas Environmental Impact Statement

Abstract

The Navy prepared this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to comply with the National Environmental Policy Act (NEPA) and Executive Order (EO) 12114. The Navy identified its need to support and conduct current, emerging, and future training and testing activities in the Atlantic Fleet Training and Testing (AFTT) Study Area, located in the western Atlantic Ocean, off the eastern coast of the United States, in the Gulf of Mexico, and in portions of the Caribbean Sea. Three alternatives were analyzed:

- The No Action Alternative included current and historic levels of activity based on previously completed Navy NEPA/EO 12114 analysis. The No Action Alternative did not include any changes to current training and testing levels.
- Alternative 1 included the activities addressed in the No Action Alternative, expansion of the Study Area, and adjustments to types and levels of training and testing activities.
- Alternative 2 (Preferred Alternative) included all elements of Alternative 1 plus established new range capabilities, modified existing capabilities, and adjusted the type and levels of training and testing.

In this EIS/OEIS, the Navy analyzed potential impacts on environmental resources resulting from activities under the alternatives. Evaluated resources included sediments and water quality, air quality, marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety.

In accordance with its At-Sea Policy, the Navy developed a programmatic approach to environmental compliance for ranges and operating areas within its areas of responsibility. The Study Area combined the geographic scope of the range complexes on the east coast of the United States and in the Gulf of Mexico and includes additional areas where training and testing activities historically occur; this EIS/OEIS also included new platforms and weapon systems not previously addressed.

Prepared by: United States Department of the Navy

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FOREWORD

The Draft Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) was released for public review and comment 25 May 2012 through 10 July 2012. Changes in this Final EIS/OEIS reflect all substantive comments made on the Draft EIS/OEIS during the public comment period and Navy refinements to the Proposed Action. Additionally, the analysis has been refined to more accurately quantify the expected acoustic effects on marine mammals, taking into consideration animal avoidance or movement and Navy mitigations. Public comments are summarized and responded to in Appendix E, Public Comments and Responses.

While most sections in the EIS/OEIS were changed in some manner between the draft and final versions, many of those changes entailed minor modifications to improve wording. The key changes between the AFTT Draft EIS/OEIS and Final EIS/OEIS follow.

- Chapter 2 (Description of Proposed Action and Alternatives):

  Annual levels of certain activities and resulting quantities of associated military expended materials were adjusted to reflect more accurate estimates of future training and testing needs and to correct errors. The general types and locations of training and testing did not change. Tables 1 through 8 identify the changes between the Draft EIS/OEIS and Final EIS/OEIS for sonar and explosive usage during training and testing by alternative.

  Some of these changes affected the modeled marine mammal exposure results, such that modeled exposures decreased overall for training, and modeled behavioral exposures increased overall for testing activities. These changes are presented in Appendix B to the Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement Technical Report, available at http://www.aftteis.com. Specifically, the modeled activities for the No Action Alternative for training increased in the FEIS because the number of hull-mounted sonar hours were underestimated in the DEIS model inputs, resulting in an overall increase in estimated marine mammal exposures for the No Action Alternative in the FEIS. For training, activities hours for Alternatives 1 and 2 increased overall, partly due to an increase in estimated sonar usage for the mine detection and classification sonar after publication of the DEIS. For testing, the number of countermeasure testing activities in the DEIS was over estimated for Alternatives 1 and 2, resulting in an overestimation of marine mammal exposures, particularly with regards to temporary threshold shift (TTS) and permanent threshold shift (PTS) in the DEIS, resulting in a corresponding decrease in modeled TTS and PTS exposures when remodeled for the FEIS. Additionally, the requirements for the anti-submarine warfare ASW2 source class testing, mid-frequency sonobuoys, increased following the publication of the DEIS, resulting in an increase in modeled behavioral response exposures. The remainder of the source class changes resulted in only minor modeled exposure changes due primarily to the types of sources and the minimal potential impact they have.

Table 1: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Training Activities Analyzed in this FEIS Compared to the DEIS

For Annual Training Activities											
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Low-Frequency (LF) Sources that produce signals less than 1 kHz	LF3	Hours	0	0	–	0	0	–	0	0	–
	LF4	Hours	0	0	–	0	0	–	0	0	–
	LF5	Hours	0	0	–	0	0	–	0	0	–
	LF6	Hours	0	0	–	0	0	–	0	0	–
Mid-Frequency (MF) Tactical and nontactical sources that produce signals from 1 to 10 kHz	MF1	Hours	3,757	4,370	+613	9,805	9,844	+39	9,805	9,844	+39
	MF1K	Hours	156	156	–	163	163	–	163	163	–
	MF2	Hours	1,618	1,498	-120	3,140	3,150	+10	3,140	3,150	+10
	MF2K	Hours	59	59	–	61	61	–	61	61	–
	MF3	Hours	1,607	1,706	+99	2,054	2,058	+4	2,054	2,058	+4
	MF4	Hours	588	647	+59	925	927	+2	925	927	+2
	MF5	Count	7,740 (774)[1]	10,112	+2,372	14,472 (1,447)[1]	14,556	+84	14,472 (1,447)[1]	14,556	+84
	MF6	Count	0	0	–	0	0	–	0	0	–
	MF8	Hours	0	0	–	0	0	–	0	0	–
	MF9	Hours	0	0	–	0	0	–	0	0	–
	MF10	Hours	0	0	–	0	0	–	0	0	–
	MF11	Hours	0	0	–	800	800	–	800	800	–
	MF12	Hours	16	23	+7	687	687	–	687	687	–
High-Frequency (HF) Tactical and nontactical sources that produce signals greater than 10 kHz but less than 180 kHz	HF1	Hours	393	410	+17	1,676	1,676	–	1,676	1,676	–
	HF2	Hours	0	0	–	0	0	–	0	0	–
	HF3	Hours	0	0	–	0	0	–	0	0	–
	HF4	Hours	3,340	6,680	+3,340	4,388	8,464	+4,076	4,388	8,464	+4,076
	HF5	Hours	0	0	–	0	0	–	0	0	–
	HF6	Hours	0	0	–	0	0	–	0	0	–
	HF7	Hours	0	0	–	0	0	–	0	0	–
	HF8	Hours	0	0	–	0	0	–	0	0	–

DEIS: draft environmental impact statement; FEIS: final environmental impact statement; HF: high frequency; kHz: kilo hertz; LF: low frequency; MF: mid-frequency

[1] In the DEIS, source class MF5 was presented as hours of use (quantity in hours shown in parentheses). The equivalent count is shown here for comparison.

Table 1: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Training Activities Analyzed in this FEIS Compared to the DEIS (Continued)

For Annual Training Activities											
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Anti-Submarine Warfare (ASW) Tactical sources used during anti-submarine warfare training and testing activities	ASW1	Hours	0	0	–	128	128	–	128	128	–
	ASW2[2]	Hours	436	0	-436	1,016	0	-1,016	1,016	0	-1,016
	ASW2[2]	Count	0	1450	+1450	0	2,620	+2,620	0	2,620	+2,620
	ASW3	Hours	3,671	5,202	+1,531	13,555	13,586	+31	13,555	13,586	+31
	ASW4	Count	211	1,006	+795	450	1,365	+915	450	1,365	+915
Doppler Sonar (DS) Sonar using Doppler effect to aid in navigation/collect oceanographic information	DS1	Hours	0	0	–	0	0	–	0	0	–
Acoustic Modems (M) Transmit data acoustically through the water	M3	Hours	0	0	–	0	0	–	0	0	–
Synthetic Aperture Sonar (SAS) Post-processed signals form high-resolution images of the seafloor	SAS1	Hours	0	0	–	0	0	–	0	0	–
	SAS2	Hours	0	0	–	0	0	–	0	0	–
	SAS3	Hours	0	0	–	0	0	–	0	0	–
Swimmer Detection Sonar (SD) Used to detect divers and submerged swimmers	SD1–SD2	Hours	0	0	–	0	0	–	0	0	–
Forward Looking Sonar (FLS) Forward or upward looking object-avoidance sonar.	FLS2–FLS3	Hours	0	0	–	0	0	–	0	0	–

ASW: anti-submarine warfare; DEIS: draft environmental impact statement; DS: Doppler sonar; FEIS: final environmental impact statement; FLS: forward looking sonar; M: acoustic modems; SAS: synthetic aperture sonar; SD: swimmer detection sonar

[2] The use of source class ASW2 proposed in Alternatives 1 and 2 is the same in both the DEIS and FEIS, although it was represented as hours in the DEIS and count in the FEIS.

Table 1: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Training Activities Analyzed in this FEIS Compared to the DEIS (Continued)

For Annual Training Activities										
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Torpedoes (TORP) Source classes associated with active acoustic signals produced by torpedoes	TORP1	Count	29	42	+13	13	54	+41	13	54	+41
	TORP2	Count	23	93	+70	20	80	+60	20	80	+60

DEIS: draft environmental impact statement; FEIS: final environmental impact statement; HF: high frequency; kHz: kilo hertz; TORP: torpedoes

Table 2: Change in Non-Annual Sonar and Other Active Acoustic Source Class Usage during Training Activities Analyzed in this FEIS Compared to the DEIS

For Non-Annual Training Activities										
Source Class Category	Source Class	Units	Usage over a 5-Year Period								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS[1]	FEIS	Change	DEIS[1]	FEIS	Change	DEIS[1]	FEIS	Change
High-Frequency (HF) Tactical and nontactical sources that produce signals greater than 10 kHz but less than 180 kHz	HF4	Hours	0	0	–	96	192	+96	96	192	+96

DEIS: draft environmental impact statement; FEIS: final environmental impact statement; HF: high frequency; kHz: kilo hertz

[1] The table describing use of sonar and other active acoustic sources during non-annual activities was inadvertently left out of the AFTT Draft EIS/OEIS. The impacts due to these activities, however, were analyzed in the AFTT Draft EIS/OEIS.

Table 3: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS

For Annual Testing Activities										
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Low-Frequency (LF) Sources that produce signals less than 1 kHz	LF3	Hours	0	0	–	0	0	–	0	0	–
	LF4	Hours	100	100	–	218	218	–	254	254	–
	LF5	Hours	551	33	-518	453	325	-128	498	370	-128
	LF6	Hours	0	0	–	8	0	-8	12	0	-12
Mid-Frequency (MF) Tactical and nontactical sources that produce signals from 1 to 10 kHz	MF1	Hours	18	18	–	156	206	+50	170	220	+50
	MF1K	Hours	5	5	–	14	18	+4	15	19	+4
	MF2	Hours	0	0	–	20	36	+16	20	36	+16
	MF2K	Hours	0	0	–	0	0	–	0	0	–
	MF3	Hours	32	32	–	369	371	+2	433	434	+1
	MF4	Hours	87	126	+39	465	698	+233	510	776	+266
	MF5	Count [1]	1,070 (107)	1,099	+29	3,394 (339)	3,802	+408	3,763 (376)	4,184	+421
	MF6	Count	1	69	+68	2	255	+253	2	303	+301
	MF8	Hours	80	80	–	72	72	–	90	90	–
	MF9	Hours	1,334	299	-1,035	12,071	11,825	-246	13,280	13,034	-246
	MF10	Hours	17	12	-5	1,064	1,066	+2	1,065	1,067	+2
	MF11	Hours	0	0	–	0	0	–	0	0	–
	MF12	Hours	0	0	–	8	144	+136	12	144	+132
High-Frequency (HF) Tactical and nontactical sources that produce signals greater than 10 kHz but less than 180 kHz	HF1	Hours	26	26	–	1,099	1,104	+5	1,239	1,243	+4
	HF2	Hours	0	0	–	0	0	–	0	0	–
	HF3	Hours	26	26	–	307	307	–	387	384	-3
	HF4	Hours	692	692	–	1,340	4,841	+3,501	1,722	5,572	+3,850
	HF5	Hours	737	219	-518	1,188	1,135	-53	1,360	1,206	-154
	HF6	Hours	1,986	433	-1,553	2,138	1,754	-384	2,358	1,974	-384
	HF7	Hours	547	30	-517	449	321	-128	494	366	-128
	HF8	Hours	0	0	–	0	0	–	0	0	–

DEIS: draft environmental impact statement; FEIS: final environmental impact statement; HF: high frequency; kHz: kilo hertz; LF: low frequency; MF: mid-frequency

[1] In the DEIS, source class MF5 was presented as hours of use (quantity in hours shown in parentheses). The equivalent count is shown here for comparison.

Table 3: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS (Continued)

For Annual Testing Activities											
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Anti-Submarine Warfare (ASW) Tactical sources used during anti-submarine warfare training and testing activities	ASW1	Hours	0	0	–	0	96	+96	0	96	+96
	ASW2[2]	Hours	434	0	-434	936	200	-736	1,047	274	-773
	ASW2[2]	Count	0	1,115	+1,115	0	2,378	+2,378	0	2,743	+2,743
	ASW3	Hours	89	89	–	822	901	+79	1,002	948	-54
	ASW4	Count	48	144	+96	133	400	+267	161	483	+322
Doppler Sonar (DS) Sonar using Doppler effect to aid in navigation/collect oceanographic information	DS1	Hours	0	0	–	0	0	–	0	0	–
Acoustic Modems (M) Transmit data acoustically through the water	M3	Hours	46	46	–	344	392	+48	414	461	+47
Synthetic Aperture Sonar (SAS) Post-processed signals form high-resolution images of the seafloor	SAS1	Hours	1,665	5	-1,552	3,432	6	-384	3,814	6	-384
	SAS2	Hours		108			3,042			3,424	
	SAS3	Hours	0	0	–	0	0	–	0	0	–
Swimmer Detection Sonar (SD) Used to detect divers and submerged swimmers	SD1–SD2	Hours	80	80	–	200	200	–	230	230	–

ASW: anti-submarine warfare; DEIS: draft environmental impact statement; DS: Doppler sonar; FEIS: final environmental impact statement; FLS: forward looking sonar; M: acoustic modems; SAS: synthetic aperture sonar; SD: swimmer detection sonar

[1] The use of source class ASW2 proposed in Alternatives 1 and 2 is the same in both the DEIS and FEIS, although it was represented as hours in the DEIS and count in the FEIS.

Table 3: Change in Annual Sonar and Other Active Acoustic Source Class Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS (Continued)

For Annual Testing Activities										
Source Class Category	Source Class	Units	Annual Usage								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
Forward Looking Sonar (FLS) Forward or upward looking object avoidance sonar.	FLS2–FLS3	Hours	0	30	+30	448	320	-128	493	365	-128
Torpedoes (TORP) Source classes associated with active acoustic signals produced by torpedoes	TORP1	Count	20	86	+66	145	540	+395	166	581	+415
	TORP2	Count	35	43	+8	100	464	+364	113	521	+408

FLS: forward looking sonar; DEIS: draft environmental impact statement; FEIS: final environmental impact statement; TORP: torpedoes

Table 4: Change in Non-Annual Sonar and Other Active Acoustic Source Class Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS

For Annual Testing Activities										
Source Class Category	Source Class	Units	Usage Over a 5-Year Period								
			No Action Alternative			Alternative 1			Alternative 2		
			DEIS[1]	FEIS	Change	DEIS[1]	FEIS	Change	DEIS[1]	FEIS	Change
Low-Frequency (LF) Sources that produce low-frequency (less than 1 kHz) signals	LF5	Hours	517	129	-388	128	240	+112	128	240	+112
Mid-Frequency (MF) Tactical and nontactical sources that produce mid-frequency (1 to 10 kHz) signals	MF9	Hours	1,034	259	-775	256	480	+224	256	480	+224
High-Frequency (HF) Tactical and nontactical sources that produce high-frequency (greater than 10 kHz but less than 180 kHz) signals	HF5	Hours	517	129	-388	128	240	+112	128	240	+112
	HF6	Hours	1,552	388	-1,164	384	720	+336	384	720	+336
	HF7	Hours	517	129	-388	128	240	+112	128	240	+112
Synthetic Aperture Sonar (SAS) Sonar in which active acoustic signals are post-processed to form high-resolution images of the seafloor	SAS2	Hours	1,552	388	-1,164	384	720	+336	384	720	+336
Forward Looking Sonar (FLS) Forward or upward looking object avoidance sonar.	FLS2–FLS3	Hours	0	129	+129	128	240	+112	128	240	+112

lb.: pound; DEIS: draft environmental impact statement; FEIS: final environmental impact statement; FLS: forward looking sonar; HF: high frequency; kHz: kilo hertz; LF: low frequency; MF: mid-frequency; SAS: synthetic aperture sonar

[1] The table describing use of sonar and other active acoustic sources during non-annual activities was inadvertently left out of the AFTT Draft EIS/OEIS. The impacts due to these activities, however, were analyzed in the AFTT Draft EIS/OEIS.

Table 5: Change in Annual Explosive Usage during Training Activities Analyzed in this FEIS Compared to the DEIS

For Annual Training Activities									
Source Class (Net Explosive Weight)	Number of Explosives								
	No Action Alternative			Alternative 1			Alternative 2		
	DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
E1 (0.1 – 0.25 lb.)	394	103	-291	123,112	124,552	+1,440	123,112	124,552	+1,440
E2 (0.26 – 0.5 lb.)	68	32	-36	858	856	-2	858	856	-2
E3 (0.6 – 2.5 lb.)	0	100	+100	3,132	3,132	–	3,132	3,132	–
E4 (2.6 – 5 lb.)	2,214	2,130	-84	2,180	2,190	+10	2,180	2,190	+10
E5 (6 – 10 lb.)	5,090	1,400	-3,690	14,370	14,370	–	14,370	14,370	–
E6 (11 – 20 lb.)	143	140	-3	440	500	+60	440	500	+60
E7 (21 – 60 lb.)	0	30	+30	316	322	+6	316	322	+6
E8 (61 – 100 lb.)	54	54	–	77	77	–	77	77	–
E9 (101 – 250 lb.)	7	7	–	2	2	–	2	2	–
E10 (251 – 500 lb.)	5	5	–	8	8	–	8	8	–
E11 (501 – 650 lb.)	4	4	–	1	1	–	1	1	–
E12 (651 – 1,000 lb.)	27	27	–	133	133	–	133	133	–
E13 (1,001 – 1,740 lb.)	0	0	–	0	0	–	0	0	–
E14 (1,741 – 3,625 lb.)	0	0	–	0	0	–	0	0	–

lb.: pound; DEIS: draft environmental impact statement; FEIS: final environmental impact statement

Table 6: Change in Non-Annual Explosive Usage during Training Activities Analyzed in this FEIS Compared to the DEIS

For Non-Annual[1] Training Activities									
Source Class (Net Explosive Weight)	Number of Explosives								
	No Action Alternative			Alternative 1			Alternative 2		
	DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
E2 (0.26 – 0.5 lb.)	0	0	–	2	2	–	2	2	–
E4 (2.6 – 5 lb.)	0	0	–	2	2	–	2	2	–

lb.: pound; DEIS: draft environmental impact statement; FEIS: final environmental impact statement

[1] The table describing use of explosives during non-annual activities was inadvertently left out of the AFTT Draft EIS/OEIS. The impacts due to these activities, however, were analyzed in the AFTT Draft EIS/OEIS.

Table 7: Change in Annual Explosive Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS

For Annual Testing Activities									
Source Class (Net Explosive Weight)	Number of Explosives								
	No Action Alternative			Alternative 1			Alternative 2		
	DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
E1 (0.1 – 0.25 lb.)	7,000	7,000	–	20,600	22,802	+2,202	22,600	25,501	+2,901
E2 (0.26 – 0.5 lb.)	0	0	–	0	0	–	0	0	–
E3 (0.6 – 2.5 lb.)	892	734	-158	2,848	2,128	-720	3,589	2,912	-677
E4 (2.6 – 5 lb.)	462	479	+17	1,053	1,143	+90	1,266	1,432	+166
E5 (6 – 10 lb.)	94	94	–	448	448	–	495	495	–
E6 (11 – 20 lb.)	7	8	+1	36	49	+13	41	54	+13
E7 (21 – 60 lb.)	0	0	–	0	0	–	0	0	–
E8 (61 – 100 lb.)	4	4	–	10	10	–	11	11	–
E9 (101 – 250 lb.)	0	0	–	0	0	–	0	0	–
E10 (251 – 500 lb.)	0	0	–	0	8	+8	0	10	+10
E11 (501 – 650 lb.)	32	20	-12	25	25	–	27	27	–
E12 (651 – 1,000 lb.)	0	0	–	0	0	–	0	0	–
E13 (1,001 – 1,740 lb.)	0	0	–	0	0	–	0	0	–
E14 (1,741 – 3,625 lb.)	3	3	–	3	3	–	4	4	–

lb.: pound; DEIS: draft environmental impact statement; FEIS: final environmental impact statement

Table 8: Change in Non-Annual Explosive Usage during Testing Activities Analyzed in this FEIS Compared to the DEIS

For Non-Annual[1] Testing Activities									
Source Class (Net Explosive Weight)	Number of Explosives								
	No Action Alternative			Alternative 1			Alternative 2		
	DEIS	FEIS	Change	DEIS	FEIS	Change	DEIS	FEIS	Change
E1 (0.1 – 0.25 lb.)	0	0	–	600	600	–	600	600	–
E16 (7,251 – 14,500 lb.)	0	0	–	12	12	–	12	12	–
E17 (14,501 – 58,000 lb.)	0	0	–	4	4	–	4	4	–

lb.: pound; DEIS: draft environmental impact statement; FEIS: final environmental impact statement

[1] The table describing use of explosives during non-annual activities was inadvertently left out of the AFTT Draft EIS/OEIS (the table describing explosives used during ship shock trials, source classes E16 and E17, was included in the DEIS). The impacts due to these activities, however, were analyzed in the AFTT Draft EIS/OEIS.

- Section 3.0 (Introduction to Affected Environment and Environmental Consequences):

  Tables were updated to reflect different annual levels of certain activities and resulting quantities of associated military expended materials based on changes to Chapter 2 (Description of Proposed Action and Alternatives). Changes in the number of activities proposed also prompted updates to the tables describing the level of use of acoustic sources.

- Section 3.1 (Sediments and Water Quality):

  Changes in quantities of military expended materials were adjusted based on changes made to Chapter 2 (Description of Proposed Action and Alternatives) and military expended material numbers in Section 3.0 (Introduction). Additional detail was added on the chemical and biological simulant testing activities. The analyses of impacts on water quality and sediments as a result of these changes were modified accordingly.

- Section 3.2 (Air Quality):

  The analyses of impacts on air quality as a result of changes to annual levels of certain activities, as detailed in Chapter 2 (Description of Proposed Action and Alternatives), were modified accordingly. In addition, updates to text were made to capture recent regulatory changes.

- Section 3.3 (Marine Habitats):

  Changes in quantities of explosives on or near the bottom and military expended materials were adjusted based on changes made to Chapter 2 (Description of Proposed Action and Alternatives) and tables in Section 3.0.5.3 (Identification of Stressors for Analysis). The analyses of impacts on marine habitats as a result of these changes were modified accordingly. In addition, the definition of hard bottom substrate was clarified and a new source of hard bottom data was referenced for training and testing locations in the Gulf of Mexico. Updates were made to Essential Fish Habitat findings to match those contained in the AFTT Essential Fish Habitat Assessment Final Report.

- Section 3.4 (Marine Mammals):

  The analyses of impacts on marine mammals as a result of changes to annual levels of certain activities, as detailed in Chapter 2 (Description of Proposed Action and Alternatives) and tables in Section 3.0.5.3 (Identification of Stressors for Analysis) were modified accordingly. The acoustic analysis was revised to more accurately quantify the expected acoustic effects on marine mammals, taking into consideration animal avoidance or movement and standard Navy mitigations.

- Section 3.5 (Sea Turtles and Other Marine Reptiles):

  The analyses of impacts on sea turtles and other marine reptiles as a result of changes to annual levels of certain activities, as detailed in Chapter 2 (Description of Proposed Action and Alternatives) and tables in Section 3.0.5.3 (Identification of Stressors for Analysis) were modified accordingly.

- Section 3.6 (Birds):

  Only minor clarifications to text were made with no substantial changes. Changes were made to text to account for the red knot (*Calidris canutus*) which is a candidate for listing under the Endangered Species Act (ESA).

- Section 3.7 (Marine Vegetation):

  Changes in quantities of explosives and military expended materials were adjusted based on changes made to Chapter 2 (Description of Proposed Action and Alternatives) and tables in Section 3.0.5.3 (Identification of Stressors for Analysis). The analyses of impacts on marine vegetation as a result of these changes were modified accordingly. In addition, updates were made to Essential Fish Habitat findings to reflect those contained in the AFTT Essential Fish Habitat Assessment Final Report.

- Section 3.8 (Marine Invertebrates):

  Table 3.8-2, Federally Managed Marine Invertebrate Species with Essential Fish Habitat within the Study Area Covered under Each Fishery Management Plan was modified. Changes were made to text to account for the proposed Endangered Species Act (ESA) listing of seven coral species and for the change in status from "threatened" to "endangered" for elkhorn and staghorn corals (*Acropora palmata and A. cervicornis).* Minor modifications were made to the analyses of impacts on corals at the South Florida Ocean Measurement Facility Testing Range as a result of these proposed ESA changes. In addition, information was added on the queen conch (*Lobatus gigas*), and Essential Fish Habitat findings were modified to match those found in the AFTT Essential Fish Habitat Assessment Final Report.

- Section 3.9 (Fish):

  Endangered Species Act findings for Atlantic salmon were clarified for entanglement and ingestion stressors. Critical habitat determinations for Gulf sturgeon were updated to correspond with textual discussion of impacts from military expended material strikes. Endangered Species Act findings for each acoustic substressor were separated for clarity. Table 3.9-1, Status and Presence of Endangered Species Act Endangered, Threatened, and Candidate Fish Species, and Species of Concern in the Study Area, was updated to reflect changing status of certain species and additions of species previously not listed. Additional information was added regarding the dwarf seahorse (*Hippocampus zosterae*) and detail was added to Section 3.9.2.2 (General Threats) regarding the *Deepwater Horizon* oil spill.

- Section 3.10 (Cultural Resources):

  The regulatory finding for Section 106 of the National Historic Preservation Act in the Final EIS/OEIS was adjusted to "no historic properties affected" due to mitigation measured employed (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). In the unlikely event that the Navy

impacts a submerged historic property, consultation will commence with the appropriate state historic preservation officer.

- Section 3.11 (Socioeconomic Resources):

  Changes were made to the account for updated information, including recently released data.

- Chapter 4 (Cumulative Impacts):

  Updates were made to the status of ongoing projects. In addition, updates were made to reflect changes made to other chapters in the EIS/OEIS.

- Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring):

  In response to public comment, modifications were made to the discussion of how activities recommence after a marine mammal or sea turtle sighting, and to the Effectiveness and Operational Assessment discussions. Also as a result of public comment, modifications were made to improve consistency across mitigation measures wherever possible. Section 5.5 (Mitigation Measures Considered but Eliminated) was restructured, supplemented with additional discussion, and migrated into Section 5.3 (Mitigation Assessment). Additional information was added to Section 5.3.1.1 (Specialized Training) about the U.S. Navy Afloat Environmental Compliance Training Series. Ship shock trial mitigation measures were revised to clarify the recommended mitigation measures. The Effectiveness Assessment for Lookout Procedural Measures was modified to provide a Study-Area specific detection probability table (Table 5.3-1), additional mitigation areas were recommended for manatees (Section 5.3.3.1.2, West Indian Manatee). Discussion of seafloor habitats was modified (Section 5.3.3.2, Seafloor Resources). Table 5.4-1 (Summary of Recommended Mitigation Measures) was updated to reflect the changes made within the chapter.

- Chapter 6 (Additional Regulatory Considerations):

  To address public comments received, wording was modified in some areas to reflect exact regulatory language for Marine Protected Areas. In addition, language was clarified for Marine Protected Areas to indicate which Navy activities were and were not allowed to occur in those areas.

- Chapter 8 (Public Involvement and Distribution):

  A section was added to identify who was notified of the comment period for the National Marine Fisheries Service Marine Mammal Protection Act Proposed Rule.

- Appendix A (Navy Activities Descriptions):

  Changes were made to reflect modifications made to Chapter 2 (Description of Proposed Action and Alternatives) and to correct errors.

- Appendix C (Agency Correspondence):

  Agency correspondence received since the public release of the Draft EIS/OEIS.

- Appendix D (Air Quality Example of Emissions Calculations and Example Record of Non-Applicability):

  The example emissions calculations and Record of Non-Applicability were modified based on changes in numbers of annual events in Chapter 2 (Description of Proposed Action and Alternatives).

- Appendix E (Public Comments and Responses):

  Information regarding the public meetings held in conjunction with the release of the Draft EIS/OEIS, public comments received on the Draft EIS/OEIS, pertinent comments received on the National Marine Fisheries Service Proposed Rule, and the Navy's responses to comments were added.

- Appendix F (Training and Testing Activities Matrices):

  Changes were made to reflect corrections made to Chapter 2 (Description of Proposed Action and Alternatives) and to correct errors.

- Appendix H (Impacts Due To Atlantic Fleet Training and Testing Activities at the Undersea Warfare Training Range):

  This appendix was created to facilitate public understanding of impacts from the subset of AFTT activities that would occur on the Undersea Warfare Training Range.

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COMMONLY USED ABBREVIATED TERMS

AFTT	Atlantic Fleet Training and Testing
DoD	Department of Defense
DEIS	draft environmental impact statement
EIS	environmental impact statement
ESA	Endangered Species Act
FEIS	final environmental impact statement
MMPA	Marine Mammal Protection Act
Navy	U.S. Department of the Navy
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OEIS	overseas environmental impact statement
OPAREA	operating area
USEPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

The U.S. Department of the Navy (Navy) prepared this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to comply with the National Environmental Policy Act (NEPA) and Executive Order (EO) 12114. The Navy also prepared this EIS/OEIS to assess the potential environmental impacts associated with two categories of military readiness activities: training and testing. Collectively, the at-sea areas in this EIS/OEIS are referred to as the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) (Figure ES-1).

Major conflicts, terrorism, lawlessness, and natural disasters all have the potential to threaten the national security of the United States (U.S.). National security, prosperity, and vital interests are increasingly tied to other nations because of the close relationships between the United States and other national economies. The Navy carries out training and testing activities to be able to protect the United States against its enemies, to protect and defend the rights of the United States and its allies to move freely on the oceans, and to provide humanitarian assistance to failed states. Training and testing activities that prepare the Navy to fulfill its mission to protect and defend the United States and its allies potentially impact the environment. These activities may trigger legal requirements identified in many U.S. federal environmental laws, regulations, and executive orders.

After thoroughly reviewing its environmental compliance requirements, the Navy instituted a policy in the year 2000 designed to comprehensively address these requirements. That policy—the Navy's At-Sea Policy—resulted, in part, in a series of comprehensive analyses of training and testing activities on U.S. at-sea range complexes and operating areas (OPAREA). These analyses served as the basis for the National Oceanic and Atmospheric Administration to issue Marine Mammal Protection Act (MMPA) incidental take authorizations because of the potential effects of some training and testing activities on species protected by federal law. The first of these analyses and incidental take authorizations resulted in a series of documents, completed in 2008 and 2009, for which incidental take authorizations begin to expire in early 2014. This EIS/OEIS updates these analyses and supports issuance of new incidental take authorizations. This EIS/OEIS also furthers compliance with the Navy's policy for comprehensive analysis by expanding the geographic scope to include additional areas where training and testing activities have historically occurred.

The AFTT Draft EIS/OEIS was released for public review and comment 25 May 2012 through 10 July 2012. Changes in this Final EIS/OEIS reflect all substantive comments made on the Draft EIS/OEIS during the public comment period and Navy refinements to the Proposed Action. The key changes between the AFTT Draft EIS/OEIS and Final EIS/OEIS can be found in the Foreword.

ES.2 PURPOSE OF AND NEED FOR PROPOSED MILITARY READINESS TRAINING AND TESTING ACTIVITIES

The purpose of the Proposed Action is to conduct training and testing activities to ensure that the Navy meets its mission, which is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. This mission is achieved in part by conducting training and testing within the Study Area.

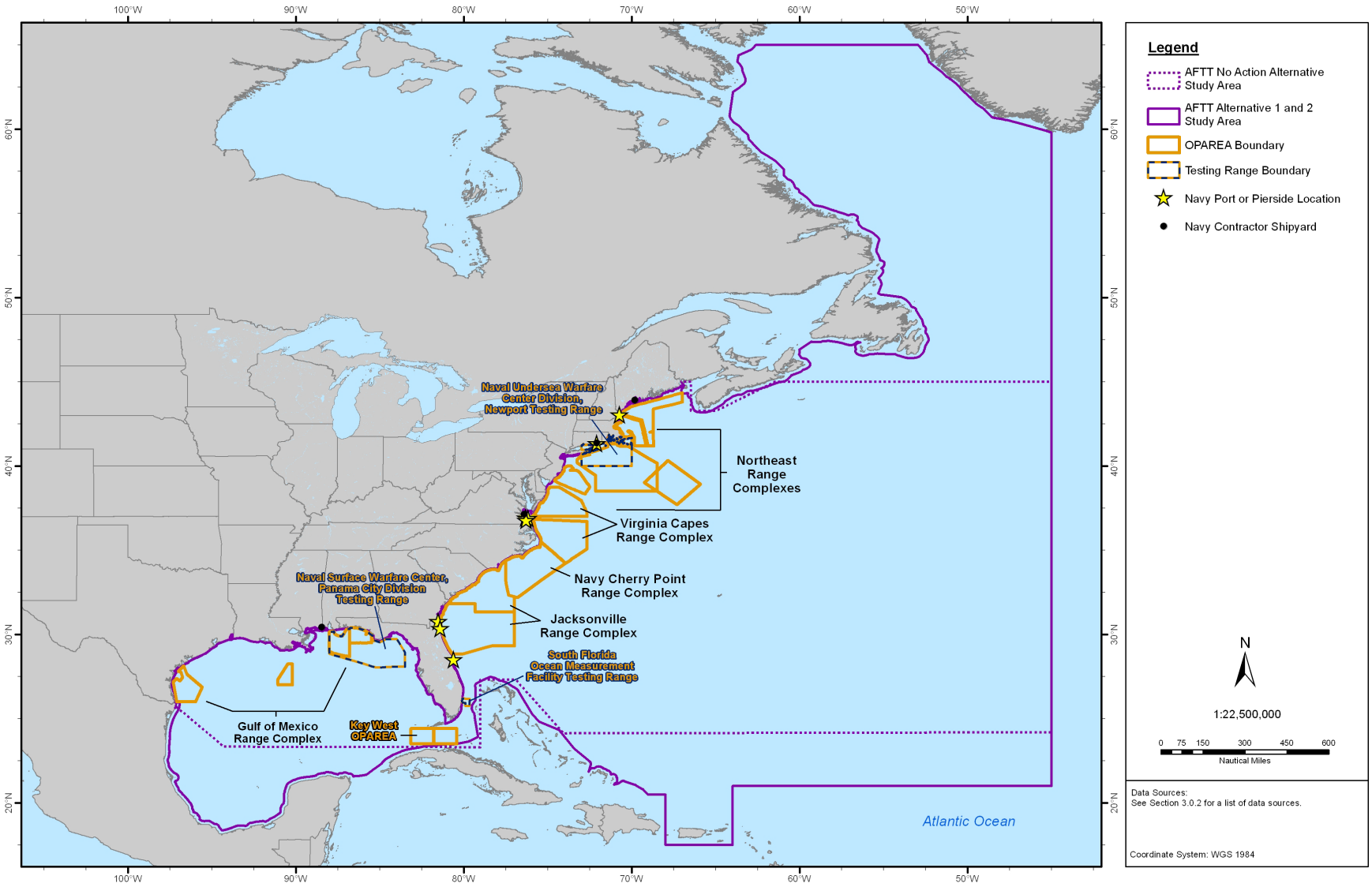

Figure ES-1: Atlantic Fleet Training and Testing Study Area
AFTT: Atlantic Fleet Training and Testing; OPAREA: operating area

ES.3 SCOPE AND CONTENT OF THE ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

In this EIS/OEIS, the Navy assessed military readiness training and testing activities that could potentially impact human and natural resources, especially marine mammals, sea turtles, and other marine resources. The range of alternatives includes the No Action and other reasonable courses of action. In this EIS/OEIS, the Navy analyzed direct, indirect, cumulative, short-term, long-term, irreversible, and irretrievable impacts. The Navy is the lead agency for the Proposed Action and is responsible for the scope and content of this EIS/OEIS. The National Marine Fisheries Service (NMFS) is a cooperating agency because of its expertise and regulatory authority over marine resources. Additionally, this document will serve as NMFS' NEPA documentation for the rule-making process under the MMPA.

In accordance with the Council on Environmental Quality Regulations, 40 Code of Federal Regulations (C.F.R.) § 1505.2, the Navy will issue a Record of Decision that provides the rationale for choosing one of the alternatives. The decision will be based on factors analyzed in this EIS/OEIS, including military training and testing objectives, best available science and modeling data, potential environmental impacts, and public interest.

ES.3.1 NATIONAL ENVIRONMENTAL POLICY ACT

Federal agencies are required under NEPA to examine the environmental impacts of their proposed actions within the United States and its territories. An EIS is a detailed public document that provides an assessment of the potential effects that a major federal action might have on the human environment, which includes the natural environment. The Navy undertakes environmental planning for major Navy actions occurring throughout the world in accordance with applicable laws, regulations, and executive orders. Presidential Proclamation 5928, issued December 27, 1988, extended the exercise of U.S. sovereignty and jurisdiction under international law to 12 nautical miles (nm); however, the proclamation expressly provides that it does not extend or otherwise alter existing federal law or any associated jurisdiction, rights, legal interests, or obligations. Thus, as a matter of policy, the Navy analyzes environmental effects and actions within 12 nm under NEPA (an EIS).

ES.3.2 EXECUTIVE ORDER 12114

This OEIS has been prepared in accordance with EO 12114 (44 Federal Register 1957) and Navy implementing regulations in 32 C.F.R. Part 187, *Environmental Effects Abroad of Major Federal Actions*. An OEIS is required because the proposed action and the alternatives have the potential to significantly harm the environment of the global commons. The global commons are defined as geographical areas outside the jurisdiction of any nation and include the oceans outside of the territorial limits (more than 12 nm from the coast) and Antarctica, but do not include contiguous zones and fisheries zones of foreign nations (32 C.F.R. § 187.3). This EIS and OEIS have been combined into one document, as permitted under NEPA and EO 12114, to reduce duplication.

ES.3.3 MARINE MAMMAL PROTECTION ACT

The MMPA of 1972 (16 United States Code [U.S.C.] §§ 1361-1407) established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The act further regulates "takes" of marine mammals in the global commons (that is, the high seas) by vessels or persons under U.S. jurisdiction. The term "take," as defined in Section 3 (16 U.S.C. § 1362(13)) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of harassment: Level A (potential injury) and Level B (potential behavioral disturbance).

The MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if NMFS finds that the taking will have a negligible impact on the species or stock(s), and will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant). The authorization must set forth the permissible methods of taking, other means of attaining the least practicable adverse impact on the species or stock and its habitat, and requirements pertaining to the mitigation, monitoring, and reporting of such taking.

The National Defense Authorization Act of Fiscal Year 2004 (Public Law 108-136) amended the definition of harassment and removed the "small numbers" provision as applied to military readiness activities or scientific research activities conducted by or on behalf of the federal government consistent with Section 104(c)(3) (16 U.S.C. § 1374(c)(3)). The Fiscal Year 2004 National Defense Authorization Act adopted the definition of "military readiness activity" as set forth in the Fiscal Year 2003 National Defense Authorization Act (Public Law 107-314). A "military readiness activity" is defined as "all training and operations of the Armed Forces that relate to combat" and "the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." Since the Proposed Action involves conducting military readiness activities, the relevant definition of harassment is any act that

- injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment") or
- disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") [16 U.S.C. § 1362(18)(B)(i) and (ii)].

ES.3.4 ENDANGERED SPECIES ACT

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531-1544) established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. An "endangered" species is a species in danger of extinction throughout all or a significant portion of its range. A "threatened" species is one that is likely to become endangered within the near future throughout all or in a significant portion of its range. The U.S. Fish and Wildlife Service and NMFS jointly administer the ESA and are also responsible for the listing of species (designating a species as either threatened or endangered). The ESA allows the designation of geographic areas as critical habitat for threatened or endangered species. Section 7(a)(2) requires each federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" a listed species, that agency is required to consult the Service (NMFS or U.S. Fish and Wildlife Service) which has jurisdiction over the species (50 C.F.R. § 402.14(a)). Under the terms of Section 7(b)(4) and Section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the act provided that such taking complies with the terms and conditions of an Incidental Take Statement. The ESA applies to marine mammals, sea turtles, crocodiles, birds, marine invertebrates, fish, and plants evaluated in this EIS/OEIS.

ES.3.5 OTHER ENVIRONMENTAL REQUIREMENTS CONSIDERED

The Navy must comply with all applicable federal environmental laws, regulations, and executive orders, including, but not limited to, those listed below. Further information can be found in Chapter 3 (Affected Environment and Environmental Consequences) and Chapter 6 (Additional Regulatory Considerations).

- Abandoned Shipwreck Act
- Antiquities Act
- Clean Air Act
- Clean Water Act
- Coastal Zone Management Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act
- National Historic Preservation Act
- National Marine Sanctuaries Act
- Rivers and Harbors Act
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*
- EO 12962, *Recreational Fisheries*
- EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*
- EO 13089, *Coral Reef Protection*
- EO 13158, *Marine Protected Areas*
- EO 13175, *Consultation and Coordination with Indian Tribal Governments*
- EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*

ES.4 PROPOSED ACTION AND ALTERNATIVES

The Navy's Proposed Action is to conduct training and testing activities—that may include the use of active sonar and explosives—primarily within existing range complexes and testing ranges in the western Atlantic Ocean off the east coast of the United States, in the Gulf of Mexico, and in portions of the Caribbean Sea. These activities will also occur at Navy pierside locations, Navy-contracted shipbuilder locations, port transit channels, and the lower Chesapeake Bay. Through this EIS/OEIS, the Navy will

- Reassess the environmental analysis of Navy at-sea training and testing activities contained in seven separate EISs/OEISs and various Environmental Assessments/Overseas Environmental Assessments and consolidate these analyses into a single environmental planning document. This reassessment will support reauthorization of incidental takes of marine mammals under the MMPA and incidental takes of threatened and endangered marine species through consultation under Section 7 of the ESA. The following seven EIS/OEIS documents are being consolidated:

    - Final Atlantic Fleet Active Sonar Training Environmental Impact Statement/Overseas Environmental Impact Statement (December 2008)
    - Virginia Capes Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (March 2009)
    - Navy Cherry Point Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement (April 2009)
    - Jacksonville Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (March 2009)

  - Final Environmental Impact Statement/Overseas Environmental Impact Statement, Naval Surface Warfare Center Panama City Division Mission Activities (September 2009)
  - Gulf of Mexico Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (December 2010)
  - Final Overseas Environmental Impact Statement/Environmental Impact Statement, Undersea Warfare Training Range (June 2009)

- Adjust baseline training and testing activities from current levels to the level needed to support Navy training and testing requirements beginning January 2014. As part of the adjustment, the Navy accounts for other activities and sound sources not addressed in the previous analyses.
- Analyze the potential environmental impacts of training and testing activities in additional areas (areas not covered in previous documents) where training and testing historically occurs, including Navy ports, naval shipyards, Navy-contractor shipyards, and the transit channels serving these areas.
- Update the at-sea environmental impact analyses for Navy activities in the previous documents to account for force structure changes, including those resulting from the development, testing, and use of weapons, platforms, and systems that will be operational by 2019.
- Implement enhanced range capabilities.
- Update environmental analyses with the best available science and most current acoustic analysis methods to evaluate the potential effects of training and testing activities on the marine environment.

ES.4.1 NO ACTION ALTERNATIVE

The No Action Alternative is required by regulations of the Council on Environmental Quality as a baseline against which the impacts of the Proposed Action are compared. The No Action Alternative continues baseline training and testing activities and force structure requirements as defined by existing Navy environmental planning documents.

The No Action Alternative represents the activities and events analyzed in previously completed documents. However, it would fail to meet the current purpose of and need for the Navy's Proposed Action because it would not allow the Navy to conduct the training and testing activities necessary to achieve and maintain fleet readiness. For example, the baseline activities do not account for changes in force structure requirements, the introduction of new weapons and platforms, and the training and testing required for proficiency with these systems.

ES.4.2 ALTERNATIVE 1

This alternative consists of the No Action Alternative plus the expansion of Study Area boundaries and adjustments to the locations and tempos of training and testing activities.

- **Adjustment of the Study Area:** This EIS/OEIS analyzes areas where Navy training and testing would continue as in the past, but which were not considered in previous environmental analyses. This alternative would not expand the area where the Navy trains and tests but would simply expand the area that is to be analyzed.
- **Adjustments to Locations and Tempo of Training and Testing Activities**: This alternative also includes changes to training and testing requirements necessary to accommodate (a) the relocation of ships, aircraft, and personnel, (b) planned aircraft, vessels, and weapons systems, and (c) ongoing activities not addressed in previous documentation.

- **Force Structure Changes:** Force structure changes involve the relocation of ships, aircraft, and personnel. As forces are moved within the existing Navy structure, training needs will necessarily change as the location of forces change.
- **Planned Aircraft, Vessels, and Weapons Systems:** This EIS/OEIS examines the training and testing requirements of planned vessels, aircraft, and weapons systems that the Navy would use in the Study Area.
- **Ongoing Activities:** Current training and testing activities that were not addressed in previous documentation are analyzed in this EIS/OEIS.

Alternative 1 reflects the adjustment to the baseline necessary to support current and proposed Navy at-sea training and testing activities through 2019.

ES.4.3 ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Alternative 2 consists of Alternative 1 plus the establishment of new range capabilities and modifications of existing capabilities, adjustments to types and tempos of training and testing, and the establishment of additional locations to conduct activities within the Study Area. This alternative is contingent upon potential budget increases, strategic necessity, and future training and testing requirements.

Alternative 2 includes the following training activities:

- Conduct additional surface-to-air, surface-to-surface, and anti-submarine warfare activities during post-delivery test and trial and during training events, which will be required to support an increased or accelerated delivery of surface ships and submarines.
- Increase air combat maneuver events in the Key West Range Complex.
- Introduce surface ships outfitted with kinetic energy weapon capability, and train with this new weapon system.
- Perform additional training with unmanned vehicles in support of mine warfare and of civilian port defense missions in commercial and civilian ports. Events would occur at various east coast and Gulf of Mexico locations.

Alternative 2 includes the following testing activities:

- New ship construction to include more sea trials for aircraft carriers, Joint High Speed Vessels, and amphibious assault ships; more Littoral Combat Ship Mission Package test events; and increased post-homeporting testing.
- Life cycle activities, including more ship signature test events.
- Naval Sea Systems Command Range activities, including more test events on each of the Naval Sea Systems Command's ranges and contingency for increased mine countermeasure testing at South Florida Ocean Measurement Facility Testing Range.
- Anti-surface warfare/anti-submarine warfare, including more events conducted as well as conducting kinetic energy weapon testing on vessels at sea.
- Mine warfare testing, including more events conducted.
- Shipboard protection systems and swimmer defense testing, including more events conducted and increased flexibility in conducting all chemical simulant testing in either location identified.

- Unmanned vehicle testing, including more events conducted and increased flexibility in conducting all underwater deployed unmanned aerial vehicle testing in either location identified.
- Other testing would include the introduction of the MQ-4C Triton Unmanned Aircraft Systems and their use during maritime patrol aircraft anti-submarine warfare testing events; more events conducted overall, with a 10 percent increase in the tempo of all proposed Naval Air Systems Command testing activities; and increased flexibility in conducting all at-sea explosive testing in either location identified.

ES.5 SUMMARY OF ENVIRONMENTAL EFFECTS

Environmental effects that might result from the implementation of the Navy's Proposed Action or alternatives have been analyzed in this EIS/OEIS. Resource areas analyzed include sediments and water quality, air quality, marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety. The effects on these resources are summarized in Table ES-1. This table compares the potential environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative).

ES.6 CUMULATIVE IMPACTS

The analyses presented in Chapters 3 (Affected Environment and Environmental Consequences) and 4 (Cumulative Impacts), indicate that the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on sediments and water quality, air quality, marine habitats, birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety would be negligible. The No Action Alternative, Alternative 1, or Alternative 2 would also make an incremental contribution to greenhouse gas emissions, representing approximately 0.01, 0.02, and 0.02 percent of U.S. 2009 greenhouse gas emissions, respectively.

Marine mammals and sea turtles are the primary resources of concern for cumulative impacts analysis for the following reasons:

- Past human actions impacted these resources to the extent that several marine mammal species and all sea turtles species occurring in the Study Area are ESA-listed. Several marine mammal species have stocks that are classified as strategic stocks under the MMPA.
- These resources would be impacted by multiple ongoing and future actions.
- Explosive detonations and vessel strikes under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill marine mammals and sea turtles.

The aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in impacts on some species of marine mammals and all sea turtle species in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 would contribute to cumulative impacts, but the relative contribution would be low compared to other actions. Compared to potential mortality or injury resulting from Navy training and testing activities, marine mammal and sea turtle mortality and injury from bycatch, commercial vessel ship strikes, entanglement, ocean pollution, and other human causes are estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals).

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2

Resource Category	Summary of Impacts
Sediments and Water Quality (3.1)	**No Action Alternative:** The Navy considered all potential stressors and determined that military expended materials containing the following have the potential to impact sediments and water quality: explosives and explosion byproducts, metals, chemicals other than explosives, and other materials. Impacts from explosion byproducts could be short-term and local; impacts from unconsumed explosives and metals could be long-term and local. In both situations, chemical, physical, or biological changes to sediments or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. Impacts from chemicals other than explosives and from other materials could be both short- and long-term and local. Chemical, physical, or biological changes to sediments or water quality would not be detectable and would be below or within existing conditions or designated uses. **Alternative 1:** The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, changes to sediments and water quality under Alternative 1 would still be considered localized and either short- or long-term depending on the explosive, explosive byproduct, metal, or chemical. Impacts under Alternative 1 would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, changes to sediments and water quality under Alternative 2 would still be considered localized and either short- or long-term depending on the explosive, explosive byproduct, metal, or chemical. Impacts under Alternative 2 would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses.
Air Quality (3.2)	**No Action Alternative:** Stressors analyzed include criteria air pollutants and hazardous air pollutants. The Proposed Action would result in minor local emissions of criteria air pollutants and hazardous air pollutants. These emissions would result in no change to attainment status of local air basins and would not cause an impact on public health. Even though these stressors co-occur in time and space, there would be sufficient dispersion so the impacts would be short term. Because changes in criteria pollutant emissions and hazardous air pollutant emissions are not expected to be detectable, air quality is expected to fully recover before experiencing a subsequent exposure. For those areas within the Study Area where the General Conformity Rule of the Clean Air Act applies, analyses showed that the low levels of emissions of all applicable criteria pollutants were *de minimis* and therefore no Conformity Determinations were required. **Alternative 1:** The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase in criteria air pollutants, changes to air quality under Alternative 1 would still be considered minor and localized; changes to air quality from hazardous air pollutants are not expected to be detectable. For those areas within the Study Area where the General Conformity Rule of the Clean Air Act applies, analyses showed that the low levels of emissions of all applicable criteria pollutants were *de minimis* and therefore no Conformity Determinations were required. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase in criteria air pollutants, changes to air quality under Alternative 2 would still be considered minor and localized; changes to air quality from hazardous air pollutants are not expected to be detectable. For those areas within the Study Area where the General Conformity Rule of the Clean Air Act applies, analyses showed that the low levels of emissions of all applicable criteria pollutants were *de minimis* and therefore no Conformity Determinations were required.

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
Marine Habitats (3.3)	**No Action Alternative:** The Navy considered all potential stressors and analyzed the following for potential impacts on marine habitats as a non-living substrate for sedentary biological communities (marine vegetation and invertebrates): acoustic (explosives on or near the bottom only) and physical disturbance and strikes (military expended materials and seafloor devices). The activities could impact marine habitats by localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short term, and impacts on hard bottom would be long term. Activities under the No Action Alternative would not impact the ability of marine substrates to serve their function as habitat. Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom, military expended materials, and seafloor devices during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, changes to marine substrates could include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short term, and impacts on hard bottom would be long term. Activities under Alternative 1 would not impact the ability of marine substrates to serve their function as habitat. Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom, military expended materials, and seafloor devices under Alternative 1 may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, changes to marine substrates could include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short term, and impacts on hard bottom would be long term. Activities under Alternative 2 would not impact the ability of marine substrates to serve their function as habitat. Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom, military expended materials, and seafloor devices under Alternative 2 may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern.
Marine Mammals (3.4)	**No Action Alternative**: The Navy considered all potential stressors and analyzed the following: acoustic (sonar and other active acoustic sources; explosives; pile driving; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; aircraft noise); energy (electromagnetic devices and high energy lasers); physical disturbance and strike (vessels in-water devices, military expended materials, seafloor devices); entanglement (fiber optic cables and guidance wires; parachutes); ingestion (munitions and military expended materials other than munitions); and secondary (explosives and byproducts, metals, chemicals, and transmission of disease and parasites).

MMPA: Marine Mammal Protection Act

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
	Acoustic: Pursuant to the MMPA, the use of sonar and other active acoustic sources may result Level A or Level B harassment of certain marine mammals; the use of explosives may result in mortality, Level A or Level B harassment of certain marine mammals; pile driving is not expected to result in mortality but may result in Level A or Level B harassment of bottlenose dolphins; the use of swimmer defense airguns, weapons firing, vessel noise, and aircraft noise are not expected to result in mortality, Level A or Level B harassment of any marine mammals. Pursuant to the ESA, sonar and other active acoustic sources and explosives may affect and are likely to adversely affect certain ESA-listed marine mammals; pile driving, swimmer defense airguns, weapons firing, vessel noise, and aircraft noise may affect but are not likely to adversely affect certain ESA-listed marine mammals; and all acoustic sources will have no effect on marine mammal critical habitats. Energy: Pursuant to the MMPA, the use of electromagnetic devices and high energy lasers is not expected to result in mortality, Level A or B harassment of any marine mammals. Pursuant to the ESA, the use of electromagnetic devices may affect but are not likely to adversely affect certain ESA-listed marine mammals and will have no effect on marine mammal critical habitats. Pursuant to the ESA, the use of high energy lasers will have no effect on any ESA-listed marine mammal and will have no effect on marine mammal critical habitats. Physical Disturbance and Strike: Pursuant to the MMPA, the use of vessels may result in mortality or Level A harassment of certain marine mammal species but is not expected to result in Level B harassment of any marine mammal. The use of in-water devices, military expended materials, and seafloor devices are not expected to result in mortality, Level A or B harassment of any marine mammal. Pursuant to the ESA, vessel use may affect and is likely to adversely affect certain ESA-listed species. The use of in-water devices and military expended materials may affect but is not likely to adversely affect certain marine mammal species. The use of seafloor devices will have no effect on any ESA-listed marine mammal. The use of vessels, in-water devices, military expended materials, and seafloor devices will have no effect on marine mammal critical habitats. Entanglement: Pursuant to the MMPA, the use of fiber optic cables, guidance wires, and parachutes is not expected to result in mortality, Level A or B harassment of any marine mammal. Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect certain ESA-listed marine mammals. Ingestion: Pursuant to the MMPA, the potential for ingestion of all military expended materials is not expected to result in mortality, Level A or B harassment of any marine mammal. Pursuant to the ESA, the potential for ingestion of all military expended materials may affect but is not likely to adversely affect certain ESA-listed species. Secondary: Pursuant to the MMPA, secondary stressors are not expected to result in mortality, Level A or B harassment of any marine mammal. Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect certain ESA-listed marine mammals and will have no effect on marine mammal critical habitats. The use of sonar and active acoustic sources are not expected to result in mortality, although the potential for beaked whale mortality coincident with use of sonar and other active acoustic sources is considered. The Navy has requested 10 beaked whale mortality takes under the MMPA as part of all training activities combined to account for any unforeseen potential impacts. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on marine mammals under Alternative 1 are still not expected to decrease the overall fitness of any marine mammal population. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on marine mammals under Alternative 2 are still not expected to decrease the overall fitness of any marine mammal population.

ESA: Endangered Species Act; MMPA: Marine Mammal Protection Act

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
Sea Turtles and Other Marine Reptiles (3.5)	**No Action Alternative**: The Navy considered all potential stressors and the following have been analyzed: acoustic (sonar and other active acoustic sources, explosives, pile driving, swimmer defense airguns, weapons firing launch, and impact noise, and aircraft and vessel noise); energy (electromagnetic devices, high energy lasers); physical disturbance and strikes (vessels, in-water devices, military expended materials, seafloor devices); entanglement (fiber optic cables, guidance wires, and parachutes); and ingestion (munitions and military expended materials other than munitions); and secondary (explosives and byproducts, metals, and chemicals). All five sea turtle species in the Study Area are ESA-listed species. Acoustics: Pursuant to the ESA, the use of sonar, other active sources, and explosives may affect and is likely to adversely affect ESA-listed sea turtles; and may affect but is not likely to adversely affect the American crocodile or American alligator. Pile driving, swimmer defense airguns and weapons firing noise may affect but are not likely to adversely ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. Aircraft and vessel noise may affect but is not likely to adversely affect ESA-listed sea turtles, the American crocodile, or the American alligator. Acoustic stressors will have no effect on critical habitat for any ESA-listed marine reptiles. Energy: Pursuant to the ESA, the use of electromagnetic devices may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. The use of high energy lasers will have no effect on any ESA-listed sea turtle species, the American alligator, or the American crocodile. The use of electromagnetic devices and high energy lasers will have no effect on critical habitat for any ESA-listed marine reptile. Physical Disturbance and Strikes: Pursuant to the ESA, vessel use may affect and is likely to adversely affect ESA-listed sea turtles. The use of in-water devices and military expended materials may affect but is not likely to adversely affect ESA-listed sea turtles. The use of vessels, in-water devices, and military expended materials will have no effect on the American crocodile or American alligator. The use of vessels, in-water devices, and military expended materials will have no effect on critical habitat for any ESA-listed marine reptiles. Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. Ingestion: Pursuant to the ESA, the use of munitions with the potential for ingestion may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, and loggerhead sea turtles; and will have no effect on the leatherback sea turtle, American crocodile, or American alligator. The potential for ingestion of military expended materials other than munitions may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed sea turtles, the American crocodile, or the American alligator and will have no effect on critical habitat for any ESA-listed marine reptile. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on sea turtles under Alternative 1 are still not expected to decrease the overall fitness of any sea turtle, American crocodile, or American alligator population. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on sea turtles under Alternative 2 are still not expected to decrease the overall fitness of any sea turtle, American crocodile, or American alligator population.

ESA: Endangered Species Act;

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
Birds (3.6)	**No Action Alternative:** The Navy considered all potential stressors and analyzed the following: acoustic (sonar and other active acoustic sources; explosives and swimmer defense airguns; pile driving; weapons firing, launch, and impact noise; aircraft and vessel noise); energy (electromagnetic devices, high energy lasers); physical disturbance and strikes (aircraft and aerial targets, vessels and in-water devices, military expended materials); ingestion (military expended materials); and Secondary (general emissions). Acoustic: Pursuant to the ESA, the use of sonar and other active acoustic sources may affect but is not likely to adversely affect ESA-listed roseate terns and will have no effect on ESA-listed piping plover (and its critical habitat), ESA-candidate red knot, or ESA-listed Bermuda petrel. The use of explosives, swimmer defense airguns, aircraft, and vessels may affect but is not likely to adversely affect ESA-listed or ESA-candidate bird species, and will have no effect on piping plover critical habitat. Pile driving may affect but is not likely to adversely affect ESA-listed piping plover and roseate terns, and will have no effect on the ESA-candidate red knot, the ESA-listed Bermuda petrel, or piping plover critical habitat. Weapons firing, launch, and impact noise may affect but is not likely to adversely affect ESA-listed Bermuda petrel or roseate terns, the ESA-candidate red knot, and will have no effect on piping plover (and its critical habitat). Energy: Pursuant to the ESA, the use of electromagnetic devices during training and testing activities may affect but is not likely to adversely affect ESA-listed piping plover (and its critical habitat), Bermuda petrel, roseate tern, or ESA-candidate red knot. The use of high energy lasers during training and testing activities will have no effect on ESA-listed piping plover (and its critical habitat), Bermuda petrel, roseate tern, or ESA-candidate red knot. Physical Disturbance and Strikes: Pursuant to the ESA, the use of aircraft and aerial targets, vessels and in-water devices, and military expended materials may affect but is not likely to adversely affect ESA-listed piping plover, Bermuda petrel, roseate tern, or ESA-candidate red knot, and will have no effect on piping plover critical habitat. Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials used during training and testing activities may affect but is not likely to adversely affect ESA-listed Bermuda petrel or roseate tern and will have no effect on the ESA-listed piping plover or the ESA-candidate red knot. Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed or ESA-candidate bird species and will have no effect on critical habitat. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on birds under Alternative 1 are still not expected to decrease the overall fitness of any bird population. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on birds under Alternative 2 are still not expected to decrease the overall fitness of any bird population.

ESA: Endangered Species Act;

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
Marine Vegetation (3.7)	**No Action Alternative**: The Navy considered all potential stressors and analyzed the following: acoustic (explosives); physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices); and secondary stressors (sediment and water quality). Acoustics: Pursuant to the ESA, the use of explosives will have no effect on ESA-listed Johnson's seagrass or its critical habitat. Physical Disturbance and Strikes: Pursuant to the ESA, the use of vessels, in-water devices, military expended materials, and seafloor devices will have no effect on ESA-listed Johnson's seagrass or its critical habitat. Secondary: Pursuant to the ESA, secondary stressors will have no effect on ESA-listed Johnson's seagrass or its critical habitat. Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, electromagnetic devices and contaminant stressors associated with training and testing activities will have no adverse impact on marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. Explosives and other impulsive sources, vessel movement, in-water devices, military expended materials, and seafloor devices associated with training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts from acoustic stressors and physical disturbance are not expected to result in detectable changes to marine vegetation growth, survival, or propagation and are not expected to result in population-level impacts. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts from acoustic stressors and physical disturbance are not expected to result in detectable changes to marine vegetation growth, survival, or propagation and are not expected to result in population-level impacts.
Marine Invertebrates (3.8)	**No Action Alternative**: The Navy considered all potential stressors and analyzed the following: acoustic (sonar and other non-impulsive acoustic sources, explosives, and other impulsive acoustic sources); energy (electromagnetic devices and high energy lasers); physical disturbance and strikes (vessels and in-water devices, military expended materials, and seafloor devices); entanglement (fiber optic cables, guidance wires, and parachutes); ingestion (military expended materials); and secondary (explosives and byproducts, metals, chemicals, and other materials). Acoustics: Pursuant to the ESA, the use of all non-impulsive and impulsive acoustic sources will have no effect on ESA-listed or proposed coral species. The use of all non-impulsive and impulsive acoustic sources will have no effect on elkhorn and staghorn critical habitat. Energy: Pursuant to the ESA, the use of electromagnetic devices and high energy lasers will have no effect on ESA-listed or proposed coral species. The use of electromagnetic devices and high energy lasers will have no effect on critical habitat.

ESA: Endangered Species Act

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
	Physical Disturbance and Strikes: Pursuant to the ESA, the use of vessels and in-water devices will have no effect on ESA-listed or proposed coral species. The use of military expended materials and seafloor devices may affect but is not likely to adversely affect ESA-listed or proposed coral species. The use of vessels, in-water devices, and seafloor devices would have no effect on critical habitat. The use of military expended materials may affect but is not likely to adversely affect critical habitat. Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes will have no effect on ESA-listed or proposed coral species. Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials will have no effect on ESA-listed or proposed coral species. Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed or proposed coral species and may affect but are not likely to adversely affect critical habitat. Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other acoustic sources, vessel noise, swimmer defense airguns, weapons firing noise, electromagnetic sources, high energy lasers, vessel movement, in-water devices, and metal, chemical, or other material contaminants will have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. The use of electromagnetic sources will have minimal and temporary adverse impact to invertebrates occupying water column Essential Fish Habitat or Habitat Areas of Particular Concern. The use of explosives, pile driving, military expended materials, seafloor devices, and explosives and explosion byproduct contaminants may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on marine invertebrates under Alternative 1 are not anticipated to result in population-level impacts. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on marine invertebrates under Alternative 2 are not anticipated to result in population-level impacts.
Fish (3.9)	**No Action Alternative:** The Navy considered all potential stressors and the following were analyzed: acoustic (sonar and other non-impulsive acoustic sources, explosives, and other impulsive acoustic sources); energy (electromagnetic devices, high energy lasers); physical disturbance and strikes (vessels and in-water devices, military expended materials, and seafloor devices); entanglement (fiber optic cables and guidance wires, parachutes); ingestion (munitions and military expended materials other than munitions); and secondary (explosives and explosion byproducts, metals, chemicals, and other materials).

ESA: Endangered Species Act

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
	Acoustic: Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources may affect but is not likely to adversely affect ESA-listed fish species; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat. Pursuant to the ESA, the use of explosives and other impulsive acoustic sources may affect and is likely to adversely affect ESA-listed Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish;; may affect but is not likely to adversely affect the Atlantic salmon, largetooth sawfish, and shortnose sturgeon; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat. Energy: Pursuant to the ESA, the use of electromagnetic devices during training and testing activities may affect but is not likely to adversely affect ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; will have no effect on Atlantic salmon; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat. Pursuant to the ESA, the use of high energy lasers will have no effect on ESA-listed fish species; and will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat. Physical Disturbance and Strikes: Pursuant to the ESA, the use of vessels, in-water devices, military expended materials, and seafloor devices may affect but is not likely to adversely affect ESA-listed fish species; may affect but is not likely to adversely affect Gulf sturgeon critical habitat; and will have no effect on Atlantic salmon and smalltooth sawfish critical habitat. Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect ESA-listed fish species. Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials may affect but is not likely to adversely affect ESA-listed fish species. Secondary Stressors: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed fish species and will have no effect on Atlantic salmon, smalltooth sawfish, and Gulf sturgeon critical habitat. Pursuant to the Essential Fish Habitat requirements, the use of sonar and other active acoustic sources (Atlantic herring only), explosives, pile driving, and electromagnetic devices may have a minimal and temporary adverse effect on the fishes that occupy water column Essential Fish Habitat. **Alternative 1**: The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on fish under Alternative 1 are not expected to decrease the overall fitness of any fish population. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase, impacts on fish under Alternative 2 are not expected to decrease the overall fitness of any fish population.

ESA: Endangered Species Act

Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (Continued)

Resource Category	Summary of Impacts
Cultural Resources (3.10)	**No Action Alternative:** The Navy considered all potential stressors and the following have been analyzed: acoustic (underwater explosions, sonic booms, and cratering from underwater detonations) and physical disturbance and strike (use of seafloor devices and deposition of military expended materials). Acoustic and physical disturbance and strike stressors would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these resources. **Alternative 1:** The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase in activities under Alternative 1, acoustic and physical disturbance and strike stressors would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these resources. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase in activities under Alternative 2, acoustic and physical disturbance and strike stressors would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these resources.
Socioeconomic Resources (3.11)	**No Action Alternative:** The Navy considered all potential stressors and the following have been analyzed: accessibility (availability of access on the ocean and in the air); airborne acoustics (weapons firing, aircraft, and vessel noise); physical disturbance and strikes (aircraft, vessels and in-water devices, military expended materials); and secondary impacts from availability of resources. Impacts would be short term and temporary. Therefore, impacts on socioeconomic resources would be negligible. **Alternative 1:** The number of individual impacts may increase under Alternative 1, but the types of impacts would be the same as the No Action Alternative. Despite the increase in activity under Alternative 1, impacts to socioeconomic resources would still be considered short term and temporary. Therefore, impacts on socioeconomic resources would be negligible. **Alternative 2 (Preferred Alternative)**: The number of individual impacts may increase under Alternative 2, but the types of impacts would be the same as the No Action Alternative. Despite the increase in activity under Alternative 2, impacts to socioeconomic resources would still be considered short term and temporary. Therefore, impacts on socioeconomic resources would be negligible.
Public Health and Safety (3.12)	**No Action Alternative**: The Navy considered all potential stressors and the following have been analyzed: underwater energy; in-air energy; physical interactions; and indirect impacts from sediment and water quality changes. Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely. **Alternative 1:** Despite the increase in activities under Alternative 1, Navy safety procedures would continue to prevent proposed activities being co-located with public activities. Because of the Navy's safety procedures, the potential for activities to impact public health and safety under Alternative 1 would be unlikely. **Alternative 2 (Preferred Alternative)**: Despite the increase in activities under Alternative 2, Navy safety procedures would continue to prevent proposed activities being co-located with public activities. Because of the Navy's safety procedures, the potential for activities to impact public health and safety under Alternative 2 would be unlikely.

ES.7 STANDARD OPERATING PROCEDURES, MITIGATION, AND MONITORING

Within the Study Area, the Navy implements standard operating procedures, mitigation, and monitoring efforts during the Proposed Action. Navy standard operating procedures have the indirect benefit of reducing potential impacts on marine resources. Mitigation measures are designed to help reduce or avoid potential impacts on marine resources. Marine species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve understanding of the impacts of training and testing activities on marine resources.

ES.7.1 STANDARD OPERATING PROCEDURES

The Navy currently employs standard practices to provide for the safety of personnel and equipment, including vessels and aircraft, as well as the success of the training and testing activities. In many cases there are incidental environmental, socioeconomic, and cultural benefits resulting from standard operating procedures. Standard operating procedures serve the primary purpose of providing for safety and mission success, and are implemented regardless of their secondary benefits. This is what distinguishes standard operating procedures, which are a component of the Proposed Action, from mitigation measures, which are designed entirely for the purpose of reducing environmental impacts resulting from the Proposed Action. Because of their importance for maintaining safety and mission success, standard operating procedures have been considered as part of the Proposed Action under each alternative, and therefore are included in the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for each resource.

ES.7.2 MITIGATION

The Navy recognizes that the Proposed Action has the potential to impact the environment. Unlike standard operating procedures, which are established for reasons other than environmental benefit, mitigation measures are modifications to the Proposed Action that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. The Navy undertook two assessment steps for each recommended mitigation measure (Step 1 is an effectiveness assessment and Step 2 is an operational assessment). Table ES-2 summarizes the Navy's recommended mitigation measures with currently implemented mitigation measures for each activity category also summarized in the table. These measures have been coordinated with NMFS and the U.S. Fish and Wildlife Service through the consultation and permitting processes. The Record of Decision for this EIS/OEIS will address any additional mitigation measures that may result from ongoing regulatory processes.

ES.7.3 MITIGATION MEASURES CONSIDERED BUT ELIMINATED

A number of mitigation measures were suggested during the public comment periods for this EIS/OEIS or previous Navy environmental documents. As a result of the assessment process, the Navy determined that some of the suggested measures would likely be ineffective at reducing environmental impacts, have an unacceptable operational impact based on the operational assessment, or would be incompatible with Section 5.2.2, Overview of Mitigation Approach.

ES.7.4 MONITORING

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and complying with the suite of federal environmental laws and regulations. As a complement to the Navy's commitment to avoiding and reducing impacts of the Proposed Action through mitigation, the Navy will undertake monitoring efforts to track compliance with take

authorizations, help evaluate the effectiveness of implemented mitigation measures, and gain a better understanding of the impacts of the Proposed Action on marine resources. Taken together, mitigation and monitoring comprise the Navy's integrated approach for reducing environmental impacts from the Proposed Action. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible.

Consistent with the cooperating agency agreement with NMFS, mitigation and monitoring measures presented in this Final EIS/OEIS focus on the requirements for protection and management of marine resources. Discussions with resource agencies during the consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the Record of Decision and consultation documents such as the ESA Biological Opinion.

The Integrated Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy trains and to allocate the most appropriate level and type of effort for each range complex. The current Navy monitoring program is composed of a collection of "range-specific" monitoring plans, each of which was developed individually as part of MMPA and ESA compliance processes as environmental documentation was completed. These individual plans establish specific monitoring requirements for each range complex or testing range and are collectively intended to address the Integrated Comprehensive Monitoring Program top-level goals. A Scientific Advisory Group of leading marine mammal scientists developed recommendations that would serve as the basis for a Strategic Plan for Navy monitoring. The Strategic Plan is intended to be a primary component of the Integrated Comprehensive Monitoring Program and provide a "vision" for Navy monitoring across geographic regions—serving as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address Integrated Comprehensive Monitoring Program top-level goals and satisfy MMPA regulatory requirements. The objective of the Strategic Plan is to continue the evolution of Navy marine species monitoring towards a single integrated program, incorporating Scientific Advisory Group recommendations, and establishing a more transparent framework for soliciting, evaluation, and implementing monitoring work across the Fleet range complexes.

Table ES-2: Summary of Recommended Mitigation Measures

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Specialized Training	Lookouts will complete the Introduction to the U.S. Navy Afloat Environmental Compliance Training Series and the U.S. Navy Marine Species Awareness Training or civilian equivalent.	The mitigation zones observed by Lookouts are specified for each Mitigation Zone Procedural Measure below.	The mitigation zones observed by Lookouts are specified for each Mitigation Zone Procedural Measure below.
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar during Anti-Submarine Warfare and Mine Warfare	2 Lookouts (general) 1 Lookout (minimally manned, moored, or anchored)	Sources that can be powered down: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals (hull-mounted mid-frequency and low-frequency) and sea turtles (low-frequency only). Sources that cannot be powered down: 200 yd. (183 m) shutdown for marine mammals and sea turtles. Both: observation for concentrations of floating vegetation (*Sargassum* or kelp paddies).	Hull-mounted mid-frequency: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals and sea turtles; avoidance of *Sargassum* rafts. Low-frequency: None
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	1 Lookout	200 yd. (183 m) for marine mammals (high-frequency and mid-frequency), sea turtles (bins MF8, MF9, MF10, and MF12 only), and concentrations of floating vegetation (*Sargassum* or kelp paddies).	Non-hull mounted mid-frequency: 200 yd. (183 m) for marine mammals, floating vegetation, and kelp paddies. High-frequency: None
Improved Extended Echo Ranging Sonobuoys	1 Lookout	600 yd. (549 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Passive acoustic monitoring conducted with Navy assets participating in the activity.	1,000 yd. (914 m) for marine mammals and sea turtles; 400 yd. (366 m) for floating vegetation and kelp paddies. Passive acoustic monitoring conducted with Navy assets participating in the activity.
Explosive Sonobuoys Using 0.6–2.5 Pound NEW	1 Lookout	350 yd. (320 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Passive acoustic monitoring conducted with Navy assets participating in the activity.	None
Anti-Swimmer Grenades	1 Lookout	200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	200 yd. (183 m) for marine mammals, sea turtles, floating vegetation, and kelp paddies.

m: meter; NEW: net explosive weight; yd.: yard

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	General: 1 or 2 Lookouts (NEW dependent) Diver-placed: 2 Lookouts Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom.	Both: NEW dependent for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) from surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. Both: 1 nm from beach in the VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island for birds. Diver-placed: 3.2 nm from an estuarine inlet and 1.6 nm from shoreline within the Navy Cherry Point Range Complex for sea turtles.	General: NEW dependent for marine mammals and sea turtles. Diver-placed: 700 yd. (640 m) for up to 20 lb. NEW for marine mammals and turtles. Both: 1,000 ft. (305 m) from surveyed live hard bottom, artificial reefs, and shipwrecks. Both: 1 nm from beach and 3,000 ft. (914 m) around Fisherman Island in the VACAPES Range Complex for birds. Diver-placed: 3.2 nm from estuarine inlet and 1.6 nm from shoreline in VACAPES, Navy Cherry Point, and JAX Range Complexes for sea turtles.
Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices	4 Lookouts Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom.	Up to 10 min. time-delay using up to 20 lb. NEW: 1,000 yd. (915 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. 1 nm from beach in the VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island for birds. 3.2 nm from an estuarine inlet and 1.6 nm from shoreline within the Navy Cherry Point Range Complex for sea turtles.	10 min. time-day on 20 lb. NEW: 1,450 yd. (1.3 km) for marine mammals and sea turtles.

ft.: feet; JAX: Jacksonville; km: kilometer; lb.: pound; m: meter; min.: minute; NEW: net explosive weight; nm: nautical mile; yd.: yard; VACAPES: Virginia Capes

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Explosive and Non-Explosive Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	200 yd. (183 m) for marine mammals, sea turtles, floating vegetation, and surveyed shallow coral reefs.
Explosive and Non-Explosive Gunnery Exercises – Large-Caliber Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	Explosive: 600 yd. (549 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Non-Explosive: 200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) for surveyed shallow coral reefs.	Explosive: 600 yd. (549 m) for marine mammals, sea turtles, floating vegetation, and surveyed shallow coral reefs. Non-Explosive: 200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 70 yd. (64 m) around entire ship for marine mammals and sea turtles.
Non-Explosive Missile Exercises and Explosive Missile Exercises (Including Rockets) up to 250 Pound NEW Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	900 yd. (823 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	1,800 yd. (1.6 km) for marine mammals, sea turtles, floating vegetation, and kelp paddies.
Explosive Missile Exercises Using 251–500 Pound NEW Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	2,000 yd. (1.8 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	None

km: kilometer; lb.: pound; m: meter; NEW: net explosive weight; yd.: yard

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Explosive and Non-Explosive Bombing Exercises	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	Explosive: 2,500 yd. (2.3 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Non-Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) for surveyed shallow coral reefs.	Explosive: 5,100 yd. (4.7 km) for marine mammals, sea turtles, and floating vegetation. Non-Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles, floating vegetation, and kelp paddies.
Torpedo (Explosive) Testing	1 Lookout	2,100 yd. (1.9 km) for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.	5,063 yd. (4.6 km) for marine mammals, sea turtles, floating vegetation, and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.
Sinking Exercises	2 Lookouts	2.5 nm for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.	4.5 nm for marine mammals and sea turtles. 2.5 nm for floating vegetation and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.
At-Sea Explosive Testing	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	1,600 yd. (1.4 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	None
Ordnance Testing – Line Charge Testing	1 Lookout	900 yd. (823 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	880 yd. (805 m) for marine mammals and sea turtles. 0.5 mi. (0.8 km) for Gulf sturgeon.

km: kilometer; lb.: pound; m: meter; mi: mile; nm: nautical mile; yd.: yard

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Ship Shock Trials	At least 10 Lookouts or trained marine species observers (or combination)	10,000 lb. and 40,000 lb. charge: 3.5 nm for all locations for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), jellyfish aggregations, large schools of fish, and flocks of seabirds.	10,000 lb. charge: 3 nm/3.5 nm for VACAPES / JAX for marine mammals, sea turtles, floating vegetation, jellyfish aggregations, large schools of fish, and flocks of seabirds. 40,000 lb. charge: None.
Elevated Causeway System – Pile Driving	1 Lookout	60 yd. (55 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	None
Vessel Movements	1 Lookout	500 yd. (457 m) for whales. 200 yd. (183 m) for all other marine mammals (except bow riding dolphins).	500 yd. (457 m) for whales. 200 yd. (183 m) for all other marine mammals (except bow riding dolphins).
Towed In-Water Device Use	1 Lookout	250 yd. (229 m) for marine mammals.	250 yd. (229 m) for marine mammals.
Precision Anchoring	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom	Avoidance of precision anchoring within the anchor swing diameter of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks.	Avoidance of precision anchoring within the anchor watch circle diameter of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks.
North Atlantic Right Whale Calving Habitat off the Southeast United States	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Avoidance or minimization of conduct of specific activities seasonally. Use Early Warning System sightings data.	Avoidance or minimization of conduct of specific activities seasonally. Use Early Warning System sightings data.

JAX: Jacksonville; km: kilometer; lb.: pound; m: meter; nm: nautical mile; VACAPES: Virginia Capes; yd.: yard

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
North Atlantic Right Whale Foraging Habitat off the Northeast	3 Lookouts during torpedo (non-explosive) testing activities All other activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Avoidance or minimization of conduct of specific activities seasonally. Use Sighting Advisory System sightings data. Specific measures for torpedo (non-explosive) testing activities year-round.	Avoidance or minimization of conduct of specific activities seasonally. Use Sighting Advisory System sightings data. Conduct torpedo (non-explosive) testing activities in five designated areas seasonally. Submit written requests prior to conducting hull-mounted surface and submarine active sonar training or helicopter dipping in the mitigation area.
North Atlantic Right Whale Mid-Atlantic Migration Corridor	1 Lookout	Practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives.	Practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives.
West Indian Manatee Habitat	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Mayport, Florida: Comply with all federal, state, and local Manatee Protection Zones; sightings communication. Port Canaveral, Florida: Pierside sonar observations and sightings communication. Kings Bay, Georgia: Pierside sonar observations and sightings communication. Camp Lejeune, North Carolina: Pile driving observations and sightings log.	Mayport, Florida: Comply with all federal, state, and local Manatee Protection Zones; sightings communication. Port Canaveral, Florida: Pierside sonar observations and sightings communication. Kings Bay, Georgia: Pierside sonar observations and sightings communication. Camp Lejeune, North Carolina: None
Planning Awareness Areas	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Limit planning major active sonar exercises.	Limit planning major active sonar exercises.

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Shallow Coral Reefs, Hard bottom Habitat, Artificial Reefs, and Shipwrecks	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom	No precision anchoring within the anchor swing diameter and no explosive mine countermeasure and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. No explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target; explosive or non-explosive missile exercises using a surface target; explosive or non-explosive bombing exercises; or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs.	Varying mitigation zone distances based on marine mammal ranges to effects.
Live Hard bottom and Shallow Coral Reefs within South Florida Ocean Measurement Facility	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs and live hard bottom	Anchors and Mine-like Objects: Installation of anchors and mine-like objects are conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. Bottom Crawling Unmanned Underwater Vehicles: If deployment occurs greater than 9.8 ft. (3 m) in depth, it will be conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities.	Anchors and Mine-like Objects: Installation of anchors and mine-like objects are conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. Bottom Crawling Unmanned Underwater Vehicles: None

ft.: feet; GIS: Geographic Information System; GPS: Global Positioning System; m: meter; yd.: yard

Table ES-2: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Sea Turtle Nesting Habitat	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Naval Surface Warfare Center, Panama City Division: Sea turtle nesting season is defined as from March through September; Avoidance of ordnance testing – line charge testing activities during the night during nesting season. Navy Cherry Point Range Complex: Positive control and time-delay diver-placed mine neutralization and countermeasure activities remain 3.2 nm from estuarine inlets and 1.6 nm from shoreline from March through September.	Naval Surface Warfare Center, Panama City Division: Sea turtle nesting season is defined as from May through September; Avoidance of electromagnetic mine countermeasure and neutralization activities within 32 yd. (30 m) of shore during nesting season; Avoidance of ordnance testing – line charge testing activities (day and night) during nesting season. VACAPES, Navy Cherry Point, and JAX Range Complexes: Positive control diver-placed mine neutralization and countermeasure activities remain 3.2 nm from estuarine inlets and 1.6 nm from shoreline.
Piping Plover Habitat in Virginia	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	1 nm from beach in VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island during positive control and time-delay diver-placed mine neutralization and countermeasure activities.	1 nm from beach in VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island during positive control diver-placed mine neutralization and countermeasure activities.
Gulf Sturgeon Habitat in the Gulf of Mexico	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	No ordnance testing – line charge testing activities will occur within nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida from the shoreline to 1 mi. (1.6 km) offshore between October and March (except within the designated line charge testing location on Santa Rosa Island).	No ordnance testing – line charge testing activities will occur within nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida from the shoreline to 1 mi. (1.6 km) offshore between October and March.

ft.: feet; JAX: Jacksonville; km: kilometer; m: meter; mi.: mile; nm: nautical mile; VACAPES: Virginia Capes; yd.: yard

ES.7.5 REPORTING

The Navy is committed to documenting and reporting relevant aspects of training and testing activities in order to document species sightings, reduce environmental impact, and improve future environmental assessments. Initiatives include exercise and monitoring reporting, stranding response plan, bird strikes, and manatee reporting.

ES.8 OTHER CONSIDERATIONS

ES.8.1 CONSISTENCY WITH OTHER FEDERAL, STATE, REGIONAL, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Based on an evaluation of consistency with statutory obligations, the Navy's proposed training and testing activities would not conflict with the objectives or requirements of federal, state, regional or local plans, policies, or legal requirements. The Navy consulted with regulatory agencies as appropriate during the NEPA process and before implementing the Proposed Action to ensure that all legal requirements are met.

In accordance with the Coastal Zone Management Act, the Navy reviewed the enforceable policies of each state and territory's federally-approved Coastal Zone Management Plan relevant to the Study Area. There are 18 states (Alabama, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Texas, and Virginia) and two U.S. territories (Puerto Rico and U.S. Virgin Islands) whose coastal zones could be affected by the Proposed Action. Based on an evaluation of the effects of the Proposed Action discussed in this EIS/OEIS and the enforceable policies of each state and territory's Coastal Zone Management Plan, and pursuant to 15 C.F.R. § 930.39, the Navy prepared consistency determinations for the affected states and territories.

Many areas of the marine environment have some level of federal, state, or local management or protection. Marine protected areas vary widely in purpose, managing agencies, management approaches, level of protection, and restrictions on human uses. The levels of protection provided by these marine protected areas range from fully protected reserves (i.e., no take of any species is permitted) to sites allowing multiple uses, including fishing, recreation, and industrial uses (National Marine Protected Areas Center 2008). EO 13158, *Marine Protected Areas*, requires each federal agency whose actions affect the natural or cultural resources protected by a marine protected area to identify such actions, and in taking such actions, avoid harm to those natural and cultural resources to the maximum extent practicable. All resources of the marine protected areas located within the Study Area have been incorporated into the analyses in Chapter 3 (Affected Environment and Environmental Consequences). In accordance with EO 13158, the Navy has considered the potential impacts of its proposed activities on the national system of marine protected areas that contain marine waters within the Study Area. Management policies specific to military activities have been reviewed as well as any area-specific prohibitions.

ES.8.2 RELATIONSHIP BETWEEN SHORT-TERM USE OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

In accordance with NEPA, this EIS/OEIS analyzes the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. The Proposed Action could result in both short- and long-term environmental impacts. However, these are not expected to result in any impacts

that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public.

ES.8.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

For the Proposed Action, most resource commitments would be neither irreversible nor irretrievable. Most impacts would be short term and temporary, or long lasting but within historical or desired conditions. Because there would be no building or facility construction, the consumption of material typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irretrievably lost.

Implementation of the Proposed Action would require fuels used by aircraft and vessels. Since fixed- and rotary-wing aircraft and ship activities would increase relative to the baseline, total fuel use would increase. Therefore, total fuel consumption would increase under the Proposed Action, and this nonrenewable resource would be considered irretrievably lost.

ES.8.4 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES AND MITIGATION MEASURES

Resources that will be permanently and continually consumed by project implementation include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Prevention of the introduction of potential contaminants is an important component of mitigation of the alternatives' adverse impacts. To the extent practicable, considerations to prevent the introduction of potential contaminants are included.

Sustainable range management practices are in place that protect and conserve natural and cultural resources and preserve access to training areas for current and future training requirements while addressing potential encroachments that threaten to impact range and training area capabilities.

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1 PURPOSE AND NEED

1.1 INTRODUCTION

Major conflicts, terrorism, lawlessness, and natural disasters all have the potential to threaten national security of the United States (U.S.). National security, prosperity, and vital interests of the United States are increasingly tied to other nations because of the close relationships between the United States and other national economies. The U.S. Department of the Navy (Navy) carries out training and testing activities to be able to protect the United States against its enemies, to protect and defend the rights of the United States and its allies to move freely on the oceans, and to provide humanitarian assistance to failed states. The Navy operates on the world's oceans, seas, and coastal areas—the international maritime domain—on which 90 percent of the world's trade and two-thirds of its oil are transported. The majority of the world's population also lives within a few hundred miles of an ocean.

The U.S. Congress, after World War II, established the National Command Authorities to identify defense needs based on the existing and emergent situations in the United States and overseas that must be dealt with now or may be dealt with in the future. The National Command Authorities, which are composed of the President and the Secretary of Defense, divide defense responsibilities among services. The heads (secretaries) of each service ensure that military personnel are trained, prepared, and equipped to meet those operational requirements.

Training and testing activities that prepare the Navy to fulfill its mission to protect and defend the United States and its allies potentially impact the environment. These activities may trigger legal requirements identified in many U.S. federal environmental laws, regulations, and executive orders.

Training. Navy personnel first undergo entry-level (or schoolhouse) training, which varies according to their assigned warfare community (aviation, surface warfare, submarine warfare, and special warfare) and the community's unique requirements. Personnel then train within their warfare community at sea in preparation for deployment; each warfare community has primary mission areas (areas of specialized expertise that involve multiple warfare communities) that overlap one another, described in detail in Chapter 2 (Description of Proposed Action and Alternatives). The Marine Corps similarly trains to support its core capabilities.

Testing. The Navy researches, develops, tests, and evaluates new platforms[1], systems, and technologies. Many tests are conducted in realistic conditions at sea and can range in scale from testing new software, to operating manned portable devices, to conducting ship shock trials. Testing activities may occur independently of or in conjunction with training activities.

The Navy prepared this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to comply with the National Environmental Policy Act (NEPA) and Executive Order (EO) 12114. The Navy also prepared this EIS/OEIS to assess the potential environmental impacts associated with the two categories of military readiness activities mentioned above: training and testing. Collectively, the at-sea areas in this EIS/OEIS are referred to as the Atlantic Fleet Training and Testing (AFTT) Study Area (Figure 1.1-1). The land areas and land activities associated with the range complexes and operating areas (OPAREAs) within the AFTT Study Area (Study Area) were covered in previous environmental documents and are not part of the analysis in this EIS/OEIS.

[1] Throughout this EIS/OEIS, ships and aircraft may be referred to as "platforms"; weapons, combat systems, sensors, and related equipment may be referred to as "systems."

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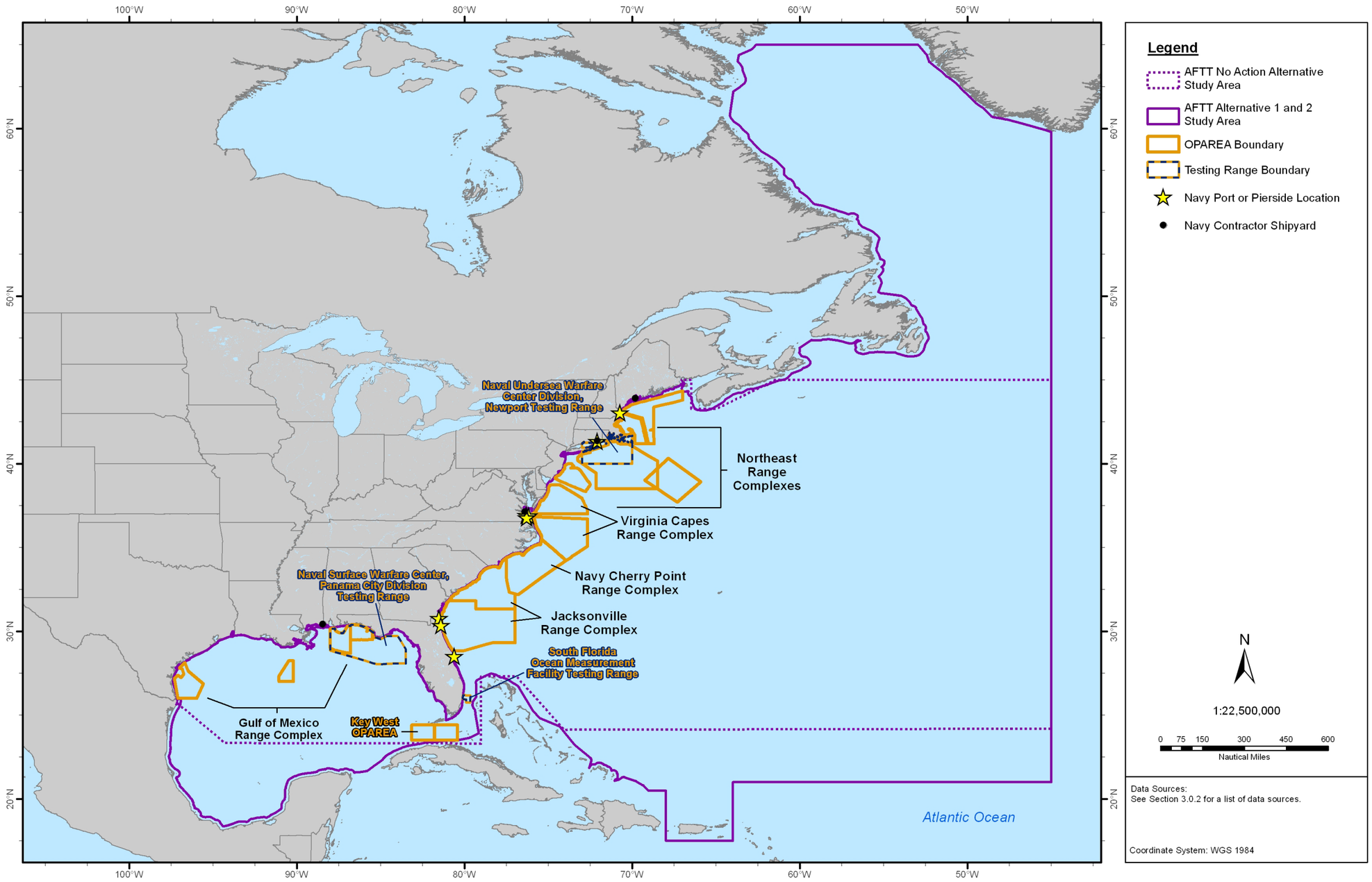

Figure 1.1-1: Atlantic Fleet Training and Testing Study Area
AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

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1.2 THE NAVY'S ENVIRONMENTAL COMPLIANCE AND AT-SEA POLICY

In 2000, the Navy completed a thorough review of its environmental compliance requirements for training at sea and instituted a policy designed to comprehensively address them. The policy, known as the At-Sea Policy, directed, in part, that the Navy develop a programmatic approach to environmental compliance for exercises and training at sea for ranges and OPAREAs within its areas of responsibility (U.S. Department of the Navy 2000). Ranges affected by the At-Sea Policy are designated water areas that are managed and used to conduct training or testing activities. OPAREAs affected by the policy are those ocean areas, defined by specific geographic coordinates, used by the Navy to undertake training and testing activities. To meet the requirements of the policy, the Navy developed an updated Concept of Operations for Phase II Environmental Planning and Compliance for Navy Military Readiness and Scientific Research Activities At Sea in September of 2010. The concept of operations laid out a plan to achieve comprehensive environmental planning and compliance for Navy training and testing activities at sea.

Phase I of the planning program. The first phase of the planning program was accomplished by preparation and completion of individual or separate environmental documents for each range complex and OPAREA. The Navy prepared NEPA/EO 12114 documents for range complexes and OPAREAs on the east coast and in the Gulf of Mexico to analyze training and testing activities. Many of these range complexes and OPAREAs predate World War II and have remained in continuous use by naval forces. The previous NEPA/EO 12114 documents cataloged training and testing activities, analyzed potential environmental impacts, and supported permits and other requirements under applicable environmental laws, regulations, and executive orders. As an example, Marine Mammal Protection Act (MMPA) incidental take authorizations (also known as Letters of Authorization), issued by the National Marine Fisheries Service (NMFS), were obtained for range complexes on the east coast and in the Gulf of Mexico and will expire in early 2014[2].

Phase II of the planning program. The second phase of the planning program will cover activities previously analyzed in Phase I NEPA/EO 12114 documents and also analyze additional geographic areas including, but not limited to, pierside locations and transit routes. This EIS/OEIS is part of the second phase of environmental planning documents needed to support the Navy's request to obtain an incidental take authorization from NMFS. The Navy reevaluated impacts from historically conducted activities and updated the training and testing activities based on changing operational requirements, including those associated with new platforms and systems. The Navy will use this new analysis to support incidental take authorizations under the MMPA.

The Study Area combines the geographic scope of the range complexes on the east coast and in the Gulf of Mexico, as well as study areas covered in NEPA documents for other OPAREAs on the east coast, and analyzes ongoing, routine at-sea activities that occur during transit between these range complexes and OPAREAs. The Navy expanded the geographic scope of this EIS/OEIS to include additional areas where training and testing activities historically occur; this EIS/OEIS also includes new platforms and weapon systems not addressed in previous NEPA/EO 12114 documents.

[2] The Navy did not reanalyze the land portions of these range complexes in this EIS/OEIS because the Incidental Take Statements and Biological Opinions of nonjeopardy for those land portions will not be altered by the Proposed Action.

1.3 PROPOSED ACTION

The Navy's Proposed Action, described in detail in Chapter 2 (Description of Proposed Action and Alternatives), is to conduct training and testing activities—which may include the use of active sound navigation and ranging (sonar) and explosives—in the western Atlantic Ocean off the east coast of the United States, in the Gulf of Mexico, and portions of the Caribbean Sea. These activities will also occur at Navy pierside locations, Navy-contracted shipbuilder locations, port transit channels, and the lower Chesapeake Bay (see Figure 1.1-1 and Section 2.1 [Description of the Atlantic Fleet Training and Testing Study Area] for more detail on the geographic areas analyzed with regard to the Proposed Action). The Proposed Action also includes activities such as sonar maintenance and gunnery exercises conducted concurrently with ship transits and which may occur outside Navy range complexes and testing ranges. The Proposed Action includes pierside sonar testing conducted as part of overhaul, modernization, maintenance, and repair activities at shipyards and Navy piers.

1.4 PURPOSE OF AND NEED FOR PROPOSED MILITARY READINESS TRAINING AND TESTING ACTIVITIES

The purpose of the Proposed Action is to conduct training and testing activities to ensure that the Navy meets its mission, which is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. This mission is achieved in part by conducting training and testing within the Study Area.

The following sections are an overview of the need for military readiness training and testing activities.

> Title 10 Section 5062 of the U.S. Code provides: "The Navy shall be organized, trained, and equipped primarily for prompt and sustained combat incident to operations at sea. It is responsible for the preparation of naval forces necessary for the effective prosecution of war except as otherwise assigned and, in accordance with integrated joint mobilization plans, for the expansion of the peacetime components of the Navy to meet the needs of war."

1.4.1 WHY THE NAVY TRAINS

Naval forces must be ready for a variety of military operations—from large-scale conflict to maritime security and humanitarian assistance/disaster relief—to deal with the dynamic, social, political, economic, and environmental issues that occur in today's world. The Navy supports these military operations through its continuous presence on the world's oceans: the Navy can respond to a wide range of issues because, on any given day, over one-third of its ships, submarines, and aircraft are deployed overseas. Naval forces must be prepared for a broad range of capabilities—from full-scale armed conflict in a variety of different geographic areas[3] to disaster relief efforts[4]—before deployment on the world's oceans. To learn these capabilities, personnel must train with the equipment and systems that will achieve military objectives. The training process provides personnel with an in-depth understanding of their individual limits and capabilities; the training process also helps the testing community improve new weapon systems.

Modern weapons bring both unprecedented opportunity and innumerable challenges to the Navy. For example, modern (or smart) weapons are very accurate and help the Navy accomplish its mission with

[3] Operation Iraqi Freedom in Iraq and Operation Enduring Freedom in Afghanistan; maritime security operations, including anti-piracy efforts like those in Southeast Asia and the Horn of Africa.

[4] Evacuation of noncombatants from American embassies under hostile conditions, as well as humanitarian assistance/disaster relief like the tsunami responses in 2005 and 2011 and Haiti's earthquake in 2009.

greater precision and far less collateral damage than in past conflicts; however, modern weapons are very complex to use. Military personnel must train regularly with these weapons to understand the capabilities, limitations, and operations of the platform or system. Modern military actions require teamwork among hundreds or thousands of people and the use of various equipment, vehicles, ships, and aircraft to achieve success.

Military readiness training and preparation for deployment include everything from teaching basic and specialized individual military skills to intermediate skills or small unit training. As personnel increase in skill level and complete the basic training, they advance to intermediate and larger exercise training events, which culminate in advanced, integrated training events composed of large groups of personnel and, in some instances, joint service exercises[5].

Military readiness training must be as realistic as possible to provide the experiences so important to success and survival. While simulators and synthetic training are critical elements of training—to provide early skill repetition and enhance teamwork—there is no substitute for live training in a realistic environment. The range complexes, test ranges, and OPAREAs have these realistic environments, with sufficient sea and airspace vital for safety and mission success. Just as a pilot would not be ready to fly solo after simulator training, a Navy commander cannot allow military personnel to engage in real combat activities based merely on simulator training.

1.4.2 FLEET READINESS TRAINING PLAN

The Navy developed the Fleet Response Plan to ensure the constant readiness of naval forces. This plan maintains, staffs, and trains naval forces to deploy for missions. The Fleet Response Plan increases the number of personnel and vessels that can be deployed on short notice. For example, the Navy completed an unscheduled deployment of an additional aircraft carrier to the Middle East in January 2007 because of adherence to the Fleet Response Plan. Observance of the Fleet Response Plan also allows the Navy to respond to global events more robustly while maintaining a structured process that ensures continuous availability of trained, ready Navy forces.

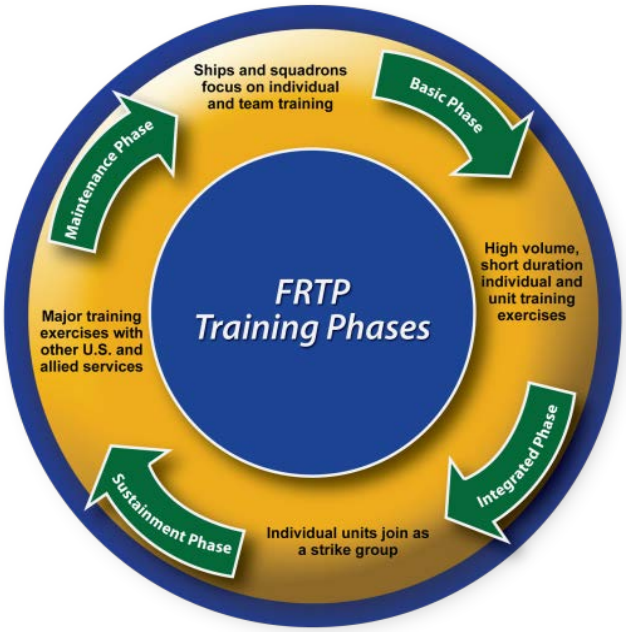

Figure 1.4-1: Fleet Readiness Training Plan

The Fleet Readiness Training Plan implements the requirements in the Fleet Response Plan. The Fleet Readiness Training Plan outlines the training activities required for military readiness that prepares Navy personnel for any conflict or operation. The Navy's building-block approach to training is cyclical and qualifies its personnel to perform their assigned missions. Training activities proceed in four phases: basic, integrated, sustainment, and maintenance, as depicted in Figure 1.4-1.

[5] Large group exercises may include carrier strike groups and expeditionary strike groups. Joint exercises may be with other U.S. services and other nations.

1.4.2.1 Basic Phase

The basic phase consists of training exercises performed by individual ships and aircraft; it is characterized mostly as unit level training. Fundamental combat skills are learned and practiced during this phase. Operating area and range support requirements for unit level training are of relatively modest size compared to large-scale, major exercises. Training exercises with two or more units (ships or aircraft, or both), known as coordinated unit level training exercises, are also included in the basic phase. These training exercises further refine the basic, fundamental skills while increasing difficulty through coordination with other units.

Access to local range complexes and OPAREAs near the locations where Sailors and Marines are stationed reduces the amount of travel time and training costs.

1.4.2.2 Integrated Phase

The integrated phase combines the units involved in the basic, coordinated unit-level training into strike groups. Strike groups are composed of multiple ships and aircraft. Strike group skills and proficiencies are developed and evaluated through major exercises. The integrated phase concludes when the strike group is certified for deployment, meaning that the strike group demonstrated the skills and proficiencies across the entire spectrum of warfare that may be needed during deployment.

Major exercises in this phase require access to large, relatively unrestricted ocean OPAREAs, multiple targets, and unique range attributes (oceanographic features, proximity to naval bases, and land-based targets).

1.4.2.3 Sustainment Phase

The strike group needs continued training activities to maintain its skills after certification for deployment in the integrated phase; these continued training activities fall within the sustainment phase. Sustainment phase activities provide strike groups additional training, as well as the ability to evaluate new and developing technologies and to evaluate and develop new tactics.

Similar to the integrated phase, sustainment exercises require access to large, relatively unrestricted ocean OPAREAs and their unique range attributes to support the scenarios.

1.4.2.4 Maintenance Phase

Naval forces enter the maintenance phase after returning from deployment. Maintenance may involve relatively minor repair or major overhaul, depending on the system and its age. The maintenance phase also includes testing a ship's systems; these tests may take place pierside or at sea. Naval forces reenter the basic phase upon completion of the maintenance phase.

1.4.3 WHY THE NAVY TESTS

The Navy's research and acquisition community conducts military readiness activities that involve testing. The Navy tests ships, aircraft, weapons, combat systems, sensors, and related equipment, and it conducts scientific research activities to achieve and maintain military readiness. The fleet identifies military readiness requirements to support its mission; the Navy's research and acquisition community, including the Navy's systems commands and associated scientific research organizations, provides Navy personnel with ships, aircraft, weapons, combat systems, sensors, and related equipment. The Navy's research and acquisition community is responsible for researching, developing, testing, evaluating, acquiring, and delivering modern platforms and systems to the fleet—and supporting the systems

throughout their life. The Navy's research and acquisition community is responsible for furnishing high-quality platforms, systems, and support matched to the requirements and priorities of the fleet, while providing the necessary high return on investment to the American taxpayer.

The Navy's research and acquisition community includes the following:

- The Naval Air Systems Command, which develops, acquires, delivers, and sustains aircraft and systems with proven capability and reliability to ensure that Sailors achieve mission success.
- The Naval Sea Systems Command, which develops, acquires, delivers, and maintains surface ships, submarines, and weapon system platforms that provide the right capability to Sailors.
- The Space and Naval Warfare Systems Command, which provides Sailors with knowledge superiority by developing, delivering, and maintaining effective, capable, and integrated command, control, communications, computer, intelligence, and surveillance systems.
- The Office of Naval Research, which plans, fosters, and encourages scientific research that promotes future naval seapower and enhances national security.
- The Naval Research Laboratory, which conducts a broad program of scientific research, technology, and advanced development to meet the complex technological challenges of today's world.

The Navy's research and acquisition community, in cooperation with private companies, designs, tests and builds components, systems, and platforms to address requirements identified by the fleets. Private companies are contracted to assist the Navy in acquiring the platform, system, or upgrade. The Navy's research and acquisition community must test and evaluate the platform, system, or upgrade to validate whether it performs as expected and to determine whether it is operationally effective, suitable, survivable, and safe for its intended use by the fleet.

Testing performed by the Navy's research and acquisition community can be categorized as scientific research testing, private contractor testing, developmental testing and operational testing (including lot acceptance testing), fleet training support, follow-on test and evaluation, or maintenance and repair testing. Fleet training events often offer the most suitable environment for testing a system because such training is designed to accurately replicate operational conditions. System tests, therefore, are often embedded in training events such that it would be difficult for an observer to differentiate the two activities.

- **Scientific research testing.** Navy testing organizations conduct scientific research to evaluate emerging threats or technology enhancement before developing a new system. As an example, testing might occur on a current weapon system to determine if a newly developed technology would improve system accuracy or enhance safety to personnel.
- **Private contractor testing.** Contractors are often required to conduct performance and specification tests before delivering a system or platform to the Navy. These tests may be conducted on a Navy range, in a Navy OPAREA, or seaward of ranges and OPAREAs; these tests are sometimes done in conjunction with fleet training activities.
- **Developmental testing.** A series of tests are conducted by specialized Navy units to evaluate a platform or system's performance characteristics and to ensure that it meets all required specifications.
- **Operational testing**. Operations are conducted with the platform or system as it would be used by the fleet.

- **Fleet training support.** Systems still under development may be integrated on ships or aircraft for testing. If training has not been developed for use of a particular system, the Navy's systems commands may support the fleet by providing training on the operation, maintenance, and repair of the system during developmental testing activities.
- **Follow-on test and evaluation.** A follow-on test and evaluation phase occurs when a platform receives a new system, after a significant upgrade to an existing system, or when the system failed to meet contractual performance specifications during previous testing. Tests similar to those conducted during the developmental testing or operational testing phase are conducted again, as needed, to ensure that the modified or new system meets performance requirements and does not conflict with existing platform systems and subsystems.
- **Maintenance and repair testing.** Following periodic maintenance, overhaul, modernization, or repair of systems, testing of the systems may be required to assess performance. These testing activities may be conducted at shipyards or Navy piers.

Preparatory checks of a platform or system-to-be-tested are often made prior to actual testing to ensure the platform or system is operating properly. This preparatory check is similar to checking the wipers and brakes on a car before taking a trip. These checks are done to ensure everything is operating properly before expending the often-considerable resources involved in conducting a full-scale test. For example, the MH-60 helicopter program often conducts a functional check of its dipping sonar system in a nearshore area before conducting a more rigorous test of the sonar system farther offshore. Pierside platform and systems checks are conducted during Navy repair and construction activities and are essential to ensure safe operation of the platform or system at sea.

The Navy uses a number of different testing methods, including computer simulation and analysis, throughout the development of platforms and systems. Although simulation is a key component in the development of platforms and systems, it cannot provide information on how a platform or system will perform or whether it will be able to meet performance and other specification requirements in the environment in which it is intended to operate without comparison to actual performance data. For this reason, platforms and systems must undergo at-sea testing at some point in the development process. Thus, like the fleet, the research and acquisition community requires access to large, relatively unrestricted ocean operating areas, multiple strike targets, and unique range attributes to support its testing requirements. Navy platforms and systems must be tested and evaluated within the broadest range of operating conditions available (e.g., bathymetry, topography, geography) because Navy personnel must be capable of performing missions within the wide range of conditions that exist worldwide. Furthermore, Navy personnel must be assured that platforms and systems will meet performance specifications in the real-world environment in which they will be operated.

1.5 Overview and Strategic Importance of Existing Range Complexes and Testing Ranges

The Navy historically uses areas along the eastern coast of the United States and in the Gulf of Mexico for training and testing. These areas were designated by the Navy into geographic regions, and named "range complexes" (Figure 1.1-1). A range complex is a set of adjacent areas of sea space, undersea space, land ranges, and overlying airspace delineated for military training and testing activities. Range complexes provide controlled and safe environments where military ship, submarine, and aircraft crews can train in realistic conditions. The combination of undersea ranges and operating areas with land training ranges, safety landing fields, and nearshore amphibious landing sites is critical to realistic training, which allows electronics on the range to capture data on the effectiveness of tactics and equipment—data that provide a feedback mechanism for training evaluation.

In previous decades, the Navy developed facilities in the Study Area to provide support for at-sea testing of platforms and systems. These existing facilities support specific Navy testing requirements. Fleet assets support testing activities on test ranges, while systems commands frequently conduct tests on fleet range complexes and use fleet assets to support the testing. Range complexes must provide flexibility to meet these diverse training and testing requirements given the wide range of warfare specialties and range of skills and proficiencies the fleets must demonstrate before certification for deployment.

The range complexes and testing ranges analyzed in this EIS/OEIS have each existed for many decades, some dating back to the 1940s. Range use and infrastructure have developed over time as training and testing requirements in support of modern warfare have evolved. The Navy has not proposed and is not proposing to create new range complexes or operating areas. Further, only activities historically conducted or similar to those historically conducted within the at-sea portions of the current range complexes are proposed and therefore analyzed within this EIS/OEIS. Land-based activities were analyzed in prior EISs/OEISs and, therefore, are not re-addressed within this document. Thus, for example, activities conducted at Rodman Range in the Jacksonville Range Complex are not included in this EIS/OEIS.

Proximity of the AFTT range complexes to naval homeports is strategically important to the Navy because close access allows for efficient execution of training activities and non-training maintenance functions and access to alternate airfields when necessary. The proximity of training to homeports also ensures that Sailors and Marines do not have to routinely travel far from their families. For example, the Norfolk and Jacksonville areas are home to thousands of military families. The Navy is required to track and, where possible, limit the amount of time Sailors and Marines spend deployed from home. Less time away from home is an important factor in military readiness, morale, and retention. The proximate availability of the AFTT range complexes is critical to Navy efforts in these areas.

Northeast Range Complexes: The Northeast Range Complexes are the Boston Range Complex, Narragansett Bay Range Complex, and Atlantic City Range Complex, which consist of OPAREAs and associated special use airspace for fleet training and testing activities. The OPAREAs and special use airspace areas are the Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA. These complexes occupy waters off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey.

Naval Undersea Warfare Center Division, Newport Testing Range: The Naval Undersea Warfare Center Division, Newport Testing Range consists of waters within Narragansett Bay; nearshore waters of Rhode Island Sound; Block Island Sound; and coastal waters of New York, Connecticut, and Massachusetts.

Virginia Capes Range Complex: The Virginia Capes Range Complex consists of an OPAREA and several associated special use airspaces. The Virginia Capes OPAREA extends southward from the Delaware-Maryland border along the coast of Maryland, Virginia, and North Carolina.

Navy Cherry Point Range Complex: The Navy Cherry Point Range Complex consists of an OPAREA and associated special use airspace. The Navy Cherry Point OPAREA extends southeast along the coast of North Carolina.

Jacksonville Range Complex: The Jacksonville Range Complex consists of two OPAREAs and associated special use airspace. The OPAREAs extend southward from the North Carolina-South Carolina border and along the coasts of South Carolina, Georgia, and Florida.

Naval Surface Warfare Center Carderock Division, South Florida Ocean Measurement Facility Testing Range: The South Florida Ocean Measurement Facility Testing Range is located at two sites just south of Fort Lauderdale, Florida.

Key West Range Complex: The Key West Range Complex consists of an OPAREA and associated extensive special use airspace in proximity to Key West, Florida.

Gulf of Mexico Range Complex: The Gulf of Mexico Range Complex consists of four OPAREAs and associated special use airspace in the Gulf of Mexico. These four OPAREAs are proximal to Panama City, Pensacola, New Orleans, and Corpus Christi.

Naval Surface Warfare Center, Panama City Division Testing Range: The Naval Surface Warfare Center, Panama City Division conducts testing activities in the Pensacola and Panama City OPAREAs, in St. Andrew Bay, and military warning areas W-151, W-155, and W-470.

Information on the range complexes and testing ranges included in the Study Area can be found in Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area).

1.6 The Environmental Planning Process

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies to examine the environmental impacts of their proposed actions within the United States and its territories. An EIS is a detailed public document that provides an assessment of the potential effects that a major federal action might have on the human environment, which includes the natural environment. The Navy undertakes environmental planning for major Navy actions occurring throughout the world in accordance with applicable laws, regulations, and executive orders.

1.6.1 National Environmental Policy Act Requirements

The first step in the NEPA process (Figure 1.6-1) for an EIS is to prepare a Notice of Intent to develop an EIS. The Notice of Intent is published in the *Federal Register* and provides an overview of the proposed action and the scope of the EIS. The Notice of Intent is also the first step in engaging the public.

Scoping is an early and open process for developing the "scope" of issues to be addressed in an EIS and for identifying significant issues related to a proposed action. The scoping process for an EIS is initiated by publication of the Notice of Intent in the *Federal Register* and local newspapers. During scoping, the public helps define and prioritize issues through public meetings and written comments.

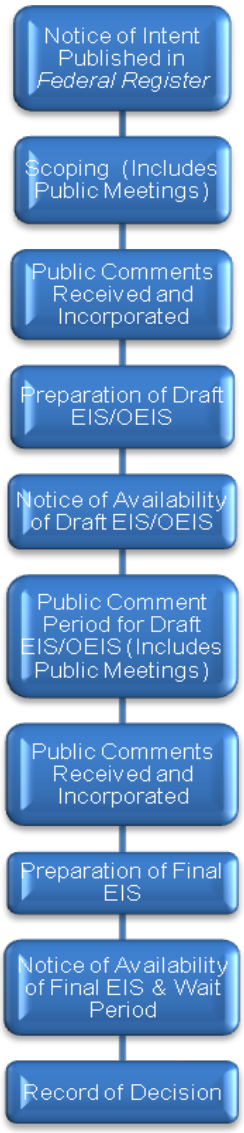

Figure 1.5-1: National Environmental Policy Act Process

Subsequent to the scoping process, a Draft EIS is prepared to assess potential impacts of the proposed action and alternatives on the environment. When completed, a Notice of Availability is published in the *Federal Register* and notices are placed in local or regional newspapers announcing the availability of the Draft EIS. The Draft EIS is circulated for review and comment; public meetings are also held.

The Final EIS addresses all public comments received on the Draft EIS. Responses to public comments may include correction of data, clarifications of and modifications to analytical approaches, and inclusion of new or additional data or analyses.

Finally, the decision maker will issue a Record of Decision no earlier than 30 days after a Final EIS is made available to the public.

1.6.2 EXECUTIVE ORDER 12114

Executive Order 12114, *Environmental Impacts Abroad of Major Federal Actions*, directs federal agencies to provide for informed environmental decision making for major federal actions outside the United States and its territories. Presidential Proclamation 5928, issued December 27, 1988, extended the exercise of U.S. sovereignty and jurisdiction under international law to 12 nautical miles (nm); however, the proclamation expressly provides that it does not extend or otherwise alter existing federal law or any associated jurisdiction, rights, legal interests, or obligations. Thus, as a matter of policy, the Navy analyzes environmental effects and actions within 12 nm under NEPA (an EIS) and those effects occurring beyond 12 nm under the provisions of EO 12114 (an OEIS).

1.6.3 OTHER ENVIRONMENTAL REQUIREMENTS CONSIDERED

The Navy must comply with all applicable federal environmental laws, regulations, and executive orders, including, but not limited to, those listed below. Further information can be found in Chapter 3 (Affected Environment and Environmental Consequences) and Chapter 6 (Additional Regulatory Considerations).

- Abandoned Shipwreck Act
- Antiquities Act
- Clean Air Act
- Clean Water Act
- Coastal Zone Management Act
- Endangered Species Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- National Historic Preservation Act
- National Marine Sanctuaries Act
- Rivers and Harbors Act
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*
- EO 12962, *Recreational Fisheries*
- EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*
- EO 13089, *Coral Reef Protection*
- EO 13158, *Marine Protected Areas*
- EO 13175, *Consultation and Coordination with Indian Tribal Governments*
- EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*

1.7 SCOPE AND CONTENT

In this EIS/OEIS, the Navy assessed military readiness training and testing activities that could potentially impact human and natural resources, especially marine mammals, sea turtles, and other marine resources. The range of alternatives includes the No Action and other reasonable courses of action. In

this EIS/OEIS, the Navy analyzed direct, indirect, cumulative, short-term, long-term, irreversible, and irretrievable impacts. The Navy is the lead agency for the Proposed Action and is responsible for the scope and content of this EIS/OEIS. The National Marine Fisheries Service is a cooperating agency because of its expertise and regulatory authority over marine resources. Additionally, this document will serve as NMFS' NEPA documentation for the rule-making process under the MMPA.

In accordance with the Council on Environmental Quality Regulations, 40 C.F.R. § 1505.2, the Navy will issue a Record of Decision that provides the rationale for choosing one of the alternatives. The decision will be based on factors analyzed in this EIS/OEIS, including military training and testing objectives, best available science and modeling data, potential environmental impacts, and public interest.

1.8 ORGANIZATION

To meet the need for decision making, this EIS/OEIS is organized as follows:

- Chapter 1 describes the purpose of and need for the Proposed Action.
- Chapter 2 describes the Proposed Action, alternatives considered but eliminated in the EIS/OEIS, and alternatives to be carried forward for analysis in the EIS/OEIS (including the preferred alternative).
- Chapter 3 describes the existing conditions of the affected environment and analyzes the potential impacts of the training and testing activities in each alternative.
- Chapter 4 describes the analysis of cumulative impacts, which are the impacts of the Proposed Action when added to past, present, and reasonably foreseeable future actions.
- Chapter 5 describes the measures the Navy evaluated that could mitigate impacts to the environment.
- Chapter 6 describes other considerations required by NEPA and describes how the Navy complies with other federal, state, and local plans, policies, and regulations.
- Chapter 7 includes a list of the EIS/OEIS preparers.
- Chapter 8 includes a list of agencies, government officials, tribes, groups, and individuals on the distribution lists for receipt of the Draft EIS/OEIS, Proposed Rule notification, and the Final EIS/OEIS.
- Appendices provide technical information that supports the EIS/OEIS analyses and its conclusions.

1.9 RELATED ENVIRONMENTAL DOCUMENTS

The progression of NEPA/EO 12114 documentation for Navy activities has developed from planning individual range complex exercises and testing events to theater assessment planning that spans multiple years and covers multiple range complexes. The following publicly available documents relate to Navy training and testing activities and may be referenced in this EIS/OEIS, as appropriate:

- Final Atlantic Fleet Active Sonar Training Environmental Impact Statement/Overseas Environmental Impact Statement (December 2008)
- Virginia Capes Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (March 2009), Navy Cherry Point Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (April 2009), Jacksonville Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (March 2009), Gulf of Mexico Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (December 2010), and Final Environmental

Assessment/Overseas Environmental Assessment on the Key West Range Complex (January 2010)

- Final Environmental Assessment for the Homebasing of the MH-60R/S on the East Coast of the United States (May 2002)
- Final EIS for Proposed Homeporting of Additional Surface Ships at Naval Station Mayport, Florida (January 2009)
- Final EIS for Introduction of the P-8A Multi-Mission Maritime Aircraft into the U.S. Navy Fleet (March 2009)
- EIS for Introduction of F/A-18E/F Super Hornets to the East Coast of the U.S. (July 2003)
- Shock Trials of the Mesa Verde (LPD-19) Final EIS/OEIS (May 2008)
- Environmental Impact Statement for the Shock Trial of the Winston S Churchill (DDG-81) (February 2001)
- Overseas Environmental Assessment for High Speed Sea Trials in the Gulf of Mexico (June 2009)
- Programmatic Overseas Environmental Assessment on Sinking Exercises (SINKEX) in the Western Atlantic Ocean (March 2006)
- Final Overseas Environmental Impact Statement/Environmental Impact Statement for Undersea Warfare Training Range (June 2009)
- Final Environmental Impact Statement/Overseas Environmental Impact Statement for Naval Surface Warfare Center, Panama City Division Mission Activities (September 2009)
- Environmental Assessment of Test Operations in Rhode Island Waters for the Naval Undersea Warfare Center Division Newport (May 2008)
- Environmental Impact Statement for Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) Sonar (April 2007)
- Final Environmental Assessment for the Transition of E-2C Hawkeye to E-2D Advanced Hawkeye at Naval Station Norfolk, Virginia and Naval Base Ventura County Point Mugu, California (January 2009)
- Final Environmental Assessment for the Homeporting of Six Zumwalt Class Destroyers at East and West Coast Installations (Including Hawaii) (May 2008)

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REFERENCES

U.S. Department of the Navy, Undersecretary of the Navy. (2000). Memorandum for the Chief of Naval operations [and] Commandant of Marine Corps: Compliance with environmental requirements in the conduct of naval exercises or training at sea. Washington, DC.

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2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Department of the Navy's (Navy) Proposed Action is to conduct training and testing activities— that may include the use of active sonar and explosives[1]—primarily within existing range complexes and testing ranges in the western Atlantic Ocean off the east coast of the United States, in the Gulf of Mexico, and in portions of the Caribbean Sea. These activities will also occur at Navy pierside locations, Navy-contracted shipbuilder locations, port transit channels, and the lower Chesapeake Bay (Figure 2.1-1). The Proposed Action includes activities such as sonar maintenance and gunnery exercises conducted concurrently with ship transits and that may occur outside of Navy range complexes and testing ranges. The Proposed Action also includes pierside sonar testing conducted as part of overhaul, modernization, maintenance, and repair activities at Navy piers, as well as new construction at Navy-contracted shipbuilder locations.

Through this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), the Navy will

- Reassess the environmental analysis of Navy at-sea training and testing activities contained in seven separate EISs/OEISs and various Environmental Assessments (EAs)/Overseas Environmental Assessments (OEAs) and consolidate these analyses into a single environmental planning document. This reassessment will support reauthorization of incidental takes of marine mammals under the Marine Mammal Protection Act (MMPA) and incidental takes of threatened and endangered marine species through consultation under Section 7 of the Endangered Species Act (ESA). The following seven EIS/OEIS documents are being consolidated:
  - *Final Atlantic Fleet Active Sonar Training Environmental Impact Statement/Overseas Environmental Impact Statement* (December 2008)
  - *Virginia Capes Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement* (March 2009)
  - *Navy Cherry Point Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement* (April 2009)
  - *Jacksonville Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement* (March 2009)
  - *Final Environmental Impact Statement/Overseas Environmental Impact Statement, Naval Surface Warfare Center Panama City Division Mission Activities* (September 2009)
  - *Gulf of Mexico Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement* (December 2010)
  - *Final Overseas Environmental Impact Statement/Environmental Impact Statement, Undersea Warfare Training Range* (June 2009)
- Adjust baseline training and testing activities from current levels to the level needed to support Navy training and testing requirements beginning January 2014. As part of the adjustment, the Navy accounts for other activities and sound sources not addressed in the previous analyses.
- Analyze the potential environmental impacts of training and testing activities in additional areas (areas not covered in previous documents) where training and testing historically occurs, including Navy ports, naval shipyards, and Navy-contractor shipyards, and the transit channels serving these areas.

[1] The terms 'explosive' and 'high-explosive' are used interchangeably throughout the document.

- Update the at-sea environmental impact analyses for Navy activities in the previous documents to account for force structure changes, including those resulting from the development, testing, and use of weapons, platforms, and systems that will be operational by 2019.
- Implement enhanced range capabilities.
- Update environmental analyses with the best available science and most current acoustic analysis methods to evaluate the potential effects of training and testing activities on the marine environment.

In this chapter, the Navy will build upon the purpose and need to train and test by describing the study area and identifying the primary mission areas under which these activities are conducted. Each warfare community conducts activities that uniquely contribute to the success of a primary mission area. Each primary mission area requires unique skills, sensors, weapons, and technologies to accomplish the mission. For example, in the primary mission area of anti-submarine warfare, surface, submarine, and aviation communities each utilize different skills, sensors, and weapons to locate, track, and eliminate submarine threats. The testing community contributes to the success of anti-submarine warfare by anticipating and identifying technologies and systems that respond to the needs of the warfare communities. As each warfare community develops its basic skills and integrates them into combined units and strike groups, the problems of communication, coordination and planning, movement and positioning of naval forces and targeting/delivery of weapons become increasingly complex. This complexity creates a need for coordinated training and testing between the fleets and systems commands.

To address the activities needed to accomplish this training and testing in this EIS/OEIS, the Navy has broken down each training and testing activity into basic components analyzed for their potential environmental impacts. The training and testing events are captured in tables and the discussion that follows. Additionally, Chapter 2 provides detailed discussion of how the training and testing activities occur and the platforms, weapons, and systems that are required to complete the activities.

Chapter 2 is organized into eight sections.

- Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) outlines the area where training and testing activities would occur.
- Section 2.2 (Primary Mission Areas) outlines the primary mission areas, which are how training and testing activities are categorized.
- Section 2.3 (Description of Sonar, Ordnance/Munitions, Targets, and Other Systems Employed in the Atlantic Fleet Training and Testing Events) provides information on the sonar systems, ordnance and munitions, and targets utilized during training and testing activities.
- Section 2.4 (Proposed Activities) outlines the proposed training and testing activities.
- Section 2.5 (Alternatives Development) outlines the process to develop the alternatives for the Proposed Action.
- Section 2.6 (No Action Alternative: Current Military Readiness within the Atlantic Fleet Region) outlines the No Action Alternative proposed in this EIS/OEIS.
- Section 2.7 (Alternative 1: Expansion of Study Area Plus Adjustments to the Baseline and Additional Weapons, Platforms, and Systems) outlines Alternative 1 proposed in this EIS/OEIS.
- Section 2.8 (Alternative 2: Includes Alternative 1 Plus Increased Tempo of Training and Testing Activities) outlines Alternative 2 proposed in this EIS/OEIS.

The proposed activities are complex and therefore the Navy has prepared several appendices that provide a greater level of detail – these appendices will be referenced in the appropriate chapters.

2.1 DESCRIPTION OF THE ATLANTIC FLEET TRAINING AND TESTING STUDY AREA

The Atlantic Fleet Training and Testing (AFTT) EIS/OEIS Study Area (Study Area) is in the western Atlantic Ocean and encompasses the east coast of North America and the Gulf of Mexico. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs (Sections 2.1.11, Bays, Harbors, and Civilian Ports, and 2.1.12, Pierside Locations) are also included in the Study Area.

The Study Area also includes several Navy testing ranges and range complexes. A range complex is a designated set of specifically bounded geographic areas and encompasses a water component (above and below the surface), airspace, and may encompass a land component where training and testing of military platforms, tactics, munitions, explosives, and electronic warfare systems occur. Range complexes include established OPAREAs and special use airspace, which may be further divided to provide better control of the area and events being conducted for safety reasons.

- **Operating Area**. An ocean area defined by geographic coordinates with defined surface and subsurface areas and associated special use airspace. OPAREAs include the following:
  - **Danger Zones.** A danger zone is a defined water area used for gunnery, bombing, rocket firing, or other especially hazardous military activities. Danger zones are established pursuant to statutory authority of the Secretary of the Army and are administered by the United States (U.S.) Army Corps of Engineers. Danger zones may be closed to the public on a full-time or intermittent basis (33 Code of Federal Regulations [C.F.R.] Part 334).
  - **Restricted Areas.** A restricted area is a defined water area for the purpose of prohibiting or limiting public access to the area. Restricted areas generally provide security for government property and also provide protection to the public from the risks of damage or injury arising from the government's use of that area (33 C.F.R. Part 334).
- **Special Use Airspace**. Airspace of defined dimensions where activities must be confined because of their nature or where limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration Order 7400.8). Types of special use airspace most commonly found in range complexes include the following:
  - **Restricted Areas.** Airspace where aircraft are subject to restriction due to the existence of unusual, often invisible hazards (e.g., release of ordnance) to aircraft. Some areas are under strict control of the Department of Defense (DoD) and some are shared with non-military agencies.
  - **Military Operations Area.** Airspace with defined vertical and lateral limits established for the purpose of separating or segregating certain military training activities from instrument flight rules traffic and to identify for visual flight rules traffic where these activities are conducted.

- **Warning Area.** Areas of defined dimensions, extending from 3 nautical miles (nm) outward from the coast of the United States, which serve to warn non-participating aircraft of potential danger.
- **Air Traffic Control Assigned Airspace.** Airspace of defined vertical/lateral limits, assigned by Air Traffic Control, for the purpose of providing air traffic segregation between the specified activity being conducted within the assigned airspace and other instrument flight rules traffic.

The Study Area includes only the at-sea components of the range complexes and testing ranges. The Study Area also includes Narragansett Bay, lower Chesapeake Bay, St. Andrew Bay, and pierside locations. The remaining inland waters and land-based portions of the range complexes are not a part of the Study Area and will be or already have been addressed under separate National Environmental Policy Act (NEPA) documentation. Some training and testing occurs outside the OPAREAs (i.e., some activities are conducted seaward of the OPAREAs, and a limited amount of active sonar is used shoreward of the OPAREAs, pierside, and in transit to and from Navy piers). The Study Area is depicted in Figure 2.1-1. Regional maps, Figures 2.1-2, 2.1-3, and 2.1-4, are provided for additional detail of the range complexes and testing ranges. The following range complexes and components are part of the Study Area.

2.1.1 NORTHEAST RANGE COMPLEXES

The three range complexes of Boston Range Complex, Narragansett Bay Range Complex, and Atlantic City Range Complex are collectively referred to as the Northeast Range Complexes. These range complexes span 761 miles (mi.) (1,225 km) along the coast from Maine to New Jersey. The Northeast Range Complexes include special use airspace with associated warning areas and surface and subsurface sea space of the Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA. For purposes of this document the CGULL testing area is considered an OPAREA and part of the Northeast Range Complexes and includes 22,525 nm^2 of sea space (Figure 2.1-2).

2.1.1.1 Special Use Airspace

The Northeast Range Complexes include 30,930 nm^2 of special use airspace overlying the Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA. The altitude at which aircraft may fly varies from the surface to 60,000 ft., except for warning area W-107A in the Atlantic City Range Complex, which is unlimited. Warning areas within the Northeast Range Complexes include W-102, W-103, W-104, W-105, W-106, and W-107.

2.1.1.2 Sea and Undersea Space

The Northeast Range Complexes include three OPAREAs – Boston, Narragansett Bay, and Atlantic City. These OPAREAs encompass 45,619 nm^2 of sea space and undersea space. The Boston, Narragansett Bay, and Atlantic City OPAREAs are offshore of the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey. The OPAREAs of the three complexes are outside 3 nm but within 200 nm from shore.

2.1.2 NAVAL UNDERSEA WARFARE CENTER DIVISION, NEWPORT TESTING RANGE

The Naval Undersea Warfare Center Division, Newport Testing Range includes the waters of Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, and Long Island Sound (Figure 2.1-2).

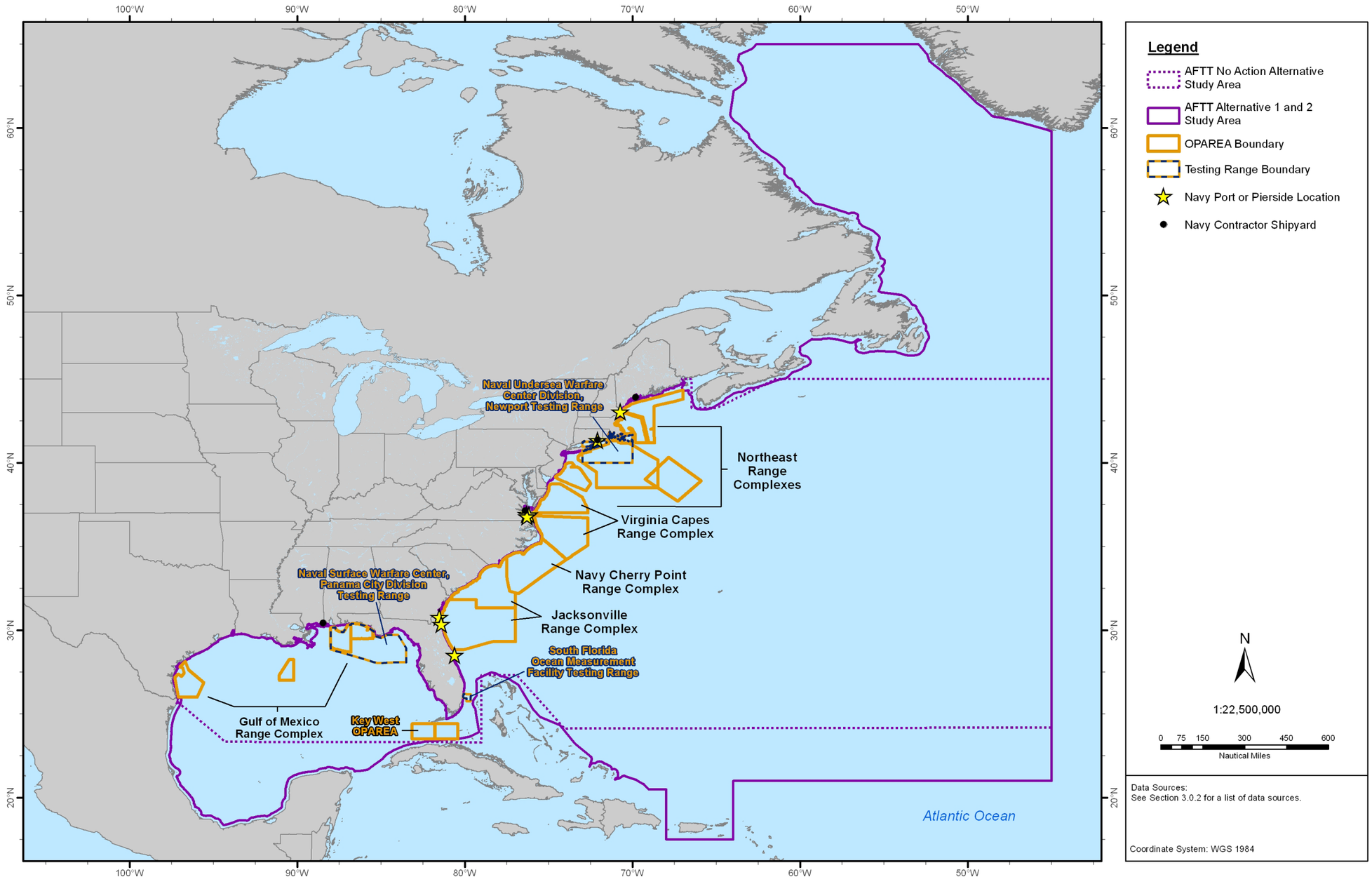

Figure 2.1-1: Atlantic Fleet Training and Testing Study Area
AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

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2.1.2.1 Special Use Airspace

A portion of Naval Undersea Warfare Center Division, Newport Testing Range is under R-4105A, known as No Man's Land Island restricted airspace. There are minimal testing requirements associated with airspace within Naval Undersea Warfare Center Division, Newport Testing Range.

2.1.2.2 Sea and Undersea Space

Three restricted areas are located within the area of the Naval Undersea Warfare Center Division, Newport Testing Range.

- Coddington Cove restricted area, adjacent to Naval Undersea Warfare Center Division, Newport,
- Narragansett Bay Restricted Area (6.1 nm^2 area surrounding Gould Island) including the Hole Test Area, and the North Test Range, and
- Rhode Island Sound Restricted Area, a rectangular box (27.2 nm^2) located in Rhode Island and Block Island Sounds.

2.1.3 VIRGINIA CAPES RANGE COMPLEX

The Virginia Capes (VACAPES) Range Complex spans 270 mi. (434.5 km) along the coast from Delaware to North Carolina from the shoreline to 155 nm seaward (Figure 2.1-2). The VACAPES Range Complex includes special use airspace with associated warning and restricted areas, and surface and subsurface sea space of the VACAPES OPAREA. The VACAPES Range Complex also includes established mine warfare training areas located within the lower Chesapeake Bay and off the coast of Virginia.

2.1.3.1 Special Use Airspace

The VACAPES Range Complex includes 28,672 nm^2 of special use airspace overlying the VACAPES OPAREA. Flight altitudes range from surface to ceilings of 18,000 ft. to unlimited altitudes. Warning areas within the VACAPES Range Complex include W-50, W-386, W-387, W-72, and W-110. Restricted airspace within the VACAPES Range Complex is designated R-6606, which extends from the shoreline to approximately the 3 nm state territorial sea limit.

2.1.3.2 Sea and Undersea Space

The VACAPES Range Complex shore boundary roughly follows the shoreline from Delaware to North Carolina; the seaward boundary extends 155 nm into the Atlantic Ocean proximate to Norfolk, Virginia. The VACAPES OPAREA encompasses 27,661 nm^2 of sea space and undersea space. The VACAPES OPAREA is offshore of the states of Delaware, Maryland, Virginia, and North Carolina.

2.1.4 NAVY CHERRY POINT RANGE COMPLEX

The Navy Cherry Point Range Complex, off the coast of North Carolina, encompasses the sea space from the shoreline to 120 nm seaward. The Navy Cherry Point Range Complex includes special use airspace with associated warning areas and surface and subsurface sea space of the Cherry Point OPAREA (Figure 2.1-3). The Navy Cherry Point Range Complex is adjacent to the U.S. Marine Corps Cherry Point and Camp Lejeune Range Complexes associated with Marine Corps Air Station Cherry Point and Marine Corps Base Camp Lejeune.

2.1.4.1 Special Use Airspace

The Navy Cherry Point Range Complex includes 18,966 nm^2 of special use airspace overlying the Cherry Point OPAREA. The airspace varies from the surface to unlimited altitude. Special use airspace within the Navy Cherry Point Range Complex is composed of a single warning area, W-122.

2.1.4.2 Sea and Undersea Space

The Navy Cherry Point Range Complex is roughly aligned with the shoreline and extends out 120 nm into the Atlantic Ocean. The Cherry Point OPAREA encompasses 18,617 nm^2 of sea space and undersea space. The Navy Cherry Point Range Complex is offshore of the states of North Carolina and South Carolina.

2.1.5 JACKSONVILLE RANGE COMPLEX

The Jacksonville (JAX) Range Complex spans 520 mi. along the coast from North Carolina to Florida from the shoreline to 250 nm seaward. The JAX Range Complex includes special use airspace with associated warning areas and surface and subsurface sea space of the Charleston and JAX OPAREAs. The Undersea Warfare Training Range is located within the JAX Range Complex (Figure 2.1-3 and Appendix H, Impacts Due to Atlantic Fleet Training and Testing Activities at the Undersea Warfare Training Range).

2.1.5.1 Special Use Airspace

The JAX Range Complex includes approximately 50,068 nm^2 of special use airspace overlying the Charleston and JAX OPAREAs. Flight altitudes range from the surface to unlimited altitudes. Warning areas within the JAX Range Complex include: W-132, W-133, W-134, W-157, W-158, and W-159.

2.1.5.2 Sea and Undersea Space

The JAX Range Complex shore boundary roughly follows the shoreline and extends out 250 nm into the Atlantic Ocean proximate to Jacksonville, Florida. The JAX Range Complex includes two OPAREAs: Charleston and JAX. Combined, these OPAREAs encompass 50,090 nm^2 of sea space and undersea space. The Charleston and JAX OPAREAs are offshore of the states of North Carolina, South Carolina, Georgia, and Florida. The Undersea Warfare Training Range is located within the JAX Range Complex.

2.1.6 NAVAL SURFACE WARFARE CENTER CARDEROCK DIVISION, SOUTH FLORIDA OCEAN MEASUREMENT FACILITY TESTING RANGE

The Naval Surface Warfare Center Carderock Division operates the South Florida Ocean Measurement Facility Testing Range, an offshore testing area in support of various Navy and non-Navy programs. The South Florida Ocean Measurement Facility Testing Range is located adjacent to the Port Everglades entrance channel in Fort Lauderdale, Florida (Figure 2.1-3). The test area at South Florida Ocean Measurement Facility Testing Range includes an extensive cable field located within a restricted anchorage area, and two designated submarine operating areas.

2.1.6.1 Special Use Airspace

The South Florida Ocean Measurement Facility Testing Range does not include identified special use airspace. The airspace adjacent to South Florida Ocean Measurement Facility Testing Range is managed by the Fort Lauderdale International Airport. Air operations at the South Florida Ocean Measurement Facility Testing Range are coordinated with Fort Lauderdale International Airport by the air units involved in the test events.

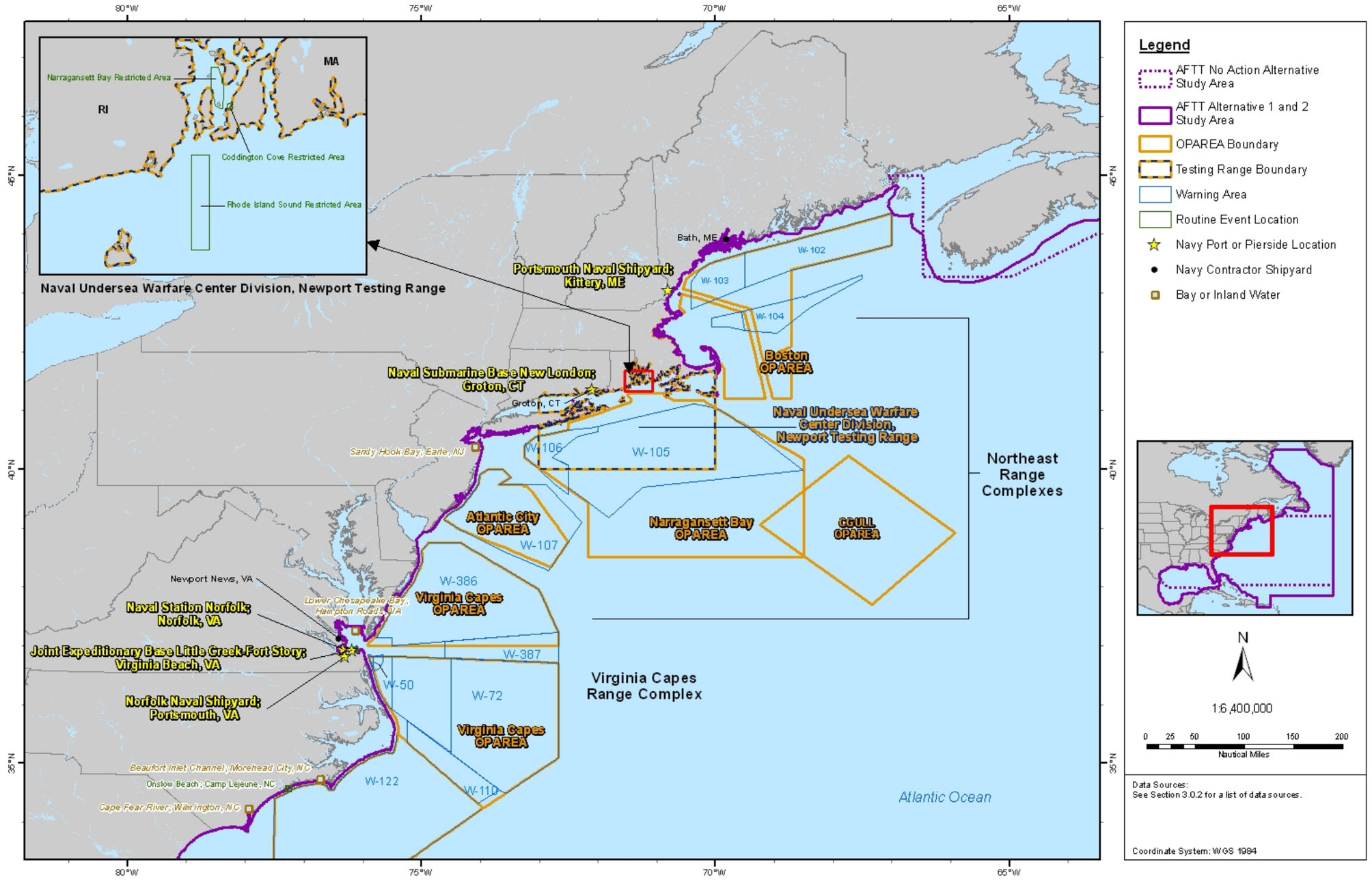

Figure 2.1-2: Study Area, Mid-Atlantic Region

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; MA: Massachusetts; ME: Maine; NC: North Carolina; NJ: New Jersey; OPAREA: Operating Area; RI: Rhode Island; VA: Virginia

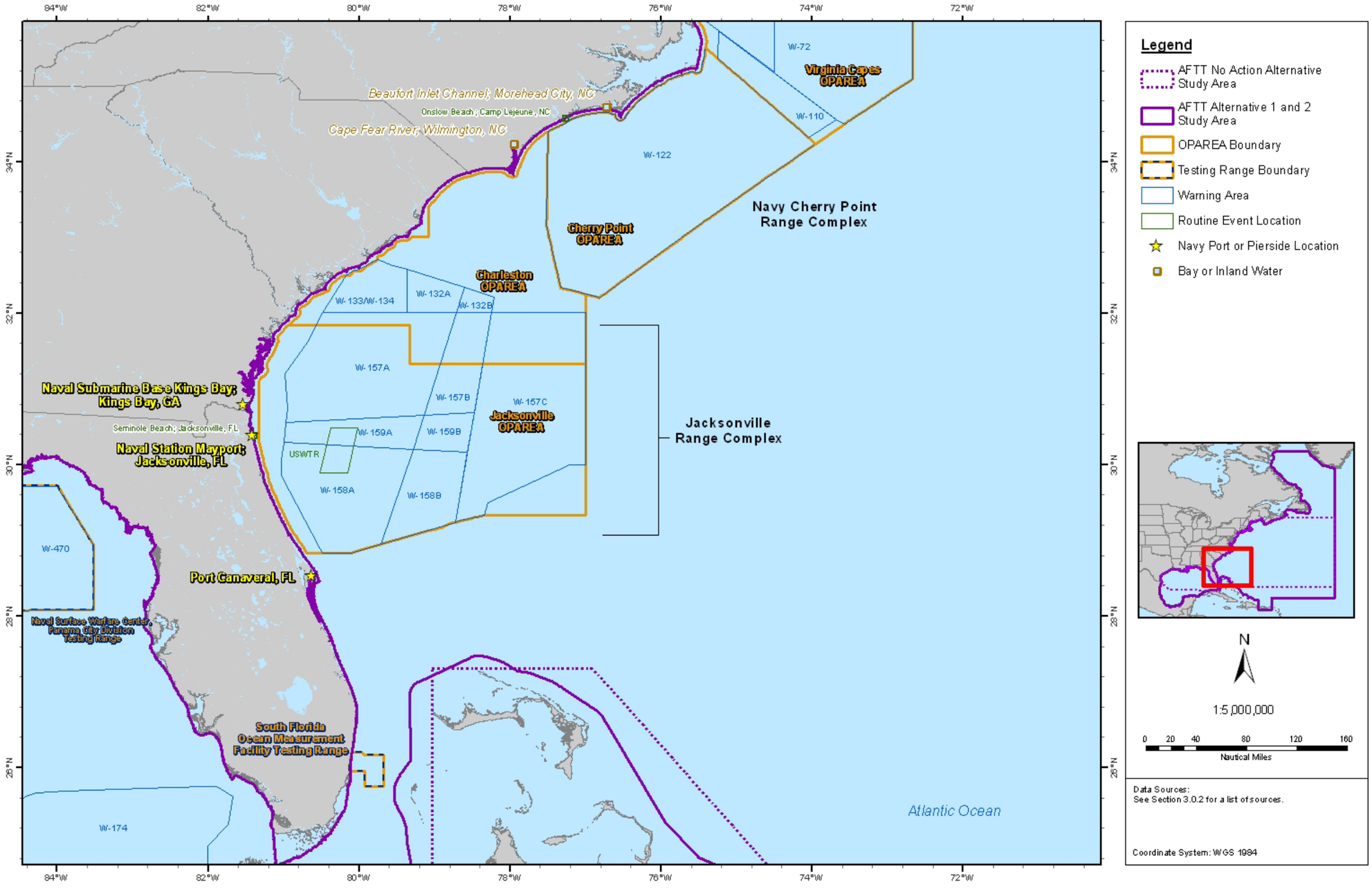

Figure 2.1-3: Study Area, Southeast Region

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; NC: North Carolina; OPAREA: Operating Area; USWTR: Undersea Warfare Training Area

2.1.6.2 Sea and Undersea Space

South Florida Ocean Measurement Facility Testing Range is divided into four subareas:

- The Port Everglades Shallow Submarine Operating Area is a 120-nm^2 area that encompasses nearshore waters from the shoreline to 900 ft. (274 m) deep and 8 nm offshore.
- The Notice of Intent Temporary Use Area is a 41-nm^2 area used for special purpose surface vessel[2] and submarine operations where the test vessels are restricted from maneuvering and require additional protection. This Notice of Intent Temporary Use Area encompasses waters from 60 to 600 ft. (18 to 183 m) deep and from 1 to 3 mi. (1.6 to 4.8 km) offshore.
- The Port Everglades Deep Submarine Operating Area is a 335-nm^2 area that encompasses the offshore range from 900 to 2,500 ft. (274 to 762 m) in depth and from 9 to 25 nm offshore.
- The Port Everglades Restricted Anchorage Area is an 11 nm^2 restricted anchorage area ranging in depths from 60 to 600 ft. (18 to 183 m) where the majority of the South Florida Ocean Measurement Facility Testing Range cables run from offshore sensors to the shore facility and where several permanent measurement arrays are used for vessel signature acquisition.

2.1.7 KEY WEST RANGE COMPLEX

The Key West Range Complex lies off the southwestern coast of mainland Florida and along the southern Florida Keys, extending seaward into the Gulf of Mexico 150 nm and south into the Straits of Florida 60 nm. The Key West Range Complex includes special use airspace with associated warning areas and surface and subsurface sea space of the Key West OPAREA (Figure 2.1-4).

2.1.7.1 Special Use Airspace

The Key West Range Complex includes approximately 20,647 nm^2 of special use airspace overlying and north of the Key West OPAREA. Flight altitudes range from the surface to unlimited. Warning areas within the Key West Range Complex include W-174A, W-174B, W-174C, W-174E, W-174F, W-174G, W-465A, W-465B, Bonefish Air Traffic Control Assigned Airspace, and Tortugas Military Operating Area.

2.1.7.2 Sea and Undersea Space

The Key West OPAREA is 8,288 nm^2 of sea space and undersea space south of Key West, Florida.

2.1.8 NAVAL SURFACE WARFARE CENTER, PANAMA CITY DIVISION TESTING RANGE

The Naval Surface Warfare Center, Panama City Division Testing Range is located off the panhandle of Florida and Alabama, extending from the shoreline to 120 nm seaward, and includes St. Andrew Bay. Naval Surface Warfare Center, Panama City Division Testing Range also includes special use airspace and offshore surface and subsurface waters of offshore OPAREAs (Figure 2.1-4).

2.1.8.1 Special Use Airspace

Special use airspace associated with Naval Surface Warfare Center, Panama City Division Testing Range includes warning areas overlying and east of the Pensacola and Panama City OPAREAs. The warning areas include W-151, W-155, and W-470.

[2] The terms 'vessel' and 'ship' are used interchangeably throughout the document.

2.1.8.2 Sea and Undersea Space

The Naval Surface Warfare Center, Panama City Division Testing Range includes the waters of St. Andrew Bay and the sea space within the Gulf of Mexico from the mean high tide line to 120 nm offshore. The Panama City OPAREA covers 3,084 nm^2 of sea space and lies off the coast of the Florida panhandle. The Pensacola OPAREA lies off the coast of Alabama and Florida west of the Panama City OPAREA and totals 4,882 nm^2.

2.1.9 GULF OF MEXICO RANGE COMPLEX

The Gulf of Mexico (GOMEX) Range Complex contains four separate OPAREAs: Panama City, Pensacola, New Orleans, and Corpus Christi. The OPAREAs within the GOMEX Range Complex are not contiguous but are scattered throughout the Gulf of Mexico unlike the previously described range complexes. The GOMEX Range Complex includes special use airspace with associated warning areas and restricted airspace, and surface and subsurface sea space of the Panama City, Pensacola, New Orleans, and Corpus Christi OPAREAs (Figure 2.1-4).

2.1.9.1 Special Use Airspace

The GOMEX Range Complex includes approximately 23,651 nm^2 of special use airspace overlying the Panama City, Pensacola, New Orleans, and Corpus Christi OPAREAs and airspace north of the New Orleans OPAREA. Flight altitudes range from the surface to unlimited. Warning areas within the GOMEX Range Complex include W-151, W-155, W-92, W-54, W-59, and W-228. Restricted airspace associated with the Pensacola OPAREA, designated R-2908, extends from the shoreline to approximately 3 nm offshore.

2.1.9.2 Sea and Undersea Space

The GOMEX Range Complex encompasses 25,753 nm^2 of sea and undersea space, and includes 285 nm of coastline. The OPAREAs span from the eastern shores of Texas to the western panhandle of Florida. They are described as follows:

- Panama City OPAREA lies off the coast of the Florida panhandle and totals 3,084 nm^2.
- Pensacola OPAREA lies off the coast of Florida west of the Panama City OPAREA and totals 4,882 nm^2.
- New Orleans OPAREA lies off the coast of Louisiana and totals 2,607 nm^2.
- Corpus Christi OPAREA lies off the coast of Texas and totals 6,867 nm^2.

2.1.10 ATLANTIC FLEET ACTIVE SONAR TRAINING ENVIRONMENTAL IMPACT STATEMENT / OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The Atlantic Fleet Active Sonar Training EIS/OEIS analyzed active sonar training activities located along the east coast and within the Gulf of Mexico. The study area boundaries included the sea space and airspace shoreward to the mean high water line and seaward to 45-degree west longitude, north to 45-degree north latitude, and south to approximately 22-degree north latitude.

2.1.11 BAYS, HARBORS, AND CIVILIAN PORTS

The Study Area includes Narragansett Bay, the lower Chesapeake Bay, and St. Andrew Bay for training and testing activities. Ports included for civilian port defense training events include Earle, New Jersey; Groton, Connecticut; Norfolk, Virginia; Morehead City, North Carolina; Wilmington, North Carolina; Kings Bay, Georgia; Mayport, Florida; Beaumont, Texas; and Corpus Christi, Texas.

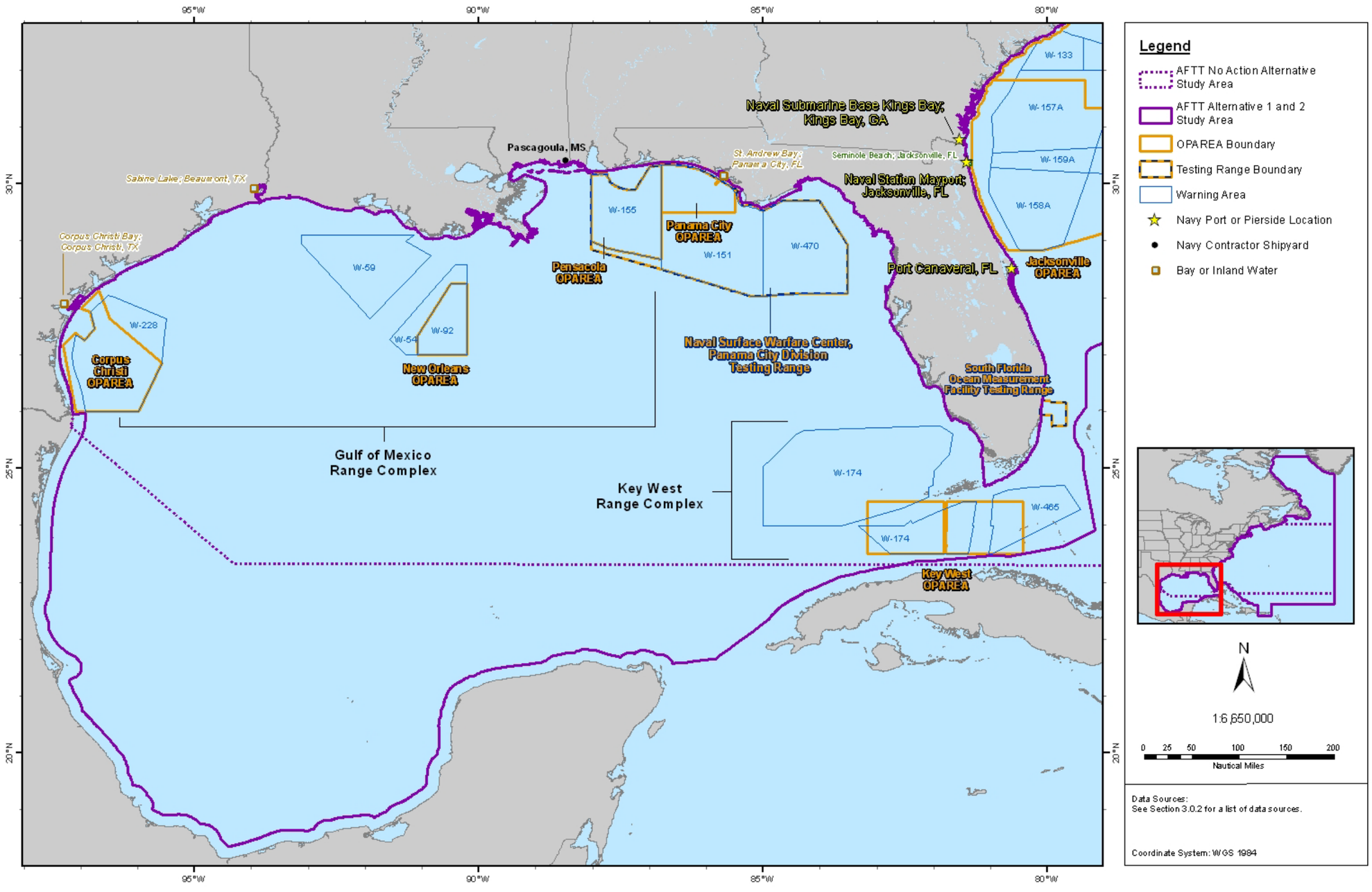

Figure 2.1-4: Study Area, Gulf of Mexico Region

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; MS: Mississippi; OPAREA: Operating Area; TX: Texas

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2.1.12 PIERSIDE LOCATIONS

The Study Area includes pierside locations where Navy surface ship and submarine sonar maintenance and testing occur. For purposes of this EIS/OEIS, pierside locations include channels and transit routes in ports and facilities associated with ports and shipyards. These locations in the Study Area are located at the following Navy ports and naval shipyards:

- Portsmouth Naval Shipyard, Kittery, Maine;
- Naval Submarine Base New London, Groton, Connecticut;
- Naval Station Norfolk, Norfolk, Virginia;
- Joint Expeditionary Base Little Creek – Fort Story, Virginia Beach, Virginia;
- Norfolk Naval Shipyard, Portsmouth, Virginia;
- Naval Submarine Base Kings Bay, Kings Bay, Georgia;
- Naval Station Mayport, Jacksonville, Florida; and
- Port Canaveral, Cape Canaveral, Florida.

Navy-contractor shipyards in the following cities are also in the Study Area:

- Bath, Maine;
- Groton, Connecticut;
- Newport News, Virginia; and
- Pascagoula, Mississippi.

2.2 PRIMARY MISSION AREAS

The Navy categorizes training activities into functional warfare areas called primary mission areas. Training activities fall into the following eight primary mission areas:

- Anti-air warfare
- Strike warfare
- Anti-submarine warfare
- Mine warfare
- Amphibious warfare
- Anti-surface warfare
- Electronic warfare
- Naval special warfare

Most training activities addressed in this EIS/OEIS are categorized under one of these warfare areas; those activities that do not fall within one of these areas are in a separate category. Each warfare community (surface, subsurface, aviation, and special warfare) may train in some or all of these primary mission areas. A large number of testing activities can also be categorized under these primary mission areas and are often integrated with fleet actions and assets. The sonars, ordnance, munitions, and targets used in the training and testing activities are described in Section 2.3 (Description of Sonar, Ordnance/Munitions, Targets, and Other Systems Employed in Atlantic Fleet Training and Testing Events). Short descriptions of individual training and testing events are provided in Tables 2.4-1, 2.4-2, and 2.4-3 (Section 2.4, Proposed Activities). More detailed descriptions of the training and testing activities can be found in Appendix A (Navy Activities Descriptions).

2.2.1 ANTI-AIR WARFARE

The mission of anti-air warfare is to destroy or reduce enemy air and missile threats (including unmanned airborne threats) and serves two purposes: to protect U.S. forces from attacks from the air and to gain air superiority. Anti-air warfare also includes providing U.S. forces with adequate attack warnings, while denying hostile forces the ability to gather intelligence about U.S. forces.

Aircraft conduct anti-air warfare through radar search, detection, identification, and engagement of airborne threats—generally by firing anti-air missiles or cannon fire. Surface ships conduct anti-air warfare through an array of modern anti-aircraft weapon systems such as aircraft detecting radar, naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled cannons for close-in point defense.

Testing of anti-air warfare systems is required to ensure the equipment is fully functional under the conditions for which it will be used. Tests may be conducted on radar and other early warning detection and tracking systems, new guns or gun rounds, and missiles. Testing of these systems may be conducted on new ships and aircraft, and on existing ships and aircraft following maintenance, repair, or modification. For some systems, tests are conducted periodically to assess operability. Additionally, tests may be conducted in support of scientific research to assess new and emerging technologies.

2.2.2 AMPHIBIOUS WARFARE

The mission of amphibious warfare is to project military power from the sea to the shore through the use of naval firepower and Marine Corps landing forces. It is used to attack a threat located on land by a military force embarked on ships. Amphibious warfare operations include small unit reconnaissance or raid missions to large-scale amphibious operations involving multiple ships and aircraft combined into a strike group.

Amphibious warfare training ranges from individual, crew, and small unit events to large task force exercises. Individual and crew training include amphibious vehicles and naval gunfire support training. Small-unit training operations include shore assaults, boat raids, airfield or port seizures, and reconnaissance. Large-scale amphibious exercises involve ship-to-shore maneuver, naval fire support, such as shore bombardment, and air strike and close air support training.

Testing of guns, munitions, aircraft, ships, and amphibious vessels and vehicles used in amphibious warfare are often integrated into training activities and in most cases, the systems are used in the same manner in which they are used for fleet training activities. These tests, as well as full operational evaluations on existing amphibious vessels and vehicles following maintenance, repair, or modernization, may be conducted independently or in conjunction with other amphibious ship and aircraft activities. Testing is performed to ensure effective ship-to-shore coordination and transport of personnel, equipment, and supplies. Tests may also be conducted periodically on other systems, vessels, and aircraft intended for amphibious operations to assess operability and to investigate efficacy of new technologies.

2.2.3 STRIKE WARFARE

The mission of strike warfare is to conduct offensive attacks on land-based targets, such as refineries, power plants, bridges, major roadways, and ground forces to reduce the enemy's ability to wage war. Strike warfare employs weapons by manned and unmanned air, surface, submarine, and naval special warfare assets in support of extending dominance over enemy territory (power projection).

Strike warfare includes training of fixed-wing attack aircraft pilots and aircrews in the delivery of precision-guided munitions, non-guided munitions, rockets, and other ordnance, including the high-speed anti-radiation missile, against land-based targets in all conditions. Not all strike mission training events involve dropping ordnance and instead the event is simulated with video footage obtained by onboard sensors.

Testing of weapons used in strike warfare is conducted to develop new types of weapons that provide better capabilities and to ensure currently developed weapons perform as designed and deployed. Tests may also be conducted periodically on other systems, vessels, or aircraft intended for strike warfare operations to assess operability and to investigate efficacy of new technologies.

2.2.4 ANTI-SURFACE WARFARE

The mission of anti-surface warfare is to defend against enemy ships or boats. In the conduct of anti-surface warfare, aircraft use cannons, air-launched cruise missiles or other precision guided munitions; ships employ torpedoes, naval guns, and surface-to-surface missiles; and submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles.

Anti-surface warfare training includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events.

Testing of weapons used in anti-surface warfare is conducted to develop new technologies and to assess weapon performance and operability with new systems and platforms, such as unmanned systems. Tests include various air-to-surface guns and missiles, surface-to-surface guns and missiles, and bombing tests. Testing events may be integrated into training activities to test aircraft or aircraft systems in the delivery of ordnance on a surface target. In most cases the tested systems are used in the same manner in which they are used for fleet training activities.

2.2.5 ANTI-SUBMARINE WARFARE

The mission of anti-submarine warfare is to locate, neutralize, and defeat hostile submarine threats to surface forces (see Appendix H, Impacts Due to Atlantic Fleet Training and Testing Activities at the Undersea Warfare Training Range). Anti-submarine warfare is based on the principle of a layered defense of surveillance and attack aircraft, ships, and submarines all searching for hostile submarines. These forces operate together or independently to gain early warning and detection, and to localize, track, target, and attack hostile submarine threats.

Anti-submarine warfare training addresses basic skills such as detection and classification of submarines, and distinguishing between sounds made by enemy submarines and those of friendly submarines, ships, and marine life. More advanced, integrated anti-submarine warfare training exercises are conducted in coordinated, at-sea training events involving submarines, ships, fixed-wing aircraft, and helicopters. This training integrates the full spectrum of anti-submarine warfare from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons.

Testing of anti-submarine warfare systems is conducted to develop new technologies and assess weapon performance and operability with new systems and platforms, such as unmanned systems. Testing uses ships, submarines, and aircraft to demonstrate capabilities of torpedoes, missiles, countermeasure systems, and underwater surveillance and communications systems. Torpedo development, testing, and refinement are critical to successful anti-submarine warfare. At-sea sonar testing ensures systems are fully functional in an open-ocean environment prior to delivery to the fleet for operational use. Anti-submarine warfare systems on fixed-wing aircraft and helicopters (including dipping sonar) are tested to evaluate the ability to search and track a submarine or similar target. Sonobuoys deployed from surface vessels and aircraft are tested to verify the integrity and performance of a group, or lot, of sonobuoys in advance of delivery to the fleet for operational use. The sensors and systems onboard helicopters and maritime patrol aircraft are tested to ensure that tracking systems perform to specifications and meet operational requirements. Tests may be conducted as part of a

large-scale fleet training event involving submarines, ships, fixed-wing aircraft, and helicopters. These integrated training events offer opportunities to conduct research and acquisition activities and to train aircrew in the use of new or newly enhanced systems during a large-scale, complex exercise.

2.2.6 ELECTRONIC WARFARE

The mission of electronic warfare is to degrade the enemy's ability to use their electronic systems, such as communication systems and radar, in order to confuse or deny them the ability to defend their forces and assets. Electronic warfare is also used to recognize an emerging threat and counter an enemy's attempt to degrade the electronic capabilities of the Navy.

Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking and communications systems.

Testing of electronic warfare systems is conducted to improve the capabilities of systems and ensure compatibility with new systems. Testing involves the use of aircraft, surface ships, and submarine crews to evaluate the effectiveness of electronic systems. Typical electronic warfare testing activities include the use of airborne and surface electronic jamming devices and chaff and flares to defeat tracking and communications systems. Chaff tests evaluate newly developed or enhanced chaff, chaff dispensing equipment, or modified aircraft avoidance systems' use against chaff deployment. Flare tests evaluate deployment performance and crew competency with newly developed or enhanced flares, flare dispensing equipment, or modified aircraft avoidance systems' use against flare deployment.

2.2.7 MINE WARFARE

The mission of mine warfare is to detect, and avoid or neutralize mines to protect Navy ships and submarines and to maintain free access to ports and shipping lanes. Mine warfare also includes offensive mine laying to gain control of, or deny the enemy access to sea space. Naval mines can be laid by ships (including purpose-built minelayers), submarines, or aircraft.

Mine warfare neutralization (destruction) training includes exercises in which ships, aircraft, submarines, or underwater vehicles search for mines. Personnel train to destroy or disable mines by attaching and detonating underwater explosives to the mine. Other neutralization techniques involve impacting the mine with a bullet-like projectile or intentionally triggering the mine to detonate.

Testing and development of mine warfare systems is conducted to improve sonar, laser, and magnetic detectors intended to hunt, locate, and record the positions of mines for avoidance or subsequent neutralization. Mine warfare testing and development falls into two primary categories: mine detection and classification and mine countermeasure and neutralization. Mine detection and classification testing involves the use of air, surface, and subsurface vessels and uses sonar, including towed and side-scan sonar, mine countermeasure systems, and unmanned vehicles to support mine detection and classification testing. These mine detection systems are generally helicopter based and are sometimes used in conjunction with a mine neutralization system. Mine countermeasure and neutralization testing includes the use of air, surface, and subsurface units and uses tracking devices, countermeasure and neutralization systems, and general purpose bombs to evaluate the effectiveness of neutralizing mine threats. Most neutralization tests use mine shapes, or non-explosive practice mines, to evaluate a new or enhanced capability. During an airborne neutralization test, a previously located mine is destroyed or rendered nonfunctional using a helicopter based system that may involve the firing of a projectile or the deployment of a towed neutralization system. A small percentage of mine warfare tests require the use

of high-explosive mines to evaluate and confirm the ability of the system to neutralize a high-explosive mine under operational conditions. The majority of mine warfare systems are currently deployed by ships and helicopters; however, future mine warfare missions will increasingly rely on unmanned vehicles. Tests may also be conducted in support of scientific research to support these new technologies.

2.2.8 NAVAL SPECIAL WARFARE

The mission of naval special warfare is to conduct unconventional warfare, direct action, combat terrorism, special reconnaissance, security assistance, counter-drug operations, and recovery of personnel from hostile situations. Naval special warfare operations are highly specialized and require continual and intense training.

Naval special warfare units utilize a combination of specialized training, equipment, and tactics, including insertion and extraction operations using parachutes, submerged vehicles, rubber boats, and helicopters; boat-to-shore and boat-to-boat gunnery; underwater demolition training; reconnaissance; and small arms training.

Testing is conducted on both conventional and unconventional weapons used by naval special warfare units, including testing of submersible vehicles capable of inserting and extracting personnel or payloads into denied areas from strategic distances, active acoustic devices, underwater communications systems, and underwater demolition technologies. Doppler sonar and side scan sonar are tested for their ability to be used during extraction and insertion missions.

2.3 DESCRIPTION OF SONAR, ORDNANCE/MUNITIONS, TARGETS, AND OTHER SYSTEMS EMPLOYED IN ATLANTIC FLEET TRAINING AND TESTING EVENTS

The Navy uses a variety of sensors, platforms, weapons, and other devices, including ones used to ensure the safety of Sailors and Marines, to meet its mission. Training and testing with these systems may have the potential to introduce acoustic (sound) energy and expended materials into the environment. The environmental impact of these activities will be analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of this EIS/OEIS. This section presents and organizes sonar systems, ordnance, munitions, targets, and other systems in a manner intended to facilitate understanding of both the activities that use them and the environmental effects analysis from them, later described in Chapter 3 (Affected Environment and Environmental Consequences) of this EIS/OEIS.

2.3.1 SONAR SYSTEMS AND OTHER ACOUSTIC SENSORS

2.3.1.1 What is Sonar?

Sonar, originally an acronym for "SOund Navigation And Ranging," is a technique that uses underwater sound to navigate, communicate, or detect underwater objects (the term sonar is also used for the equipment used to generate and receive sound). There are two basic types of sonar: active and passive.

Active sonar emits sound waves that travel through the water, reflect off objects, and return to the receiver. Sonar is used to determine the distance to an underwater object by calculating the speed of sound in water and the time for the sound wave to travel to the object and back. For example, active sonar systems are used to track targets or to aid in navigation of the vessel by identifying known ocean floor features. Some whales, dolphins, and bats use echolocation, a similar technique, to identify their surroundings and to locate prey.

Passive sonar uses listening equipment, such as underwater microphones (hydrophones) and receiving sensors on ships, submarines, aircraft, and autonomous vehicles, to pick up underwater sounds. The advantage of passive sonar is that it places no sound in the water, and thus does not reveal the location of the listening vessel. Passive sonar can indicate the presence, character, and direction of ships and submarines; however, passive sonar is increasingly ineffective as modern submarines become quieter. Passive sonar has no potential acoustic impact on the environment, and therefore, is not discussed further or analyzed within this EIS/OEIS.

All sounds, including sonar, are categorized by frequency. For this EIS/OEIS, active sonar is categorized into four frequency ranges: low-frequency[3], mid-frequency, high-frequency, and very high-frequency.

- Low-frequency active sonar emits sounds at frequencies less than 1 kilohertz (kHz). Low-frequency active sonar is useful for detecting objects at great distances because low-frequency sounds do not dissipate as rapidly as higher frequency sounds.
- Mid-frequency active sonar emits sounds at frequencies from 1 to 10 kHz. Mid-frequency active sonar is the Navy's primary tool for detecting and identifying submarines. Active sonar in this frequency range provides a valuable combination of range and target accuracy.
- High-frequency active sonar emits sounds at frequencies greater than 10 kHz, up to 100 kHz. High-frequency sounds dissipate rapidly and have a small effective range; however, high-frequency sounds provide higher resolution of objects and are useful at detecting and identifying smaller objects such as sea mines.
- Very high-frequency sources are those that operate above 100 kHz but below 200 kHz.

Modern sonar technology includes a variety of sonar sensor and processing systems. In concept, the simplest active sonar emits sound waves, or "pings," sent out in multiple directions and the sound waves then reflect off of the target object in multiple directions (Figure 2.3-1). The sonar source calculates the time it takes for the reflected sound waves to return; this calculation determines the distance to the target object. More sophisticated active sonars emit a ping and then rapidly scan or listen to the sound waves in a specific area. This provides both distance to the target and directional information. Even more advanced sonars use multiple receivers to listen to echoes from several directions simultaneously and provide efficient detection of both direction and distance. It should be noted that active sonar is rarely used continuously throughout the listed activities. In addition, when sonar is in use, the sonar "pings" occur at intervals, referred to as a duty cycle, and the signals themselves are very short in duration. For example, a sonar that emits a 1-second ping every 10 seconds has a 10 percent duty cycle.

The Navy utilizes sonar systems and other acoustic sensors in support of a variety of mission requirements. Primary uses include detection of and defense against submarines (anti-submarine warfare) and mines (mine warfare); safe navigation and effective communications; and oceanographic surveys. Specific examples of how sonar systems are used for Navy activities are discussed in the following sections.

[3] Surveillance Towed Array Sensor System (SURTASS) Low-Frequency Active sonar, which may be used in the Study Area, is not among the sources analyzed in this document. The potential environmental impacts from use of SURTASS Low-Frequency Active sonar are analyzed in separate analyses under the National Environmental Policy Act.

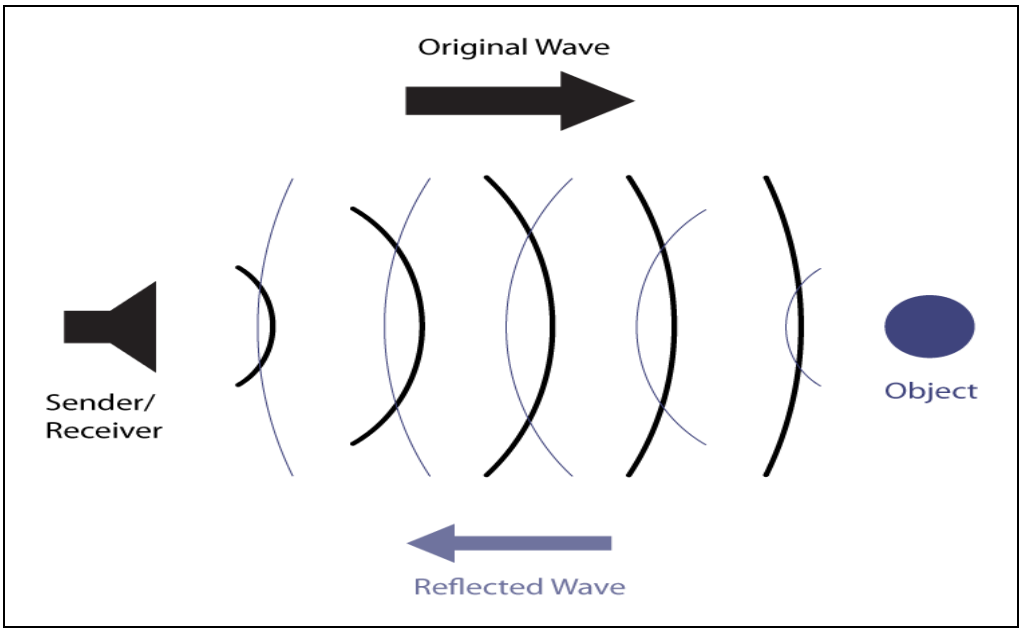

Figure 2.3-1: Principle of an Active Sonar

Anti-Submarine Warfare. Systems used in anti-submarine warfare include sonars, torpedoes, and acoustic countermeasure devices. These systems are employed from a variety of platforms (surface ships, submarines, helicopters, and fixed-wing aircraft). Surface ships conducting anti-submarine warfare are typically equipped with hull-mounted sonar (passive and active) for the detection of submarines. Helicopters use dipping sonar or sonobuoys (passive and active) to locate submarines (or submarine targets during training and testing exercises). Fixed-wing aircraft deploy both active and passive expendable sonobuoys to assist in detecting and tracking submarines. Submarines are equipped with hull-mounted sonars to detect, localize, and track other submarines and surface ships. Submarines primarily use passive sonar; active sonar is used mostly for navigation. There are also unmanned vehicles currently being developed to deploy anti-submarine warfare systems.

Anti-submarine warfare activities often use mid-frequency (i.e., 1 to 10 kHz) active sonar, though low-frequency and high-frequency active sonar systems are also used for specialized purposes. The Navy is currently developing and testing sonar systems that may utilize lower frequencies and longer duty cycles—albeit at lower source levels—than current systems. However, these new systems would only be operational if they significantly increase the Navy's ability to detect and identify quiet submarine threats.

The types of sonar systems and acoustic sensors used during anti-submarine warfare sonar training and testing exercises include the following:

- **Surface Ship Sonar Systems:** A variety of surface ships operate hull-mounted mid-frequency active sonar during training exercises and testing activities (Figure 2.3-2). Typically, only cruisers, destroyers, and frigates have surface ship sonar systems.

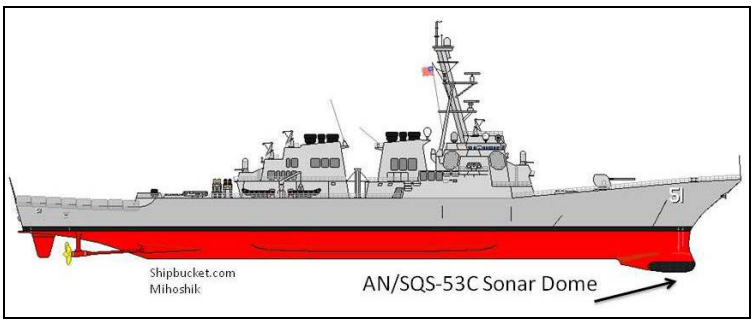

Figure 2.3-2: Guided Missile Destroyer with an AN/SQS-53 Sonar

- **Submarine Sonar Systems:** Submarines are equipped with hull-mounted mid-frequency and high-frequency active sonar used to detect and target enemy submarines and surface ships (Figure 2.3-3). A submarine's mission relies on its stealth; therefore, a submarine uses its active sonar sparingly because each sound emission gives away the submarine's location.

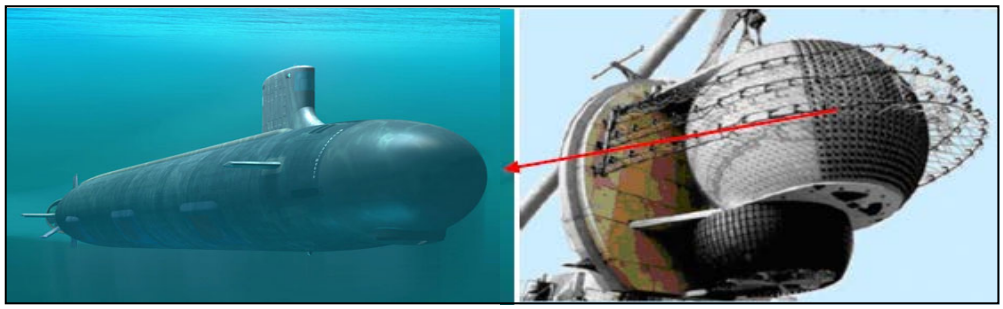

Figure 2.3-3: Submarine AN/BQQ-10 Active Sonar Array

- **Aircraft Sonar Systems:** Aircraft sonar systems include sonobuoys and dipping sonars.
  - **Sonobuoys:** Sonobuoys are expendable devices that contain a transmitter and a hydrophone. The sounds collected by the sonobuoy are transmitted back to the aircraft for analysis. Sonobuoys are either active or passive and allow for short and long-range detection of surface ships and submarines. These systems are deployed by both helicopter and fixed-wing patrol aircraft (Figure 2.3-4).

Figure 2.3-4: Sonobuoy (e.g., AN/SSQ-62)

- **Dipping Sonars:** Dipping sonars are recoverable devices lowered into the water via cable from manned and unmanned helicopters (Figure 2.3-5). The sonar detects underwater targets and determines the distance and movement of the target relative to the position of the helicopter.

Figure 2.3-5: Helicopter Deploys Dipping Sonar

- **Exercise Torpedoes:** Surface ships, aircraft, and submarines primarily use torpedoes in anti-submarine warfare (Figure 2.3-6). Recoverable, non-explosive torpedoes, categorized as either lightweight or heavyweight, are used during training and testing. Heavyweight torpedoes use a guidance system to operate the torpedo autonomously or remotely through an attached wire (guidance wire). The autonomous guidance systems operate either passively (listening for sounds generated by the target) or actively (pinging to search for the target). Torpedo training in the Study Area is mostly simulated—solid masses that approximate the weight and shape of a torpedo are fired, rather than fully functional torpedoes. Testing in the Study Area mostly uses fully functional exercise torpedoes.

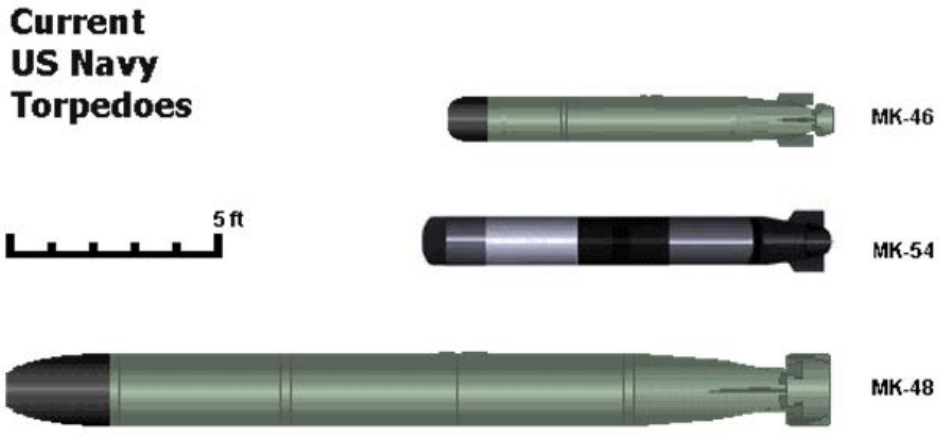

Figure 2.3-6: Current United States Navy Torpedoes

- **Acoustic Countermeasures:** Countermeasure devices are towed or free-floating noisemakers that alter the acoustic signature of a Navy ship or submarine (Figure 2.3-7) to avoid detection. In addition, countermeasures act as an alternative target for an incoming threat, such as a torpedo. Countermeasures are either expendable or recoverable.

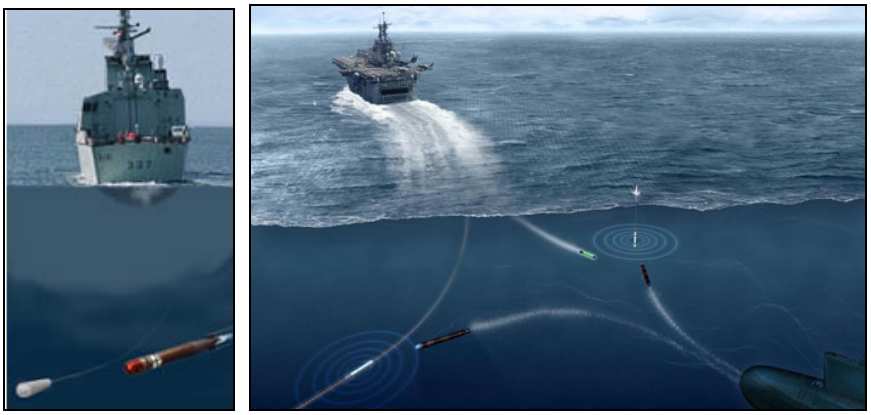

Figure 2.3-7: Acoustic Countermeasures

- **Anti-Submarine Warfare Training Targets:** Anti-submarine warfare training targets are autonomous undersea vehicles used to simulate target submarines (Figure 2.3-8). The training targets are equipped with one or more of the following devices: (1) acoustic projectors emitting sounds to simulate submarine acoustic signatures, (2) echo repeaters to simulate the characteristics of the echo of a sonar signal reflected from a submarine, and (3) magnetic sources that mimic those of a submarine.

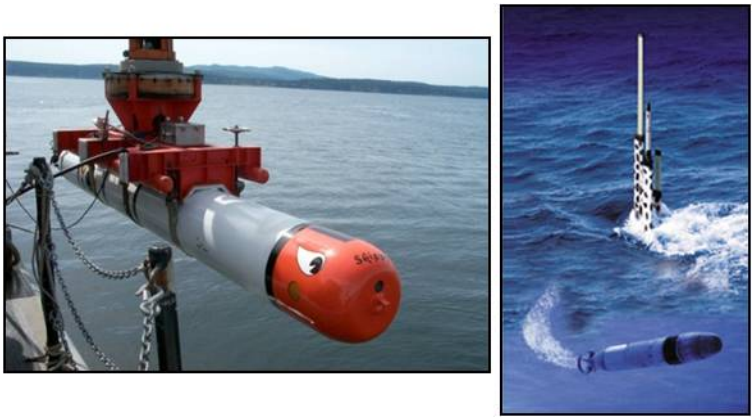

Figure 2.3-8: Anti-Submarine Warfare Training Targets
(Source: Graphic on right side from Lockheed Martin)

Mine Warfare. Mine warfare training and testing activities use a variety of different sonar systems that are typically high frequency (greater than 10 kHz) and very high-frequency (greater than 180 kHz). These sonar systems are used to detect, locate, and characterize moored and bottom mines (Figure 2.3-9). The majority of mine warfare sonar sensors can be deployed by more than one platform (i.e., helicopter, unmanned underwater vehicle, or surface ship) and may be interchangeable among platforms. Surface ships and submarines use sonar to detect mines and objects and minesweeping ships use a specialized variable-depth mine detection and classification high-frequency active sonar system to detect mines.

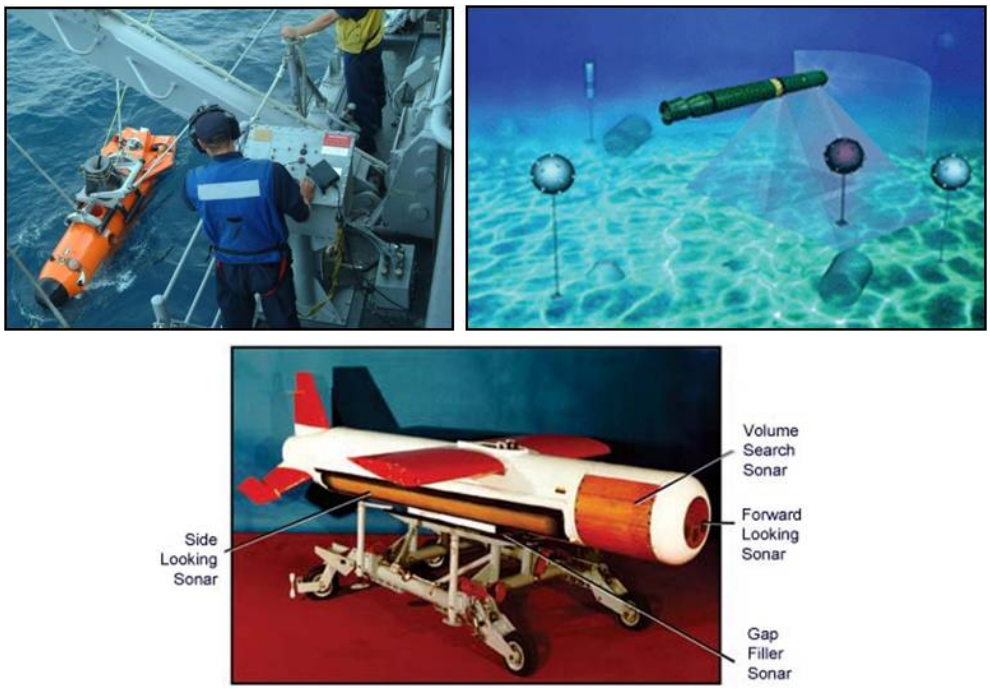

Figure 2.3-9: Mine Warfare Systems

Safety, Navigation, Communications, and Oceanographic Systems. Naval ships, submarines, and unmanned surface and subsurface vehicles rely on equipment and instrumentation that use active sonar during both routine operations and training and testing events. Sonar systems are used to gauge water depth, detect and map objects, navigational hazards, and the ocean floor, and transmit communication signals.

Other Acoustic Sensors. The Navy uses a variety of other acoustic sensors to protect ships anchored or at the pier, as well as shore facilities. These systems, both active and passive, detect potentially hostile swimmers, broadcast warnings to alert Navy divers of potential hazards, and gather information regarding ocean characteristics (ocean currents and wave measurements). They are generally stationary systems in Navy harbors and piers. Navy marine mammals (Atlantic bottlenose dolphins [*Tursiops truncatus*] and California sea lions [*Zalophus californianus*]) are also used to detect hostile swimmers around Navy facilities. A trained animal is deployed under behavioral control of a handler to find an intruding swimmer. Upon finding the "target" of the search, the animal returns to the boat and alerts the animal handlers, and the animals are given a localization marker or leg cuff that they attach to the intruder. Swimmers that have been marked with a leg cuff are reeled in by security support boat personnel via a line attached to the cuff. In addition, the Navy's research and acquisition community uses various sensors for tracking during testing activities and to collect data for test analysis.

2.3.2 ORDNANCE/MUNITIONS

Most ordnance and munitions used during training and testing events fall into three basic categories: projectiles, missiles, and bombs. Ordnance can be further defined by their net explosive weight, which is the actual weight in pounds of the explosive substance without the packaging, casings, bullets, etc. Net explosive weight is also the trinitrotoluene (TNT) equivalent of energetic material, which is the standard measure of strength of bombs and other explosives. For example, a 2,000-pound (lb.) (907 kg) bomb may have anywhere from 600 to 1,000 lb. (272 to 454 kg) of net explosive weight.

Projectiles. Projectiles are fired during gunnery exercises from a variety of weapons, including pistols and rifles to large-caliber, turret-mounted guns on the decks of Navy ships. Projectiles can be either high-explosive munitions (e.g., certain cannon shells), or non-explosive practice munitions (e.g., rifle/pistol bullets). Explosive rounds can be fused to either explode on impact or in the air (i.e., just prior to impact). Projectiles are broken down into three basic categories in this EIS/OEIS:

- **Small-Caliber Projectiles:** These projectiles are up to and including .50 caliber (approximately 1/2 inch [in.] diameter). Small-caliber projectiles (e.g., bullets), are primarily fired from pistols, rifles, and machine guns (i.e., small arms) and mostly during training events for an individual Sailor to become and remain proficient (Figure 2.3-10).

Figure 2.3-10: Shipboard Small Arms Training

- **Medium-Caliber Projectiles:** These projectiles are larger than .50 caliber, but smaller than 57 millimeter (mm) (approximately 2-1/4 in. diameter). The most common size medium- caliber projectiles are 20 mm, 25 mm, and 40 mm. Medium-caliber projectiles are fired from machine guns operated by one to two crewman and mounted on the deck of a ship, wing-mounted guns on aircraft, and fully automated guns mounted on ships for defense against missile attack (Figure 2.3-11). Medium-caliber projectiles also include 40 mm grenades, which can be fired from hand-held grenade launchers or crew-served deck-mounted guns. Medium-caliber projectiles can be non-explosive practice munitions or high-explosive projectiles. High-explosive projectiles are usually fused to detonate on impact; however, advanced high-explosive projectiles can detonate based on time, distance, or proximity to a target.

Figure 2.3-11: Shipboard Medium-Caliber Guns

- **Large-Caliber Projectiles:** These includes projectiles 57 mm and larger. The largest projectile currently in service has a 5 in. (12.7 centimeter [cm]) diameter, but larger weapons are under development. The most widely used large-caliber projectiles are 57 mm, 76 mm, and 5 in. (12.7 cm) (Figure 2.3-12). The most common 5-in. (12.7-cm) projectile is approximately 26 in. (66 cm) long and weighs 70 lb. (31.8 kg). Large-caliber projectiles are fired exclusively from turret-mounted guns located on ship decks and can be used to fire on surface ships and boats, in defense against missiles and aircraft, and against land-based targets. Large-caliber projectiles can be non-explosive practice munitions or high-explosive munitions. High-explosive projectiles can detonate on impact or in the air.

Figure 2.3-12: Shipboard Large-Caliber Gun and Projectiles

Missiles. Missiles are rocket or jet-propelled munitions used to attack ships, aircraft, and land-based targets, as well as defend ships against other missiles. Guidance systems and advanced fusing technology ensure that missiles reliably impact on or detonate near their intended target. Missiles are categorized according to their intended target, as described below, and can be further classified according to net explosive weight. Rockets are included within the category of missiles.

- **Anti-Air Missiles:** Anti-air missiles are fired from ships and aircraft against enemy aircraft and incoming missiles (Figure 2.3-13). Anti-air missiles are configured to explode near, or on impact with their intended target. Missiles are the primary ship-based defense against incoming missiles.

Figure 2.3-13: Rolling Airframe Missile and Air-to-Air Missile

- **Anti-Surface Missiles:** Anti-surface missiles are fired from aircraft, ships, and submarines against surface ships (Figure 2.3-14). Anti-surface missiles are typically configured to detonate on impact or just above the intended target.

Figure 2.3-14: Anti-Surface Missile Fired from MH-60 Helicopter

- **Strike Missiles:** Strike missiles are fired from aircraft, ships, and submarines against land-based targets. Strike missiles are typically configured to detonate on impact or near their intended target. The AGM-88 High-speed Anti-Radiation Missile, used to destroy enemy radar sites, is an example of a strike missile used during at-sea training, and is fired at a floating sea-borne target that replicates a land-based radar site.

Bombs. Bombs are unpowered munitions dropped from aircraft on land and water targets. The majority of bombs used during training and testing in the Study Area are non-explosive. However, explosive munitions are occasionally used for proficiency inspections and testing requirements. Bombs are in two categories: general-purpose bombs and subscale practice bombs. Similar to missiles, bombs are further classified according to the net explosive weight of the bomb.

- **General-Purpose Bombs:** General-purpose bombs consist of precision-guided and unguided full-scale bombs, ranging in size from 250 to 2,000 lb. (Figure 2.3-15). Common bomb nomenclature used includes: MK 80 series, which is the Navy's standard model; Guided Bomb Units and Joint Direct Attack Munitions, which are precision guided (including laser guided) bombs; and the Joint Standoff weapon, which is a long-range "glider" precision weapon. General-purpose bombs can be either non-explosive practice munitions or high-explosive.

Figure 2.3-15: F/A-18 Bomb Release and Loading General Purpose Bombs

- **Subscale Bombs:** Subscale bombs (Figure 2.3-16) are non-explosive practice munitions containing a spotting (smoke) charge to aid in scoring the accuracy of hitting the target during training and testing activities. Common subscale bombs are 25 lb. (11.3 kg) and less and are steel-constructed. Laser guided training rounds are another variation of a subscale practice bomb. They weigh approximately 100 lb. and are cost-effective non-explosive weapons used in training aircrew in laser-guided weapons employment.

Figure 2.3-16: Subscale Bombs for Training

Other Munitions. There are other munitions and ordnance used in naval at-sea training and testing events that do not fit into one of the above categories, and are discussed below:

- **Ship Shock Charges:** Ship shock trials use various sizes of underwater explosives to send a shock wave through a ship's hull to simulate near misses during combat. Four size classes of charges (ranging from 1,000 to 58,000 lb. net explosive weight) can be used in any combination during the execution of a shock trial.
- **Demolition Charges:** Divers place explosive charges in the marine environment during some training and testing activities. These activities may include the use of timed charges, in which the charge is placed, a timer is started, and the charge detonates at the set time. Munitions of up to 60-lb. blocks of composition 4 (C-4) plastic explosive, with the necessary detonators and cords, are used to support mine neutralization, demolition, and other warfare activities. All demolition charges are further classified according to the net explosive weight of the charge.
- **Anti-Swimmer Grenades:** Maritime security forces use hand grenades to defend against enemy scuba divers.
- **Torpedoes:** Explosive torpedoes are required in some training and testing events. Torpedoes are described as either lightweight or heavyweight and are further categorized according to the net explosive weight.
- **Extended Echo Ranging Sonobuoys:** Extended Echo Ranging sonobuoys include Improved Extended Echo Ranging sonobuoys and mini sound-source seeker sonobuoys that use explosive charges as the active sound source instead of electrically produced sounds.

2.3.3 TARGETS

Training and testing require an assortment of realistic and challenging targets. Targets vary from items as simple and ordinary as an empty steel drum used for small-caliber weapons training from the deck of a ship, to sophisticated, unmanned aerial drones used in air defense training. For this EIS/OEIS, targets are organized by warfare area.

- **Anti-Air Warfare Targets:** Anti-air warfare targets, tow target systems, and aerial targets, are used in training and testing events that involve detection, tracking, defending against, and attacking enemy missiles and aircraft. Aerial tow target systems include textile (nylon banner) and rigid (fiberglass shapes) towed targets used for gunnery events. Aerial targets include expendable rocket powered missiles and recoverable radio-controlled drones used for gunnery and missile exercises (Figure 2.3-17). Parachute flares are used as air-to-air missile targets. Manned high-performance aircraft may be used as targets—to test ship and aircraft defensive systems and procedures—without the actual firing of munitions.

Figure 2.3-17: Deployment and Recovery of Anti-Air Warfare Targets

- **Anti-Surface Warfare Targets:** Stationary and towed targets are used as anti-surface warfare targets during gunnery events. Targets include floating steel drums, inflatable shapes or target balloons (e.g., Killer Tomato™) (Figure 2.3-18), and towed sleds. Remote-controlled, high-speed targets, such as jet skis and motorboats, are also used (Figure 2.3-19).

Figure 2.3-18: Deploying a "Killer Tomato™" Floating Target

Figure 2.3-19: Ship Deployable Surface Target and High-Speed Maneuverable Seaborne Target

- **Anti-Submarine Warfare Targets:** Anti-submarine warfare uses multiple types of targets, including the following:

  - **Submarines:** Submarines may act as tracking and detection targets during training and testing events.
  - **Motorized Autonomous Targets:** Motorized autonomous targets simulate the acoustic and magnetic characteristics of a submarine, providing realism for exercises when a submarine is not available. These mobile targets resemble torpedoes, with some models designed for recovery and reuse, while other models are expendable.
  - **Stationary Artificial Targets:** Stationary targets either resemble submarine hulls or are simulated systems with acoustic properties of enemy submarines. These targets either rest on the sea floor or are suspended at varying depths in the water column.

2.3.4 DEFENSIVE COUNTERMEASURES

Naval forces depend on effective defensive countermeasures to protect against missile and torpedo attack. Defensive countermeasures are devices designed to confuse, distract, and confound precision-guided munitions. Defensive countermeasures are in three basic categories:

- **Chaff:** Chaff consists of reflective, aluminum-coated glass fibers used to obscure ships and aircraft from radar-guided systems. Chaff, which is stored in canisters, is either dispensed from aircraft or fired into the air from the decks of surface ships when an attack is imminent. The glass fibers create a radar cloud that masks the position of the ship or aircraft.
- **Flares:** Flares are pyrotechnic devices used to defend against heat-seeking missiles, where the missile seeks out the heat signature from the flare rather than the aircraft's engines. Similar to chaff, flares are also dispensed from aircraft and fired from ships.
- **Acoustic Countermeasures:** Acoustic countermeasures are used by surface ships and submarines to defend against torpedo attack. Acoustic countermeasures are either released from ships and submarines or towed at a distance behind the ship.

2.3.5 MINE WARFARE SYSTEMS

Mine warfare systems are in two broad categories: mine detection and mine neutralization.

Mine Detection Systems. Mine detection systems are used to locate, classify, and map suspected mines. Once located, the mines can either be neutralized or avoided. These systems are specialized to either locate mines on the surface, in the water column, or on the sea floor.

- **Towed or Hull-Mounted Mine Detection Systems:** These detection systems use acoustic and laser or video sensors to locate and classify suspect mines. Helicopters, ships, and unmanned vehicles are used for towed systems, which can rapidly assess large areas (Figure 2.3-20).

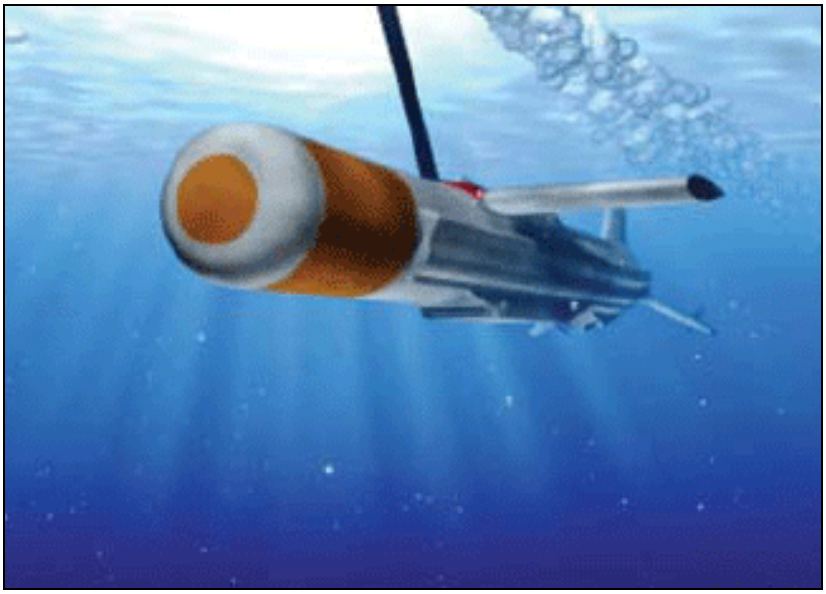

Figure 2.3-20: Towed Mine Detection System

- **Airborne Laser Mine Detection Systems:** Airborne laser detection systems work in concert with neutralization systems. The detection system initially locates mines and a neutralization system is then used to relocate and neutralize the mine (Figure 2.3-21).

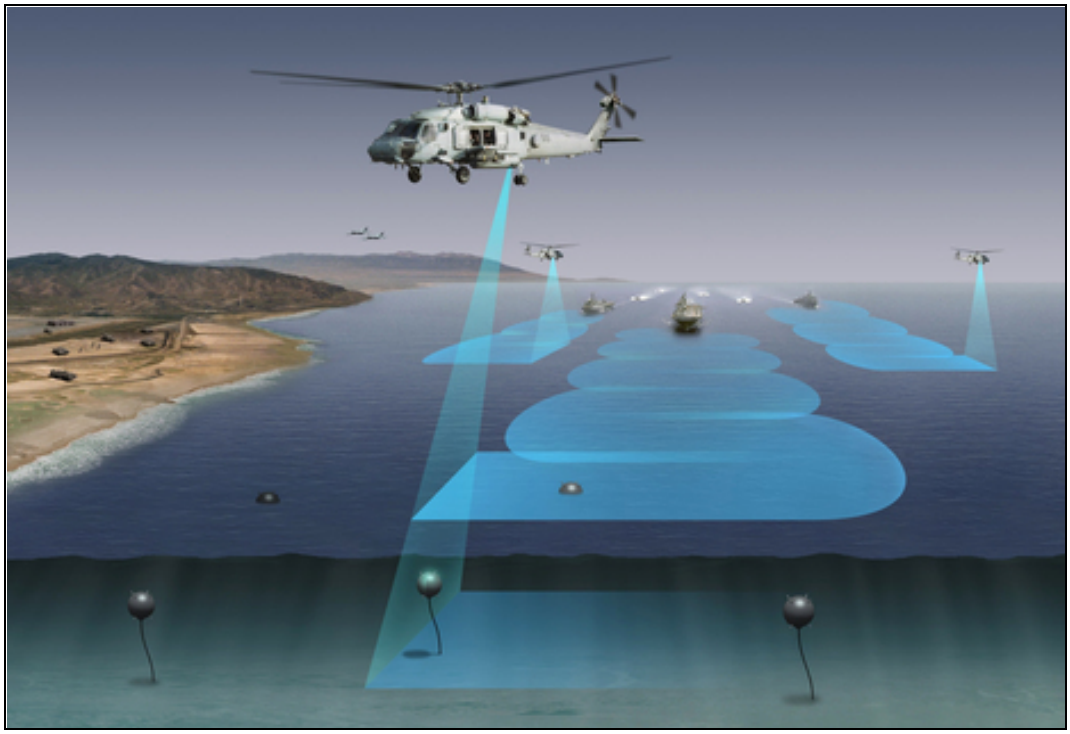

Figure 2.3-21: AN/AES-1 Airborne Laser Mine Detection System

- **Unmanned/Remotely Operated Vehicles:** These vehicles use acoustic and video or lasers to locate and classify mines. Unmanned/remotely operated vehicles provide unique mine warfare capabilities in nearshore littoral areas, surf zones, ports, and channels.
- **Marine Mammal System:** Navy personnel and Navy marine mammals work together to detect specified underwater objects. The Navy deploys trained bottlenose dolphins and California sea lions as part of the marine mammal minehunting and object recovery system.

Mine Neutralization Systems. These systems disrupt, disable, or detonate mines to clear ports and shipping lanes, as well as littoral, surf, and beach areas in support of naval amphibious operations. Mine neutralization systems can clear individual mines or a large number of mines quickly.

- **Towed Influence Mine Sweep Systems:** These systems use towed equipment that mimic a particular ship's magnetic and acoustic signature triggering the mine and causing it to explode (Figure 2.3-22).

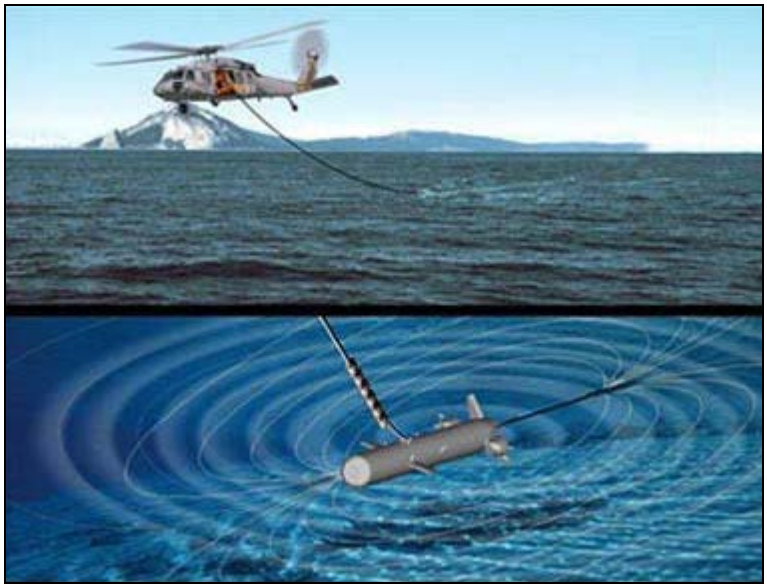

Figure 2.3-22: Organic and Surface Influence Sweep

- **Towed Mechanical Mine Sweeping Systems:** These systems tow a sweep wire to snag the line that attaches a moored mine to its anchor and then uses a series of cables and cutters to sever those lines. Once these lines are cut, the mines float to the surface where explosive ordnance personnel can neutralize the mines.
- **Unmanned/Remotely Operated Mine Neutralization Systems:** Surface ship and helicopters operate these systems, which place explosive charges near or directly against mines to destroy the mine (Figure 2.3-23).

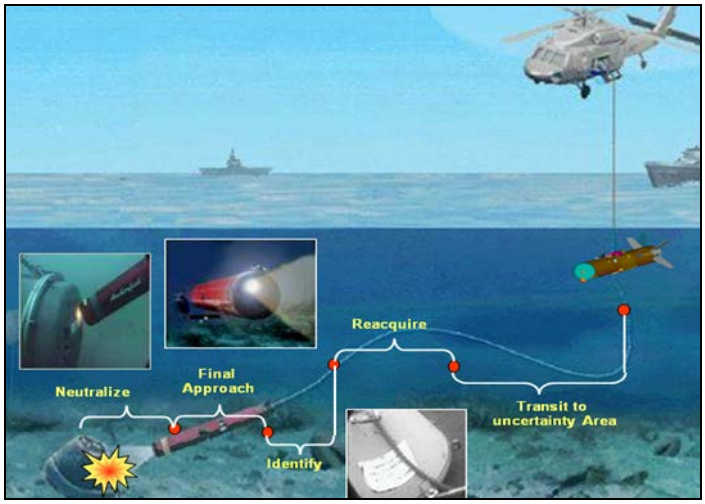

Figure 2.3-23: Airborne Mine Neutralization System

- **Projectiles:** Small- and medium-caliber projectiles fired from surface ships or hovering helicopters are used to neutralize floating and near-surface mines.
- **Diver Emplaced Explosive Charges:** Operating from small craft, divers place explosive charges, which may utilize time delay fusing, near or on mines to destroy the mine or disrupt its ability to function.

2.3.6 MILITARY EXPENDED MATERIALS

Navy training and testing events may introduce or expend various items, such as non-explosive munitions and targets, into the marine environment as a direct result of using these items for their intended purpose. In addition to the items described below, some accessory materials—related to the carriage or release of these items—may be released. These materials, referred to as military expended materials, are not recovered, and potentially result in environmental impacts. These impacts are analyzed in detail in Chapter 3 (Affected Environment and Environmental Consequences) of this EIS/OEIS. This section includes descriptions of a representative sample of military expended materials. A more comprehensive discussion can be found in Chapter 3 (Affected Environment and Environmental Consequences).

Military expended materials analyzed in this document include the following:

- **Sonobuoys:** Sonobuoys consist of parachutes and the sonobuoys themselves.
- **Torpedo Launch Accessories:** Torpedoes are usually recovered; however, materials such as parachutes used with air-dropped torpedoes, guidance wire used with submarine-launched torpedoes, and ballast weights are expended. Explosive filled torpedoes expend torpedo fragments.
- **Projectiles and Bombs:** Non-explosive projectiles, non-explosive bombs, or fragments from explosive projectiles and bombs are expended during training and testing exercises. These items are primarily constructed of lead (most small-caliber projectiles) or steel (medium- and large-caliber projectiles and all bombs).
- **Missiles and Rockets:** Non-explosive missiles and missile fragments from explosive missiles are expended during training and testing events. Propellant, and any explosive material involved, is consumed during firing/detonation. Some missiles include a wire, which is also expended. Rockets are similar to missiles and both non-explosive and fragments may be expended.
- **Countermeasures:** Countermeasures (acoustic, chaff, flares) are expended as a result of training exercises, with the exception of towed acoustic countermeasures. Chaff activities also include an expended canister, end caps, and pistons. Flares expend only end caps and pistons.
- **Targets:** Some targets are designed to be expended; other targets, such as aerial drones and remote-controlled boats, are recovered for re-use. Targets struck with ordnance will result in target fragments.

2.3.7 CLASSIFICATION OF ACOUSTIC AND EXPLOSIVE SOURCES

In order to better organize and facilitate the analysis of approximately 300 individual sources of underwater acoustic sound or explosive energy, a series of source classifications, or source bins, were developed. The use of source classification bins provides the following benefits:

- provides the ability for new sensors or munitions to be covered under existing authorizations, as long as those sources fall within the parameters of a "bin;"
- simplifies the source utilization data collection and reporting requirements anticipated under the MMPA authorizations;
- ensures a conservative approach to all impact estimates, as all sources within a given class are modeled as the loudest source (lowest frequency, highest source level, longest duty cycle, or largest net explosive weight) within that bin;
- allows analysis to be conducted in a more efficient manner, without any compromise of analytical results; and

- provides a framework to support the reallocation of source usage (hours/explosives) between different source bins, as long as the total numbers of takes remain within the overall analyzed and authorized limits. This flexibility is required to support evolving Navy training and testing requirements, which are linked to real world events.

There are two primary types of source classes: impulsive and non-impulsive acoustic. A description of each source classification is provided in Tables 2.3-1 and 2.3-2. Impulsive bins are based on the net explosive weight of the munitions or explosive devices or the source level for air and water guns. Non-impulsive acoustic sources are grouped into bins based on the frequency[4], source level[5], and when warranted, the application in which the source would be used. The following factors further describe the considerations associated with the development of active acoustic source classifications:

- Frequency of the non-impulsive acoustic source.
    - Low-frequency sources operate below 1 kHz
    - Mid-frequency sources operate at and above 1 kHz, up to and including 10 kHz
    - High-frequency sources operate above 10 kHz, up to and including 100 kHz
    - Very high-frequency sources operate above 100 kHz but below 200 kHz
- Decibel (dB) level of the non-impulsive acoustic source.
    - Greater than 160 dB, but less than 180 dB
    - Equal to 180 dB and up to 200 dB
    - Greater than 200 dB
- Application in which the source would be used.
    - How a sensor is employed supports how the sensor's acoustic emissions are analyzed.
    - Factors considered include pulse length (time source is "on"); beam pattern (whether sound is emitted as a narrow, focused beam, or, as with most explosives, in all directions); and duty cycle (how often or how many times a transmission occurs in a given period during an event).

[4] Bins are based on the typical center frequency of the source. Although harmonics may be present, those harmonics would be several dB lower than the primary frequency.

[5] Source decibel levels are expressed in terms of sound pressure level and are values given in decibels (dB) referenced to one microPascal (µPa) at one meter. Information regarding acoustic sources is provided in more detail in Section 3.0.5.3.1 (Acoustic Stressors).

Table 2.3-1: Training and Testing Non-Impulsive Acoustic Sources Used in the Atlantic Fleet Training and Testing Study Area

Source Class Category	Source Class	Description
Low-Frequency (LF): Sources that produce low-frequency (less than 1 kHz) signals.	LF3	Low-frequency sources greater than 200 dB
	LF4	Low-frequency sources equal to 180 dB and up to 200 dB
	LF5	Low-frequency sources greater than 160 dB, but less than 180 dB
Mid-Frequency (MF): Tactical and non-tactical sources that produce mid-frequency (1 to 10 kHz) signals.	MF1	Hull-mounted surface ship sonars (e.g., AN/SQS-53C and AN/SQS-60)
	MF1K	Kingfisher mode associated with MF1 sonars
	MF2	Hull-mounted surface ship sonars (e.g., AN/SQS-56)
	MF2K	Kingfisher mode associated with MF2 sonars
	MF3	Hull-mounted submarine sonars (e.g., AN/BQQ-10)
	MF4	Helicopter-deployed dipping sonars (e.g., AN/AQS-22 and AN/AQS-13)
	MF5	Active acoustic sonobuoys (e.g., DICASS)
	MF6	Active underwater sound signal devices (e.g., MK 84)
	MF8	Active sources (greater than 200 dB) not otherwise binned
	MF9	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned
	MF10	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned
	MF11	Hull-mounted surface ship sonars with an active duty cycle greater than 80%
	MF12	Towed array surface ship sonars with an active duty cycle greater than 80%
High-Frequency (HF): Tactical and non-tactical sources that produce high-frequency (greater than 10 kHz but less than 200 kHz) signals.	HF1	Hull-mounted submarine sonars (e.g., AN/BQQ-10)
	HF2	High-Frequency Marine Mammal Monitoring System
	HF3	Other hull-mounted submarine sonars (classified)
	HF4	Mine detection and classification sonar (e.g., AN/AQS-20)
	HF5	Active sources (greater than 200 dB) not otherwise binned
	HF6	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned
	HF7	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned
	HF8	Hull-mounted surface ship sonars (e.g., AN/SQS-61)
Anti-Submarine Warfare (ASW): Tactical sources such as active sonobuoys and acoustic countermeasures systems used during the conduct of anti-submarine warfare training and testing activities.	ASW1	Mid-Frequency Deep Water Active Distributed System (DWADS)
	ASW2	Mid-Frequency Multistatic Active Coherent sonobuoy (e.g., AN/SSQ-125)
	ASW3	Mid-frequency towed active acoustic countermeasure systems (e.g., AN/SLQ-25)
	ASW4	Mid-frequency expendable active acoustic device countermeasures (e.g., MK 3)

Table 2.3-1: Training and Testing Non-Impulsive Acoustic Sources Used in the Atlantic Fleet Training and Testing Study Area (Continued)

Source Class Category	Source Class	Description
Torpedoes (TORP): Source classes associated with the active acoustic signals produced by torpedoes.	TORP1	Lightweight torpedo (e.g., MK 46, MK 54, or Anti-Torpedo Torpedo)
	TORP2	Heavyweight torpedo (e.g., MK 48)
Doppler Sonars (DS): Sonars that use the Doppler effect to aid in navigation or collect oceanographic information.	DS1	Low-frequency Doppler sonar (e.g., Webb Tomography Source)
Forward Looking Sonar (FLS): Forward or upward looking object avoidance sonars.	FLS2 – FLS3	High-frequency sources with short pulse lengths, narrow beam widths, and focused beam patterns used for navigation and safety of ships
Acoustic Modems (M): Systems used to transmit data acoustically through the water.	M3	Mid-frequency acoustic modems (greater than 190 dB)
Swimmer Detection Sonars (SD): Systems used to detect divers and submerged swimmers.	SD1 – SD2	High-frequency sources with short pulse lengths, used for detection of swimmers and other objects for the purpose of port security
Airguns (AG): Underwater airguns used during swimmer defense and diver deterrent training and testing activities.	AG	Up to 60 cubic inch airguns (e.g., Sercel Mini-G)
Synthetic Aperture Sonars (SAS): Sonars in which active acoustic signals are post-processed to form high-resolution images of the seafloor.	SAS1	MF SAS systems
	SAS2	HF SAS systems
	SAS3	VHF SAS systems

Table 2.3-2: Training and Testing Explosive Sources Used in the Study Area

Source Class	Representative Munitions	Net Explosive Weight[1] (lb.)
E1	Medium-caliber projectiles	0.1-0.25
E2	Medium-caliber projectiles	0.26-0.5
E3	Large-caliber projectiles	0.6-2.5
E4	Improved Extended Echo Ranging sonobuoy	2.6-5
E5	5-in. projectiles	6-10
E6	15-lb. shaped charge	11-20
E7	40-demo block/shaped charge	21-60
E8	250-lb. bomb	61-100
E9	500-lb. bomb	101-250
E10	1,000-lb. bomb	251-500
E11	650-lb. mine	501-650
E12	2,000-lb. bomb	651-1,000
E13	1,200-lb. HBX[2] charge	1,001-1,740
E14	2,500-lb. HBX charge	1,741-3,625
E15	5,000-lb. HBX charge	3,626-7,250
E16	10,000-lb. HBX charge	7,251-14,500
E17	40,000-lb. HBX charge	14,501-58,000

[1] Net Explosive Weight refers to the amount of explosives; the actual weight of a munition may be larger due to other components
[2] HBX: High Blast Explosive family of binary explosives composed of Royal Demolition Explosive (RDX) (explosive nitroamine), TNT, powdered aluminum, and D-2 wax with calcium chloride

2.3.7.1 Sources Qualitatively Analyzed

There are in-water active acoustic sources with narrow beam widths, downward directed transmissions, short pulse lengths, frequencies above known hearing ranges, low source levels, or combinations of these factors, which are not anticipated to result in takes of protected species and, therefore, are not required to be quantitatively analyzed. These sources will be categorized as *de minimis* sources and will be qualitatively analyzed to determine the appropriate determinations under NEPA, the MMPA, and the ESA. When used during routine training and testing activities, and in a typical environment, *de minimis* sources generally meet one or more of the following criteria:

- Acoustic source classes listed in Table 2.3-3 (actual source parameters listed in the classified bin list)
- Acoustic sources that transmit primarily above 200 kilohertz (kHz)
- Sources operated with source levels of 160 decibels (dB ref 1µPa) or less

The types of sources with source levels less than 160 dB are typically hand-held sonars, range pingers, transponders, and acoustic communication devices. Assuming spherical spreading for a 160 dB source, the sound will attenuate to less than 140 dB within 10 meters (m), and less than 120 dB within 100 m of the source. Using the behavioral risk function equation:

$$R = \frac{1 - \left(\frac{L-B}{K}\right)^{-A}}{1 - \left(\frac{L-B}{K}\right)^{-2A}}$$

where,

R = risk (0-1.0)
L = received level (RL) in dB (140 dB)
B = basement RL in dB (120 dB)
K = RL increment above basement with 50 percent risk (45 dB)
A = risk transition sharpness

For odontocetes, pinnipeds, manatees, sea otters, and polar bears, A = 10, therefore, R = 0.0003, or 0.03 percent risk. For mysticetes, A = 8, therefore, R = 0.0015, or 0.15 percent risk.

Therefore:

- For all marine mammals subject to a behavioral risk function, these sources will not significantly increase the number of potential exposures as determined by the effects criteria.
- For beaked whales, the range to 140 dB behavioral threshold from a 160 dB source is 10 meters. The likelihood of any potential behavioral effect is low because of the small affected area and the relative low density of beaked whales.
- For harbor porpoises, there will be a 100 m zone from the source to 120 dB behavioral threshold. Based on the above discussion and the extremely short propagation ranges to 120 dB, the potential for exposures that would result in changes to behavioral patterns to an extent where those patterns are abandoned or significantly altered is unlikely.
- For sea turtles, the behavioral threshold of 175 dB is above the 160 dB source level, and therefore no behavioral effect would be expected.
- Additionally, for all of the above calculations, absorption of sound in water is not a consideration but would increase the actual transmission losses and further reduce the low potential for exposures.

2.3.7.2 Source Classes Qualitatively Analyzed

An entire source bin, or some sources from a bin, may be excluded from quantitative analysis (Table 2.3-3) within the scope of this EIS/OEIS if one or more of the following criteria are met:

- The source is expected to result in responses that are short term and inconsequential based on system acoustic characteristics (e.g., short pulse length, narrow beamwidth, downward-directed beam) and manner of system operation.
- The sources are determined to meet the criteria specified in Section 2.3.7.1 (Sources Qualitatively Analyzed) or Table 2.3-3.
- Bins contain sources needed for safe operation and navigation.

Sources that meet these criteria are qualitatively analyzed in Table 2.3-3 to determine the appropriate determinations under NEPA, MMPA, and ESA (Table 2.3-3).

Table 2.3-3: Training and Testing Source Classes Excluded from Quantitative Analysis

Source Class Category	Source Class	Description
Fathometers High-frequency sources used to determine water depth	FA1 – FA4	Marine mammals are expected to exhibit no more than short-term and inconsequential responses to the sonar, profiler, or pinger given their characteristics (e.g., narrow downward-directed beam). Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources. Fathometers use a downward-directed, narrowly focused beam directly below the vessel (typically much less than 30 degrees), using a short pulse length (less than 10 milliseconds). Use of fathometers is required for safe operation of Navy vessels.
Hand-Held Sonar High-frequency sonar devices used by Navy divers for object location	HHS1	Hand-held sonars generate very high frequency sound at low power levels, short pulse lengths, and narrow beam widths. Because output from these sound sources would attenuate to below any current threshold for marine species at a very short range, and they are under positive control of the diver on which direction the sonar is pointed, marine species reactions are not likely. No additional quantitative modeling is required for marine species that might encounter these sound sources.
Doppler Sonar/Speed Logs Navigation equipment, downward focused, narrow beam width, high-frequency/very high-frequency spectrum utilizing very short pulse lengths	DS2, DS3, DS4	Marine species are expected to exhibit no more than short-term and inconsequential responses to the sonar, profiler, or pinger given their characteristics (e.g., narrow, downward-directed beam), which is focused directly beneath the platform. Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources.
Imaging Sonar (IMS) High-frequency or very high-frequency, very short pulse lengths, narrow bandwidths. IMS1 is a side-scan sonar (high-frequency/very high-frequency, narrow beams, downward directed). IMS2 is a downward looking source, narrow beam, and operates above 180 kHz (basically a fathometer)	IMS1, IMS2	These side scan sonars operate in a very high-frequency range (over 120 kHz) relative to marine mammal hearing (Richardson et al. 1995[1]; Southall et al. 2007[2]). The frequency range from these side scan sonars is beyond the hearing range of mysticetes (baleen whales) pinnipeds, manatees, and sea turtles and, therefore, not expected to affect these species in the Study Area. The frequency range from these side scan sonars falls within the upper end of the odontocete (toothed whale) hearing spectrum (Richardson et al. 1995[1]), which means they are not perceived as loud acoustic signals with frequencies below 120 kHz by these animals. Therefore, marine species may be less likely to react to these types of systems in a biologically significant way. Further, in addition to spreading loss for acoustic propagation in the water column, high-frequency acoustic energies are more quickly absorbed through the water column than sounds with lower frequencies (Urick 1983[3]). Additionally, these systems are generally operated in the vicinity of the sea floor, thus reducing the sound potential of exposure even more. Marine species are expected to exhibit no more than short-term and inconsequential responses to the imaging sonar given their characteristics (e.g., narrow, downward-directed beam and short pulse length [generally 20 milliseconds]). Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources.

Table 2.3-3: Training and Testing Source Classes Excluded from Quantitative Analysis (Continued)

Source Class Category	Source Class	Description
High-Frequency Acoustic Modems (M) and Tracking Pingers (P)	M2, P1, P2, P3, P4	Acoustic modems and tracking pingers operate at frequencies between 2 and 170 kHz, have low duty cycles (single pings in some cases), short pulse lengths (typically 20 milliseconds), and relatively low source levels. Marine species are expected to exhibit no more than short-term and inconsequential responses to these systems given the characteristics described above. Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for animals that might encounter these sound sources
Acoustic Releases (R) Systems that transmit active acoustic signals to release a bottom-mounted object from its housing in order to retrieve the device at the surface	R1, R2, R3	Acoustic releases operate at mid and high frequencies. Because these types of devices are only used to retrieve bottom-mounted devices, they typically transmit only a single ping. Marine species are expected to exhibit no more than short-term and inconsequential responses to these sound sources given that any sound emitted is extremely short in duration. Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources.
Side-Scan Sonars (SSS) Sonars that use active acoustic signals to produce high-resolution images of the seafloor	SSS1, SSS2, SSS3	Marine species are expected to exhibit no more than short-term and inconsequential responses to these systems given the system characteristics such as a downward-directed beam and use of short pulse lengths (less than 20 milliseconds). Such reactions are not considered to constitute "taking" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources.
Small Impulsive Sources	Sources with explosive weights less than 0.1 lb. net explosive weight (less than bin E1)	Quantitative modeling in multiple locations has validated that these low-level impulsive sources are expected to cause no more than short-term and inconsequential responses in marine species due to the low explosive weight and corresponding very small zone of influence associated with these types of sources.

2.4 PROPOSED ACTIVITIES

The Navy has conducted military readiness activities throughout the northwest Atlantic Ocean and Gulf of Mexico for decades. The tempo and types of training and testing activities have fluctuated because of the introduction of new technologies, the evolving nature of international events, advances in warfighting doctrine and procedures, and force structure (organization of ships, weapons and personnel) changes. Such developments influenced the frequency, duration, intensity, and location of required training and testing activities. As discussed in Chapter 1 (Purpose and Need), training and testing activities were analyzed in the Tactical Theater Training Assessment Program Phase I documents. The proposed activities in this EIS/OEIS (Phase II) account for those factors that cause training and testing fluctuations in two ways. First, training and testing activities have evolved to meet changes to

military readiness requirements. Second, this EIS/OEIS includes additional geographic areas where training and testing activities historically occur.

2.4.1 PROPOSED TRAINING ACTIVITIES

The training activities proposed by the Navy are described in Table 2.4-1. The table is organized according to primary mission areas and includes the activity name and a short description. Appendix A (Navy Activities Descriptions) has more detailed descriptions of the activities.

Table 2.4-1: Typical Training Activities in the Study Area

Activity Name	Activity Description
Anti-Air Warfare (AAW)	
Air Combat Maneuver (ACM)	Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.
Air Defense Exercises (ADEX)	Aircrew and ship crews conduct defensive measures against threat aircraft or missiles.
Gunnery Exercise (Air-to-Air) (GUNEX [A-A])	Aircrews defend against threat aircraft with cannons (machine gun).
Missile Exercise (Air-to-Air) (MISSILEX [A-A])	Aircrews defend against threat aircraft with missiles.
Gunnery Exercise (Surface-to-Air) (GUNEX [S-A])	Surface ship crews defend against threat missiles and aircraft with guns.
Missile Exercise (Surface-to-Air) (MISSILEX [S-A])	Surface ship crews defend against threat missiles and aircraft with missiles.
Amphibious Warfare (AMW)	
Naval Surface Fire Support Exercise – Land-based target (FIREX [Land])	Surface ship crews use large-caliber guns to fire on land-based targets in support of forces ashore.
Naval Surface Fire Support Exercise – At Sea (FIREX [At Sea])	Surface ship crews use large-caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds impact the water and are scored by passive acoustic hydrophones located at or near the target area.
Marine Expeditionary Unit (MEU) Certification Exercise (CERTEX)	Amphibious Ready Group exercise conducted to validate the Marine expeditionary unit's readiness for deployment and includes small boat raids; visit, board, search, and seizure training; helicopter and mechanized amphibious raids; and a non-combatant evacuation operations.
Amphibious Assault	Forces move ashore from ships at sea for the immediate execution of inland objectives.
Amphibious Raid/Humanitarian Assistance Operations	Small unit forces move ashore swiftly from ships at sea for a specific short-term mission. These are quick operations with as few personnel as possible.

Table 2.4-1: Typical Training Activities in the Study Area (Continued)

Activity Name	Activity Description
Strike Warfare (STW)	
High-Speed Anti-Radiation Missile Exercise (Air- to- Surface) (HARMEX [A-S])	Aircrews launch a High-Speed Anti-Radiation Missile (HARM) against threat radar sites.
Anti-Surface Warfare (ASUW)	
Maritime Security Operations (MSO)	Helicopter and surface ship crews conduct a suite of maritime security operations (e.g., visit, board, search, and seizure; maritime interdiction operations; force protection; and anti-piracy operation).
Gunnery Exercise (Surface-to-Surface) (Ship) (GUNEX [S-S] – Ship)	Ship crews engage surface targets with ship's small-, medium-, and large-caliber guns.
Gunnery Exercise (Surface-to-Surface) (Boat) (GUNEX [S-S] – Boat)	Small boat crews engage surface targets with small- and medium-caliber guns.
Missile Exercise (Surface-to-Surface) (MISSILEX [S-S])	Surface ship crews defend against threat missiles and other surface ships with missiles.
Gunnery Exercise (Air-to-Surface) (GUNEX [A-S])	Fixed-wing and helicopter aircrews, including embarked personnel, use small- and medium-caliber guns to engage surface targets.
Missile Exercise (Air-to-Surface) (MISSILEX [A-S])	Fixed-wing and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets.
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	Fixed-wing aircrews deliver bombs against surface targets.
Laser Targeting	Fixed-winged, helicopter, and ship crews use single or multi-beam lasers to illuminate enemy targets or to defend against approaching hostile forces.
Sinking Exercise (SINKEX)	Aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a deactivated ship, which is deliberately sunk using multiple weapon systems.
Anti-Submarine Warfare (ASW)	
Tracking Exercise/ Torpedo Exercise – Submarine (TRACKEX/TORPEX – Sub)	Submarine crews search, track, and detect submarines. Exercise torpedoes may be used during this event.
Tracking Exercise/ Torpedo Exercise – Surface (TRACKEX/TORPEX – Surface)	Surface ship crews search, track and detect submarines. Exercise torpedoes may be used during this event.
Tracking Exercise/ Torpedo Exercise – Helicopter (TRACKEX/TORPEX – Helo)	Helicopter crews search, detect and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.
Tracking Exercise/ Torpedo Exercise – Maritime Patrol Aircraft (TRACKEX/TORPEX – MPA)	Maritime patrol aircraft crews search, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.

Table 2.4-1: Typical Training Activities in the Study Area (Continued)

Activity Name	Activity Description
Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoy (TRACKEX – MPA sonobuoy)	Maritime patrol aircraft crews search, detect, and track submarines with extended echo ranging sonobuoys. Recoverable air launched torpedoes may be employed against submarine targets.
Anti-Submarine Warfare Tactical Development Exercise	Multiple ships, aircraft and submarines coordinate their efforts to search, detect and track submarines with the use of all sensors. Anti-submarine warfare tactical development exercise is a dedicated anti-submarine warfare event.
Integrated Anti-Submarine Warfare Course (IAC)	Multiple ships, aircraft, and submarines coordinate the use of their sensors, including sonobuoys, to search, detect and track threat submarines. Integrated Anti-Submarine Warfare Course is an intermediate level training event and can occur in conjunction with other major exercises.
Group Sail	Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search, detect and track a threat submarine. Group sails are not dedicated anti-submarine warfare events and involve multiple warfare areas.
Anti-Submarine Warfare for Composite Training Unit Exercise (COMPTUEX)	Anti-submarine warfare activities conducted during a composite training unit exercise.
Anti-Submarine Warfare for Joint Task Force Exercise (JTFEX)/Sustainment Exercise (SUSTAINEX)	Anti-submarine warfare activities conducted during a joint task force exercise / sustainment exercise.
Electronic Warfare (EW)	
Electronic Warfare Operations (EW OPS)	Aircraft, surface ship and submarine crews attempt to control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions.
Counter Targeting – Flare Exercise (FLAREX)	Fixed-winged aircraft and helicopters crews defend against an attack by deploying flares to disrupt threat infrared missile guidance systems.
Counter Targeting – Chaff Exercise (CHAFFEX)	Surface ships, fixed-winged aircraft and helicopter crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.
Mine Warfare (MIW)	
Mine Countermeasures Exercise (MCM) – Ship Sonar	Littoral combat ship crews detect and avoid mines while navigating restricted areas or channels using active sonar.
Explosive Ordnance Disposal (EOD)/Mine Neutralization	Personnel disable threat mines. Explosive charges may be used.
Underwater Mine Countermeasures (UMCM) Raise, Tow, Beach and Exploitation Operations	Personnel recover moored mines, transfer the mines to shore, and disassemble them.
Mine Countermeasures -Towed Mine Neutralization	Ship crews and helicopter aircrews tow systems (e.g., Organic and Surface Influence Sweep, MK 104/105) through the water designed to disable and/or trigger mines.
Mine Countermeasures – Mine Detection	Ship crews and helicopter aircrews detect mines using towed and laser mine detection systems (e.g., AN/AQS-20, Airborne Laser Mine Detection System).

Table 2.4-1: Typical Training Activities in the Study Area (Continued)

Activity Name	Activity Description
Mine Countermeasures – Mine Neutralization	Ship crews and helicopter aircrews disable mines by firing small- and medium-caliber projectiles.
Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicles	Ship crews and helicopter aircrews disable mines using remotely operated underwater vehicles.
Mine Laying	Fixed-winged aircraft and submarine crews drop/launch non-explosive mine shapes.
Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises	Helicopters aircrew members train as a squadron in the use of airborne mine countermeasures, such as towed mine detection and neutralization systems.
Civilian Port Defense	Maritime security operations for military and civilian ports and harbors. Only the sonar portion of this activity is analyzed in this document. Marine mammal systems may be used during the exercise.
Major Exercises	
Composite Training Unit Exercise (COMPTUEX)	Intermediate level exercise designed to create a cohesive Strike Group prior to deployment or joint task force exercise. Typically seven surface ships, helicopters, maritime patrol aircraft, two submarines, and various unmanned vehicles. Marine mammal systems may be used during the exercise.
Joint Task Force Exercise (JTFEX)/ Sustainment Exercise (SUSTAINEX)	Final fleet exercise prior to deployment of the Strike Group. Serves as a ready-to-deploy certification for all units involved. Typically nine surface ships, helicopters, maritime patrol aircraft, two submarines, and various unmanned vehicles. Marine mammal systems may be used during the exercise.
Other Training Activities	
Search and Rescue (SAR)	Helicopter crews rescue military personnel at-sea.
Precision Anchoring	Ship crews train in releasing of anchors in designated locations.
Elevated Causeway System (ELCAS)	A temporary pier is constructed off the beach. Supporting pilings are driven into the sand and then later removed. The elevated causeway system is a portion of a larger activity, Joint Logistics Over the Shore (JLOTS) which is covered under separate documentation.
Submarine Navigation (SUB NAV)	Submarine crews locate underwater objects and ships while transiting in and out of port.
Submarine Navigation under Ice Certification	Submarine crews train to operate under ice. During training and certification other submarines and ships simulate ice.
Surface Ship Object Detection	Surface ship crews locate underwater objects that may impede transit in and out of port.
Surface Ship Sonar Maintenance	Pierside and at-sea maintenance of sonar systems.
Submarine Sonar Maintenance	Pierside and at-sea maintenance of sonar systems.

2.4.2 PROPOSED TESTING ACTIVITIES

The Navy's research and acquisition community engages in a broad spectrum of testing activities in support of the fleet. These activities include, but are not limited to, basic and applied scientific research and technology development; testing, evaluation, and maintenance of systems (missiles, radar, and sonar), and platforms (surface ships, submarines, and aircraft); and acquisition of systems and platforms to support Navy missions and give a technological edge over adversaries.

The individual commands within the research and acquisition community included in this EIS/OEIS are Naval Air Systems Command, Naval Sea Systems Command, and the Office of Naval Research and Naval Research Laboratory.

The Navy operates in an ever-changing strategic, tactical, and funding and time-constrained environment. Testing activities occur in response to emerging science or fleet operational needs. For example, future Navy experiments to develop a better understanding of ocean currents may be designed based on advancements made by non-government researchers not yet published in the scientific literature. Similarly, future but yet unknown Navy operations within a specific geographic area may require development of modified Navy assets to address local conditions. Such modifications must be tested in the field to ensure they meet fleet needs and requirements. Accordingly, generic descriptions of some of these activities are the best that can be articulated in a long-term, comprehensive document, like this EIS/OEIS.

Some testing activities are similar to training activities conducted by the fleet. For example, both the fleet and the research and acquisition community fire torpedoes. While the firing of a torpedo might look identical to an observer, the difference is in the purpose of the firing. The fleet might fire the torpedo to practice the procedures for such a firing, whereas the research and acquisition community might be assessing a new torpedo guidance technology or to ensure the torpedo meets performance specifications and operational requirements. These differences may result in different analysis and potential mitigations for the activity.

2.4.2.1 Naval Air Systems Command Testing Activities

Naval Air Systems Command testing activities generally fall in the primary mission areas used by the fleets. Naval Air Systems Command activities include, but are not limited to, the testing of new aircraft platforms, weapons, and systems before those platforms, weapons, and systems are integrated into the fleet. In addition to the testing of new platforms, weapons, and systems, Naval Air Systems Command also conducts lot acceptance testing of weapons and systems, such as sonobuoys.

The majority of testing and development activities conducted by Naval Air Systems Command are similar to fleet training events, and many platforms (e.g., the MH-60 helicopter) and systems (e.g., Airborne Towed Minehunting System [AN/AQS-20A]) currently being tested are already being used by the fleet or will ultimately be integrated into fleet training activities. However, some testing and development may be conducted in different locations and in a different manner than the fleet and, therefore, though the potential environmental effects may be the same, the analysis for those events may differ. Training with systems and platforms delivered to the fleet within the timeframe of this document are analyzed in the training sections of this EIS/OEIS. This section only addresses Naval Air Systems Command's testing activities, which are described in Table 2.4-2.

Table 2.4-2: Typical Naval Air Systems Command Testing Activities in the Study Area

Activity Name	Activity Description
Anti-Air Warfare (AAW)	
Air Combat Maneuver (ACM) Test	This event is identical to the air combat maneuver training event. Test events involve two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during air combat maneuver test activities.
Air Platform/Vehicle Test	Testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform or vehicle. No weapons are released during an air platform/vehicle test. In-flight refueling capabilities are tested.
Air Platform Weapons Integration Test	Testing performed to quantify the compatibility of weapons with the aircraft from which they would be launched or released. Mostly non-explosive weapons or shapes are used, but some tests may require the use of high-explosive weapons.
Air-to-Air (A-A) Weapons System Test	Test to evaluate the effectiveness of air-launched weapons against designated airborne targets. Fixed-wing or rotary-wing aircraft may be used. No testing of high-explosive weapons is planned.
Air-to-Air Missile Test	This event is similar to the training event missile exercise (air-to-air). Tests are a type of air-to-air weapon system test in which non-explosive practice air-to-air missiles are fired from fixed-wing aircraft against unmanned aerial drones such as BQM-34 and BQM-74.
Air-to-Air Gunnery Test	This event is similar to the training event gunnery exercise air-to-air. An air-to-air gunnery test involves the firing of guns from both fixed-wing and rotary-wing aircraft against a towed aerial banner which serves as the target. Typically non-explosive practice rounds are fired and the targets fired upon are unmanned aerial drones.
Intelligence, Surveillance, and Reconnaissance Test	Test to evaluate communications capabilities of fixed-wing and rotary-wing aircraft, including unmanned systems that can carry cameras, sensors, communications equipment, or other payloads. New systems are tested at sea to ensure proper communications between aircraft and ships.
Anti-Surface Warfare (ASUW)	
Air-to-Surface Missile Test	This event is similar to the training event missile exercise (air-to-surface). Test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapon system or as part of another systems integration test.
Air-to-Surface Gunnery Test	This event is similar to the training event gunnery exercise (air-to-surface). Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapon system.
Rocket Test	Rocket testing evaluates the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-in. rockets fired from a hovering or forward flying helicopter or from a fixed-wing strike aircraft.
Air-to-Surface Bombing Test	This event is similar to the training event bombing exercise (air-to-surface). Strike fighter and maritime patrol aircraft test the delivery of non-explosive practice bombs against surface maritime targets with the goal of evaluating the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced.
Laser Targeting Test	Aircrew use laser targeting devices integrated into aircraft or weapon systems to evaluate targeting accuracy and precision and to train aircrew in the use of newly developed or enhanced laser targeting devices. Lasers are designed to illuminate designated targets for engagement with laser-guided weapons.

Table 2.4-2: Typical Naval Air Systems Command Testing Activities in the Study Area (Continued)

Activity Name	Activity Description
High Energy Laser Weapons Test	High energy laser weapons tests evaluate the specifications, integration, and performance of an aircraft mounted, approximately 25 kW high energy laser. The laser is intended to be used as a weapon to disable small surface vessels.
Electronic Warfare (EW)	
Electronic Systems Evaluation	Test that evaluates the effectiveness of electronic systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, electronic warfare testing will assess the performance of three types of electronic warfare systems: electronic attack, electronic protect, and electronic support.
Chaff Test	Similar to the training event counter targeting – chaff exercise, chaff tests evaluate newly developed or enhanced chaff, chaff dispensing equipment, or modified aircraft systems against chaff deployment. Tests may also train pilots and aircrew in the use of new chaff dispensing equipment. Chaff tests are often conducted with flare tests and air combat maneuver events, as well as other test events, and are not typically conducted as standalone tests.
Flare Test	Similar to the training event counter targeting – flare exercise, flare tests evaluate newly developed or enhanced flares, flare dispensing equipment, or modified aircraft systems against flare deployment. Tests may also train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with chaff tests and air combat maneuver events, as well as other test events, and are not typically conducted as standalone tests.
Anti-Submarine Warfare (ASW)	
Anti-Submarine Warfare Torpedo Test	This event is similar to the training event torpedo exercise. The test evaluates anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, and track a submarine or similar target.
Kilo Dip	A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. The sonar system is briefly activated to ensure all systems are functional. A kilo dip is simply a precursor to more comprehensive testing.
Sonobuoy Lot Acceptance Test	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot, or group, of sonobuoys in advance of delivery to the fleet for operational use.
Anti-Submarine Warfare Tracking Test—Helicopter	This event is similar to the training event anti-submarine warfare tracking exercise/torpedo exercise – helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft	This event is similar to the training event anti-submarine warfare tracking exercise/torpedo exercise – maritime patrol aircraft extended echo ranging sonobuoy. The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.
Mine Warfare (MIW)	
Airborne Mine Neutralization System Test (AMNS)	Airborne mine neutralization tests of the Airborne Mine Neutralization System evaluate the system's ability to detect and destroy mines. The Airborne Mine Neutralization System uses up to four unmanned underwater vehicles equipped with high-frequency sonar, video cameras, and explosive neutralizers.
Airborne Projectile-Based Mine Clearance System Test	An MH-60 helicopter uses a laser-based detection system to search for mines and to fix mine locations for neutralization with an airborne projectile-based mine clearance system. The system neutralizes mines by firing a small- or medium-caliber inert, supercavitating projectile from a hovering helicopter.

Table 2.4-2: Typical Naval Air Systems Command Testing Activities in the Study Area (Continued)

Activity Name	Activity Description
Airborne Towed Minesweeping Test – AN/ALQ-220 (OASIS)	Tests of the Organic Airborne and Surface Influence Sweep (OASIS) would be conducted by a helicopter to evaluate the functionality of Organic Airborne and Surface Influence Sweep at sea. The Organic Airborne and Surface Influence Sweep is towed from a forward flying helicopter and works by emitting an electromagnetic field and mechanically generated underwater sound to simulate the presence of a ship. The sound and electromagnetic signature cause nearby mines to explode.
Airborne Towed Minehunting Sonar Test – AN/AQS-20A	Tests of the AN/AQS-20A to evaluate the search capabilities of this towed, mine hunting, detection, and classification system. The sonar on the AN/AQS-20A identifies mine-like objects in the deeper parts of the water column.
Airborne Laser-Based Mine Detection System Test (ALMDS)	An airborne mine hunting test of the AN/AES-1 Airborne Laser Mine Detection System, or "ALMDS" evaluates the system's ability to detect, classify, and fix the location of floating and near-surface, moored mines. The system uses a laser to locate mines and may operate in conjunction with an airborne projectile-based mine detection system to neutralize mines.
Mine Laying Test	Fixed-wing aircraft evaluate the performance of mine laying equipment and software systems to lay mines. A mine test may also train aircrew in laying mines using a new or enhanced mine deployment system.
Other Testing Activities	
Test and Evaluation Catapult Launch	Tests evaluate the function of aircraft carrier catapults at sea following enhancements, modifications, or repairs to catapult launch systems. This includes aircraft catapult launch tests. No weapons or other expendable materials would be released.
Air Platform Shipboard Integration Test	Tests evaluate the compatibility of aircraft and aircraft systems with ships and shipboard systems. Tests involve physical operations and verify and evaluate communications and tactical data links. This test function also includes an assessment of carrier-shipboard suitability and hazards of electromagnetic radiation to personnel, ordnance, and fuels.
Shipboard Electronic Systems Evaluation	Tests measure ship antenna radiation patterns and test communication systems with a variety of aircraft.
Maritime Security	Maritime patrol aircraft and helicopters participate in maritime security activities and fleet training events. Aircraft and surface ships identify, track, intercept, board, and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions or conflict rules of engagement.

2.4.2.2 Naval Sea Systems Command Testing Activities

Naval Sea Systems Command testing activities (Table 2.4-3) are aligned with its mission of new ship construction, life cycle support, and weapon systems development. Each major category of Naval Sea Systems Command activities is described below.

2.4.2.2.1 New Ship Construction Activities

Ship construction activities include pierside testing of ship systems, tests to determine how the ship performs at sea (sea trials), and developmental and operational test and evaluation programs for new technologies and systems. Pierside and at-sea testing of systems aboard a ship may include sonar, acoustic countermeasures, radars, and radio equipment. In this EIS/OEIS, pierside testing at Navy contractor shipyards consists only of sonar systems. During sea trials, each new ship propulsion engine is operated at full power and subjected to high-speed runs and steering tests. At-sea test firing of shipboard weapon systems, including guns, torpedoes, and missiles, are also conducted.

2.4.2.2.2 Shock Trials

One ship of each new class (or major upgrade) of combat surface ships constructed for the Navy typically undergoes an at-sea shock trial. A shock trial is a series of underwater detonations that send a shock wave through the ship's hull to simulate near misses during combat. A shock trial allows the Navy to validate the shock hardness of the ship and assess the survivability of the hull and ship's systems in a combat environment as well as the capability of the ship to protect the crew.

2.4.2.2.3 Life Cycle Activities

Testing activities are conducted throughout the life cycle of a Navy ship to verify performance and mission capabilities. Sonar system testing occurs pierside during maintenance, repair, and overhaul availabilities, and at sea immediately following most major overhaul periods. A Combat System Ship Qualification Trial is conducted for new ships and for ships that have undergone modification or overhaul of their combat systems.

Radar cross signature testing of surface ships is conducted on new vessels and periodically throughout a ship's life cycle to measure how detectable the ship is to radar. Additionally, electromagnetic measurements of off-board electromagnetic signatures are conducted for submarines, ships, and surface craft periodically.

2.4.2.2.4 Range Activities

Naval Sea Systems Command's testing ranges are used to conduct principal testing, analysis, and assessment activities for ship and submarine platforms, including ordnance, mines, and machinery technology for surface combat systems. Naval Surface Warfare Center, Panama City Division Testing Range focuses on surface warfare tests that often involve mine countermeasures such as sonar operations, electromagnetic operations, laser operations, and ordnance/projectile operations. Naval Undersea Warfare Center Division, Newport Testing Range focuses on the undersea aspects of warfare and is, therefore, structured to test systems such as torpedoes and unmanned underwater vehicles. The South Florida Ocean Measurement Facility Testing Range retains a unique capability that focuses on signature analysis operations and mine warfare testing events.

2.4.2.2.5 Additional Activities Outside Naval Sea Systems Command Ranges

Numerous test activities and technical evaluations in support of Naval Sea Systems Command's systems development mission occur outside the predefined boundaries of the Naval Sea Systems Command's testing ranges and often in conjunction with fleet activities within the Study Area. Tests within this category include, but are not limited to, anti-surface warfare, anti-submarine warfare, and mine warfare tests using torpedoes, sonobuoys, and mine detection and neutralization systems.

Unique Naval Sea Systems Command planned testing includes a kinetic energy weapon, which uses electromagnetic energy to propel a round at a target, and alternative electromagnetic or directed energy devices. In addition, areas of potential increased future equipment and systems testing are swimmer detection systems, lasers, new radars, unmanned vehicles, and chemical-biological detectors.

Table 2.4-3: Typical Naval Sea Systems Command Testing Activities in the Study Area

Activity Name		Activity Description
Ship Construction and Maintenance		
New Ship Construction		
Surface Combatant Sea Trials	Pierside Sonar Testing	Ship's sonar systems are tested pierside to ensure proper operation.
	Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).
	Gun Testing	Gun systems are tested using non-explosive practice munitions.
	Missile Testing	Launching systems are tested using missiles fired at target drones.
	Decoy Testing	Includes testing of the MK 36 Decoy Launching system.
	Surface Warfare Testing – Large-Caliber	Ships defend against surface targets with large-caliber guns.
	Anti-Submarine Warfare Testing	Ships demonstrate capability of countermeasure systems and underwater surveillance and communications systems.
Aircraft Carrier Sea Trials	Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).
	Gun Testing – Small-Caliber	Small-caliber gun systems are tested using non-explosive rounds.
	Gun Testing – Medium-Caliber	Medium-caliber gun systems are tested using non-explosive and explosive rounds.
	Missile Testing	Missile systems are tested using explosive rounds.
	Bomb Testing	Non-explosive bombs are tested.
Submarine Sea Trials	Pierside Sonar Testing	Submarine's sonar systems are tested pierside to ensure proper operation.
	Propulsion Testing	Submarine is run at high speeds in various formations and at various depths.
	Weapons System Testing	Submarine weapons systems are tested by cycling water through them in lieu of actual weapons firing.
	Anti-Submarine Warfare Testing	Submarines demonstrate capability of underwater surveillance and communications systems.
Other Ship Class Sea Trials	Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).
	Gun Testing – Small-Caliber	Small-caliber gun systems are tested using non-explosive rounds.
Anti-Submarine Warfare Mission Package Testing		Ships and their supporting platforms (e.g., helicopters, unmanned aerial systems) detect, localize, and prosecute submarines.
Surface Warfare Mission Package Testing		Ships defend against surface targets with small-, medium-, and large-caliber guns and medium range missiles.
Mine Countermeasure Mission Package Testing		Ships conduct mine countermeasure operations.

Table 2.4-3: Typical Naval Sea Systems Command Testing Activities in the Study Area (Continued)

Event Name	Event Description
Post-Homeporting Testing (all classes)	Electronic, navigation, and refueling capabilities are tested.
Ship Shock Trials	Explosives are detonated underwater against surface ships.
Life Cycle Activities	
Ship Signature Testing	Ship and submarine radars and electromagnetic signatures are tested.
Surface Ship Sonar Testing/ Maintenance	Pierside and at-sea testing of ship systems occurs periodically following major maintenance periods and for routine maintenance.
Submarine Sonar Testing/ Maintenance	Pierside and at-sea testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.
Combat System Ship Qualification Trial (CSSQT) – In-Port Maintenance Period	All combat systems are tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea CSSQT events.
Combat System Ship Qualification Trial (CSSQT) – Air Defense (AD)	Ship's capability to detect, identify, track, and successfully defend against live and simulated targets is tested.
Combat System Ship Qualification Trial (CSSQT) – Surface Warfare (SUW)	Capabilities of shipboard sensors to detect and track surface targets, relay the data to the gun weapon system, and defend against targets are tested.
Combat System Ship Qualification Trial (CSSQT) – Undersea Warfare (USW)	Ship's ability to track and defend against undersea targets is tested.
Naval Sea Systems Command Range Activities	
Naval Surface Warfare Center, Panama City Division Testing Range	
Air Operations	Various aircraft operations are conducted in support of other test activities.
Surface Operations	Surface vessel operations for deployment and recovery of mine warfare systems and testing of communication and propulsion systems are conducted.
Subsurface Operations	Subsurface operations include testing of underwater vehicles, items placed on the ocean floor, and diving activities.
Sonar Operations	Testing of sonar systems determines their capability to detect, locate, and characterize mine-like objects.
Electromagnetic Operations	Electromagnetic operations test an array of magnetic sensors used in mine countermeasure operations.
Laser Operations	Laser systems are tested to determine effectiveness as a tool to identify mine-like objects.
Ordnance Operations	Airborne, surface, organic (readily available units in place), and shallow water mine countermeasure systems are tested using explosive ordnance.
Projectile Firing	Airborne and surface crews defend against surface targets with small-, medium-, and large-caliber guns.
Unmanned Underwater Vehicles Demonstration	The performance of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems are tested and demonstrated.
Mine Detection and Classification Testing	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.
Mine Countermeasure / Neutralization Testing	Air, surface, and subsurface vessels neutralize threat mines and mine-like objects.
Stationary Source Testing	Stationary equipment (including swimmer defense systems) is deployed to determine functionality.

Table 2.4-3: Typical Naval Sea Systems Command Testing Activities in the Study Area (Continued)

Event Name	Event Description
Special Warfare Testing	Submersibles capable of inserting and extracting personnel or payloads into denied areas from strategic distances are tested.
Unmanned Underwater Vehicle Testing	Unmanned underwater vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.
Ordnance Testing	Airborne and surface crews defend against surface targets with small-, medium-, and large-caliber guns, as well as line charge testing.
Naval Undersea Warfare Center Division, Newport Testing Range	
Launcher Testing	Launcher systems are tested to evaluate performance.
Torpedo Testing	Non-explosive practice torpedoes are launched to record operational data.
Towed Equipment Testing	Surface vessel or unmanned underwater vehicle deploys equipment to determine functionality of towed systems.
Unmanned Underwater Vehicle Testing	Unmanned underwater vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.
Unmanned Surface Vehicle Testing	Unmanned surface vehicles are deployed to verify the functionality of basic capabilities and complex tests that involve multiple participants and missions.
Unmanned Aerial System Testing	Unmanned aerial systems are launched to test the capability to perform intelligence, surveillance, and reconnaissance, and extend the communications range of unmanned underwater vehicles, unmanned surface vehicles, and submarines.
Semi-Stationary Equipment Testing	Semi-stationary equipment (e.g., a hydrophone) is deployed to determine functionality.
Unmanned Underwater Vehicle Demonstrations	The performance of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems is tested and demonstrated.
Pierside Integrated Swimmer Defense Testing	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and defend against swimmer/diver threats in harbor environments.
South Florida Ocean Measurement Facility Testing Range	
Signature Analysis Operations	Electromagnetic, acoustic, optical, and radar signature measurements of surface ships and submarines are tested.
Mine Testing Activities	Air, surface, and sub-surface systems detect, counter, and neutralize ocean-deployed mine-like objects.
Surface Testing Activities	Various surface vessels, moored equipment, and materials are tested to evaluate performance in the marine environment.
Subsurface Testing Activities	Various underwater, bottom crawling, robotic vehicles utilized in underwater search, recovery, installation, and scanning activities are tested.
Unmanned Underwater Vehicle Demonstrations	The performance of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems are tested and demonstrated.
Additional Activities at Locations Outside of Naval Sea Systems Command Ranges	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing	
Missile Testing	Missile testing includes various missiles fired from submarines and surface combatants.
Kinetic Energy Weapon Testing	A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile.
Electronic Warfare Testing	Testing will include radiation of military and commercial radar and communication systems (or simulators).

Table 2.4-3: Typical Naval Sea Systems Command Testing Activities in the Study Area (Continued)

Event Name	Event Description
Torpedo (Non-Explosive) Testing	Air, surface, or submarine crews employ non-explosive torpedoes against submarines or surface vessels.
Torpedo (Explosive) Testing	Air, surface, or submarine crews employ explosive torpedoes against artificial targets or deactivated ships.
Countermeasure Testing	Towed sonar arrays and surface ship torpedo defense systems are employed to detect and neutralize incoming weapons.
Pierside Sonar Testing	Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities.
At-Sea Sonar Testing	Sonar systems are tested at sea to ensure they are fully functional in an open ocean environment.
Mine Warfare (MIW) Testing	
Mine Detection and Classification Testing	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.
Mine Countermeasure / Neutralization Testing	Air, surface, and subsurface vessels neutralize threat mines that would otherwise restrict passage through an area.
Shipboard Protection Systems and Swimmer Defense Testing	
Pierside Integrated Swimmer Defense Testing	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and defend against swimmer/diver threats in harbor environments.
Shipboard Protection Systems Testing	Loudhailers and small-caliber munitions are used to protect a ship against small boat threats.
Chemical/Biological Simulant Testing	Chemical/biological agent simulants are deployed against surface ships.
Unmanned Vehicle Testing	
Underwater Deployed Unmanned Aerial System Testing	Unmanned aerial systems are launched by submarines and special operations forces while submerged.
Unmanned Vehicle Development and Payload Testing	Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes.
Other Testing Activities	
Special Warfare Testing	Special warfare includes testing of submersibles capable of inserting and extracting personnel or payloads into denied areas from strategic distances.
Radio-Frequency Communications Testing	Radio-frequency communications for towed or floating buoys are tested.
Hydrodynamic Testing	Submarines maneuver in the submerged operating environment.
At-Sea Explosives Testing	Explosives are detonated at sea.

2.4.2.3 Office of Naval Research and Naval Research Laboratory Testing Activities

As the Department of the Navy's Science and Technology provider, Office of Naval Research and Naval Research Laboratory provide technology solutions for Navy and Marine Corps needs. The Office of Naval Research's mission, defined by law, is to plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security. Further, Office of Naval Research manages the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation. The Ocean Battlespace Sensing Department explores science and technology in the areas of oceanographic and meteorological observations, modeling, and prediction in the battlespace environment; submarine detection and classification (anti-submarine warfare); and mine warfare applications for detecting and neutralizing mines in both the ocean and littoral environment. The Office of Naval Research events include research, development, test, and evaluation activities; surface processes acoustic communications experiments; shallow water acoustic communications experiments; sediment acoustics experiments; shallow water acoustic propagation experiments; and long-range acoustic propagation experiments. Typical Office of Naval Research testing activities are shown in Table 2.4-4; however, because of the unpredictable nature of scientific discoveries, these descriptions are provided as examples only. The Office of Naval Research will strive to predict acoustic activity and account for that activity within the classifications described in Section 2.3.1 (Sonar Systems and Other Acoustic Sensors).

Table 2.4-4: Typical Office of Naval Research Activities in the Study Area

Acoustics Experiments	Description
Martha's Vineyard Coastal Observatory Acoustic Communications Experiment (Coastal)	The Martha's Vineyard Coastal Observatory Acoustic Communications Experiment is designed to investigate ocean surface processes and their role in the generation and evolution of surface bubbles, roughness, and internal turbulence; to investigate the impact of these processes on the propagation of acoustic signals in the ocean; and to test and evaluate different techniques for underwater acoustic communications. Acoustic (active) sources used during the experiments are deployed on bottom-mounted tripods. Passive acoustic receiving arrays (hydrophones) are also deployed on bottom-mounted tripods located at varying distances from the sources. The experiment also involves the use of small scientific acoustic sources that record and measure bubble formation. The data collected will enable scientists to understand more about the effects of bubbles on the propagation of high-frequency sound in shallow water environments. Event duration is one to two weeks.
Sediment Acoustics Experiment (Coastal)	The Sediment Acoustics Experiment is designed to investigate the seasonal variability in seafloor and shallow sub-bottom acoustic properties in shallow water Gulf of Mexico marine environments. The objective is to increase understanding of the variability of seafloor and shallow sub-surface acoustic properties that affect the ability to identify anthropogenic objects in the nearshore environment. The results will enhance understanding of surface and subsurface seafloor geological characteristics, including geoacoustical and geotechnical properties. Event duration is one to two weeks.
Northwestlant Tomography Experiment (Deep Water)	The primary purpose of Northwestlant Tomography Experiment is to gain an understanding of the behavior of low-frequency sound transmissions in the deep ocean over long distances in areas of naval interest. The experiments combine measurements of acoustic propagation and ambient noise on a vertical line array with the use of an ocean acoustic tomography array to help characterize a complex and highly dynamic region of the ocean. Deep water and long range experiments are designed to collect baseline acoustic and oceanographic data in the Study Area. The experimental active acoustic sources used include phase-coded m-sequence sources at center frequencies of 85 Hz, 230 Hz, and 270 Hz, and a source which will transmit pre-programmed sequences at frequencies in the 10–1,000 Hz band. Event duration is 52 weeks.

Table 2.4-4: Typical Office of Naval Research Activities in the Study Area (Continued)

Acoustics Experiments	Description
East Coast Shallow Water Experiment (Continental Shelf)	The goals of this experiment are to determine the dominant physical processes that affect the acoustic field and to develop decision making tools for use in shallow water environments. This includes knowing how to choose the relevant environmental parameters to measure, how often to measure them, and how to best select acoustic applications frequencies. Shallow water acoustic experiments aid in meeting the Navy's mission of fully defining the coastal underwater environment and the variables that determine shallow underwater sound transmission. This understanding is important because all users of the ocean environment must rely on acoustic signals to sense their undersea surroundings and to perform the many tasks underwater for which light and other electromagnetic radiation are used in the atmosphere. Underwater sound is used for such basic tasks as measuring ocean depth, locating underwater objects, navigation, and communication. Event duration is one to two weeks.

2.5 ALTERNATIVES DEVELOPMENT

The identification, consideration, and analysis of alternatives are important aspects of the NEPA process and contribute to the goal of objective decision making. The Council on Environmental Quality provides guidance on the development of alternatives. The regulations require the decision maker to consider the environmental effects of the Proposed Action and a range of alternatives (including the No Action Alternative) to the Proposed Action (40 C.F.R. § 1502.14). The range of alternatives include reasonable alternatives, which must be rigorously and objectively explored, as well as other alternatives that were considered but eliminated from detailed study. To be reasonable, an alternative must meet the stated purpose of and need for the Proposed Action. Mitigation measures are discussed throughout this EIS/OEIS in connection with affected resources, and are also addressed separately in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

The purpose of including a No Action Alternative in environmental impact analyses is to ensure that agencies compare the potential impacts of the Proposed Action to the potential impacts of maintaining the status quo.

The Navy developed the alternatives considered in this EIS/OEIS after careful assessment by subject matter experts, including military units and commands that utilize the ranges, military range management professionals, and Navy environmental managers and scientists.

2.5.1 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Alternatives eliminated from further consideration are described in Sections 2.5.1.1 (Alternative Training and Testing Locations) through 2.5.1.3 (Simulated Training and Testing). The Navy determined that these alternatives did not meet the purpose of and need for the Proposed Action after thorough consideration of each.

2.5.1.1 Alternative Training and Testing Locations

The Navy's use of training and testing ranges evolved over the decades because these geographic areas allow for the entire spectrum of training and testing to occur. While some unit-level training and some testing activities may require only one training element (sea surface space, undersea space, or airspace), more advanced training and testing events may require a combination of air, surface, and undersea space as well as access to land ranges. The ability to utilize the diverse and multi-dimensional

capabilities of each range complex results in the Navy's ability to develop and maintain high levels of readiness. No other locations match the unique attributes found in the Study Area, which are as follows:

- Proximity of range complexes and testing ranges off the east coast of the United States and within the Gulf of Mexico to each other.
- Proximity to the homeport regions of Norfolk, Virginia; Jacksonville, Florida; and Camp Lejeune, Jacksonville, North Carolina; as well as the Navy command headquarters, training schools, ships, submarines, aircraft squadrons, and Marine Corps forces located in each of those locations.
- Proximity to shore-based facilities and infrastructure and the logistical support provided for testing activities.
- Proximity to military families, in light of the readiness benefits derived from minimizing the length of time Sailors and Marines spend deployed away from home.
- Presence of unique training and testing ranges, which include the established mine warfare capabilities in the VACAPES Range Complex, the instrumented water ranges located at the South Florida Ocean Measurement Facility Testing Range, and naval training beaches located at Camp Lejeune capable of supporting large-scale amphibious training events.
- Environmental conditions (bathymetry, topography, and weather) that maximize the training realism and testing effectiveness.

The uniquely interrelated nature of the component parts to the range complexes and testing ranges located within the Study Area provides the training and testing support needed for complex military activities. There is no other series of integrated ranges in the Atlantic Ocean that affords this level of operational support and comprehensive integration for range activities. There are no other potential locations where land ranges, OPAREAs, undersea terrain and ranges, testing ranges, and military airspace combine to provide the venues necessary for the training and testing realism and effectiveness required to train and certify naval forces ready for combat operations.

2.5.1.2 Mitigations Including Temporal or Geographic Constraints within the Study Area

Alternatives considered under the NEPA process may include mitigation measures. This assumes, however, that appropriate mitigation can be developed before a detailed analysis of the impacts from the alternatives and compliance with other federal laws occurs. Analysis of military training and testing activities involves compliance with several federal laws, including the MMPA and the ESA. These laws require the Navy to complete complex and lengthy permitting processes, which include applying the best available science to develop mitigations. The best available science is reviewed and identified during the course of the permitting and NEPA/Executive Order (EO) 12114 processes. Consequently, to allow for potential mitigation measures to be more fully developed as part of the detailed NEPA/EO 12114 analysis and further refined and informed by applicable permitting processes, the Navy did not identify and carry forward for analysis any separate alternatives with pre-determined geographic or temporal restrictions. Rather, Chapter 5 of this EIS/OEIS (Standard Operating Procedures, Mitigation, and Monitoring) contains a detailed discussion of mitigation measures that were evaluated. Based on the analysis in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), MMPA and ESA permitting processes, and other required regulatory consultations, practical science-based mitigation measures, including temporal or geographic constraints within the Study Area, may be implemented under either action alternative.

2.5.1.3 Simulated Training and Testing

The Navy currently uses computer simulation for training and testing whenever possible (e.g., command and control exercises are conducted without operational forces); however, there are significant limitations and its use cannot completely substitute live training or testing. Therefore, simulation as an alternative that replaces training and testing in the field does not meet the purpose of and need for the Proposed Action and has been eliminated from detailed study.

2.5.1.3.1 Simulated Training

The Navy continues to research new ways to provide realistic training through simulation, but there are limits to the realism that technology can presently provide. Unlike live training, computer-based training does not provide the requisite level of realism necessary to attain combat readiness. Simulation cannot replicate the inherent high-stress environment and complexity of the coordination needed to combine multiple military assets and personnel into a single fighting unit. Most notably, simulation cannot accurately model the behavior of sound in complex training media such as the marine environment.

Today's simulation technology does not permit anti-submarine warfare training with the degree of fidelity required to maintain proficiency. While simulators are used for the basic training of sonar technicians, they are of limited utility beyond basic training. A simulator cannot match the dynamic nature of the environment, such as bathymetry and sound propagation properties, or the training activities involving several units with multiple crews interacting in a variety of acoustic environments. Moreover, it is imperative that crews achieve competence and gain confidence in their ability to use their equipment.

Sonar operators must train regularly and frequently to develop and maintain the skills necessary to master the process of identifying underwater threats in the complex subsurface environment. Sole reliance on simulation would deny service members the ability to develop battle-ready proficiency in the employment of active sonar in the following specific areas:

- Bottom bounce and other environmental conditions. Sound hitting the ocean floor (bottom bounce) reacts differently depending on the bottom type and depth. Likewise, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity is also affected. Both of these are extremely complex to simulate, and both are common in actual sonar operations.
- Mutual sonar interference. When multiple sonar sources are operating in the vicinity of each other, interference due to similarities in frequency can occur. Again, this is a complex variable that must be recognized by sonar operators, but is difficult to simulate with any degree of fidelity.
- Interplay between ship and submarine target. Ship crews, from the sonar operator to the ship's Captain, must react to the changing tactical situation with a real, thinking adversary (a Navy submarine for training purposes). Training in actual conditions with actual submarine targets provides a challenge that cannot be duplicated through simulation.
- Interplay between anti-submarine warfare teams in the strike group. Similar to the interplay between ships and submarine targets, a ship's crew must react to all changes in the tactical situation, including changes from cooperating ships, submarines, and aircraft.

Computer simulation can provide familiarity and complement live training; however, it cannot provide the fidelity and level of training necessary to prepare naval forces for deployment. Therefore, the

alternative of substituting simulation for live training fails to meet the purpose of and need for the Proposed Action and was eliminated from detailed study.

2.5.1.3.2 Simulated Testing

As described in Section 1.4.3 (Why the Navy Tests), the Navy conducts testing activities to collect scientific data; investigate, develop, and evaluate new technologies; and to support the acquisition and life cycle management of platforms and systems used by the warfighters. Throughout the life cycle of platforms and systems, from performing basic research to procurement of the platform or system, the Navy uses a number of different testing methods, including computer simulation, when appropriate. The Navy cannot use or rely exclusively on simulation when performing a number of specific testing activities, including collection of scientific data; verifying contractual requirements; and assessing performance criteria, specifications, and operational capabilities.

The Navy collects scientific data that can only be obtained from direct measurements of the marine environment to support scientific research associated with development of new platforms and systems. A full understanding of how waves in the ocean move, for example, can only be fully understood by collecting information on waves. This type of direct scientific observation and measurement of the environment is vital to developing simulation capabilities by faithfully replicating environmental conditions.

As the acquisition authority for the Navy, the various Systems Commands are responsible for administering large contracts for the Navy's procurement of platforms and systems. These contracts include performance criteria and specifications that must be verified to assure that the Navy accepts platforms and systems that support the warfighter's needs. Although simulation is a key component in platform and systems development, it does not adequately provide information on how a system will perform or whether or not it will be able to meet performance and other specification requirements because of the complexity of the technologies in development and the marine environments in which they will operate. For this reason, at some point in the development process, platforms and systems must undergo at-sea or in-flight testing. For example, a new jet airplane design can be tested in a wind tunnel that simulates flight to assess elements like maneuverability, but eventually a prototype must be constructed and flown to confirm the wind tunnel data.

Furthermore, the Navy is required by law to operationally test major platforms, systems, and components of these platforms and systems in realistic combat conditions before full-scale production can occur. Under Title 10 of the U.S. Code, this operational testing cannot be based exclusively on computer modeling or simulation. At-sea testing provides the critical information on operability and supportability needed by the Navy to make decisions on the procurement of platforms and systems, ensuring that what is purchased performs as expected, and that tax dollars are not wasted. This testing requirement is also critical to protecting the warfighters who depend on these technologies to execute their mission with minimal risk to themselves.

This alternative—substitution of simulation for live testing—fails to meet the purpose of and need for the Proposed Action and was, therefore, eliminated from detailed study.

2.5.1.4 Reduced Training and Testing

Title 10 Section 5062 of the U.S. Code provides: "The Navy shall be organized, trained, and equipped primarily for prompt and sustained combat incident to operations at sea." Reduction or cessation of

training and testing would prevent the Navy from meeting its Title 10 requirements and adequately preparing naval forces for operations at sea ranging from disaster relief to armed conflict.

2.5.2 ALTERNATIVES CARRIED FORWARD

Three alternatives are analyzed in this EIS/OEIS:

- **The No Action Alternative**—Baseline training and testing activities, as defined by existing Navy environmental planning documents, including Atlantic Fleet Active Sonar Training EIS/OEIS, VACAPES Range Complex EIS/OEIS, Navy Cherry Point Range Complex EIS/OEIS, JAX Range Complex EIS/OEIS, Naval Surface Warfare Center Panama City Division EIS/OEIS, GOMEX Range Complex EIS/OEIS, Key West Range Complex EA/OEA, and the EA of Test Operations in Rhode Island Waters for the Naval Undersea Warfare Center Division, Newport. The baseline testing activities also include those testing events that historically occur in the Study Area and have been subject to previous analysis pursuant to NEPA/EO 12114.
- **Alternative 1**—Overall expansion of the Study Area plus adjustments to types and levels of activities, from the baseline, as necessary to support current and planned Navy training and testing requirements. This alternative considers:
  - activities occurring on the range complexes and the testing ranges, as well as activities occurring within the Study Area outside of the range complexes and testing ranges; and
  - mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (ships and aircraft) and weapon systems into the fleet.
- **Alternative 2 (Preferred Alternative)**—Consists of Alternative 1 plus the establishment of new range capabilities, as well as modifications of existing capabilities, and adjustments to type and levels of training and testing.

The alternatives are discussed in further detail in Sections 2.6 (No Action Alternative: Current Military Readiness within the Atlantic Fleet Region) through 2.8 (Alternative 2: Includes Alternative 1 Plus Increased Tempo of Training and Testing Activities).

2.6 NO ACTION ALTERNATIVE: CURRENT MILITARY READINESS WITHIN THE ATLANTIC FLEET REGION

The Council on Environmental Quality regulations require that a range of alternatives to the proposed action, including a No Action Alternative, be developed for analysis. The No Action Alternative serves as a baseline description from which to compare the potential impacts of the Proposed Action. The Council on Environmental Quality provides two interpretations of the No Action Alternative, depending on the Proposed Action. One interpretation would mean the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of taking the Proposed Action. For example, this interpretation would be used if the Proposed Action was the construction of a facility. The second interpretation, which applies to this EIS/OEIS, allows the No Action Alternative to be thought of in terms of continuing with the present course of action until that action is changed. The No Action Alternative for this EIS/OEIS would continue training and testing activities currently conducted (baseline activities) and force structure (personnel, weapons, and assets) requirements as defined by existing Navy environmental planning documents described in Section 2.5.2 (Alternatives Carried Forward). The No Action Alternative activities occur within the area depicted in Figure 2.6-1. Figures 2.6-2 through 2.6-4 illustrate specific locations where explosive use occurs under the No Action Alternative. The No Action Alternative represents those training and testing activities and events as set forth in previously completed Navy environmental planning documents. However, the No Action Alternative would fail to meet the purpose of and need for the Proposed Action because it would not allow the Navy to meet current and future training and testing requirements necessary to achieve and maintain fleet readiness. For example, the baseline activities do not account for changes in force structure requirements, the introduction of new or upgraded weapons and platforms, or the training and testing required for proficiency with these systems.

Tables 2.8-1, 2.8-2, and 2.8-3 summarize the baseline training and testing activities that would occur under the No Action Alternative.

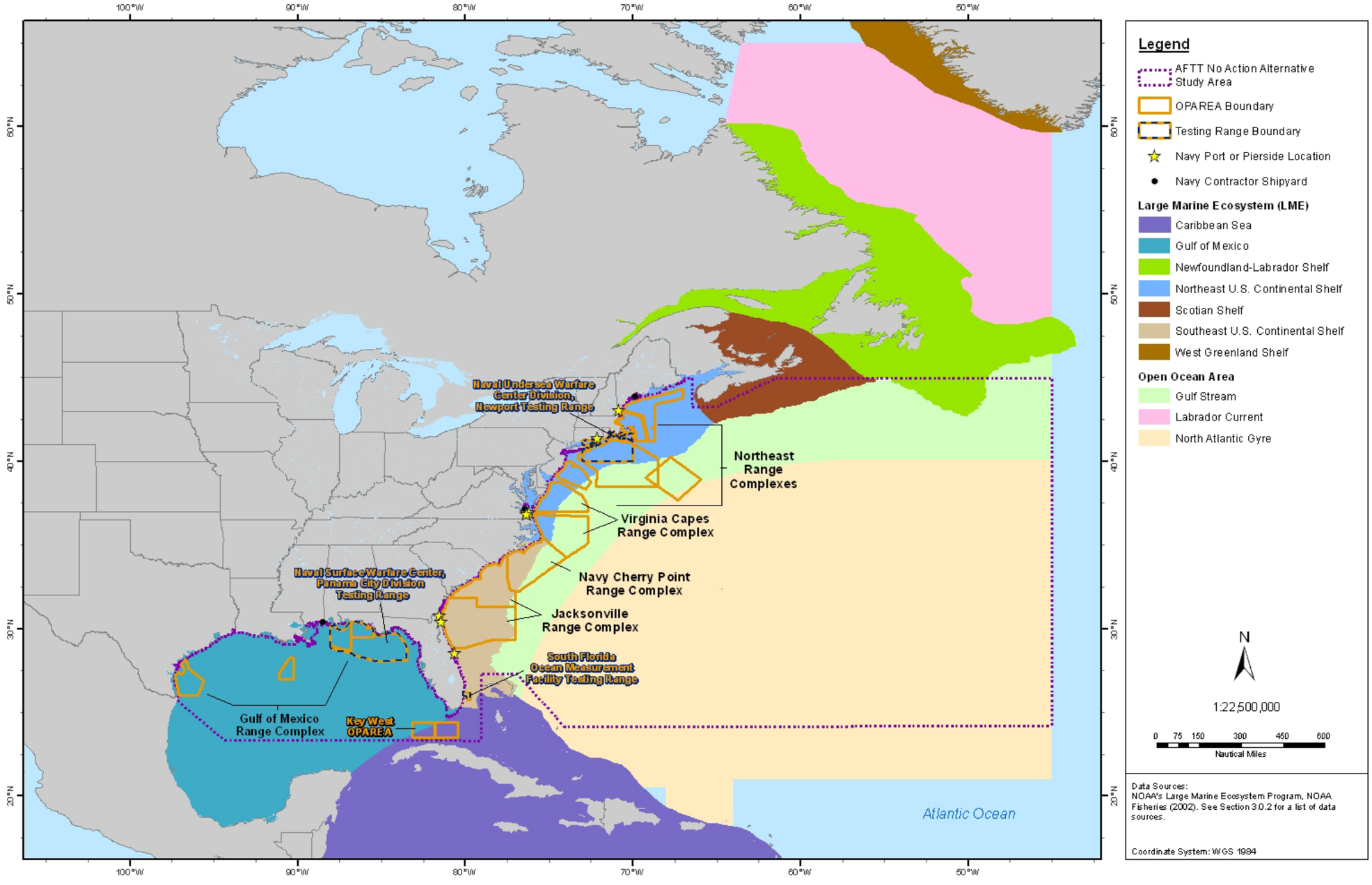

Figure 2.6-1: No Action Alternative Study Area Boundary

AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area; NOAA: National Oceanic and Atmospheric Administration

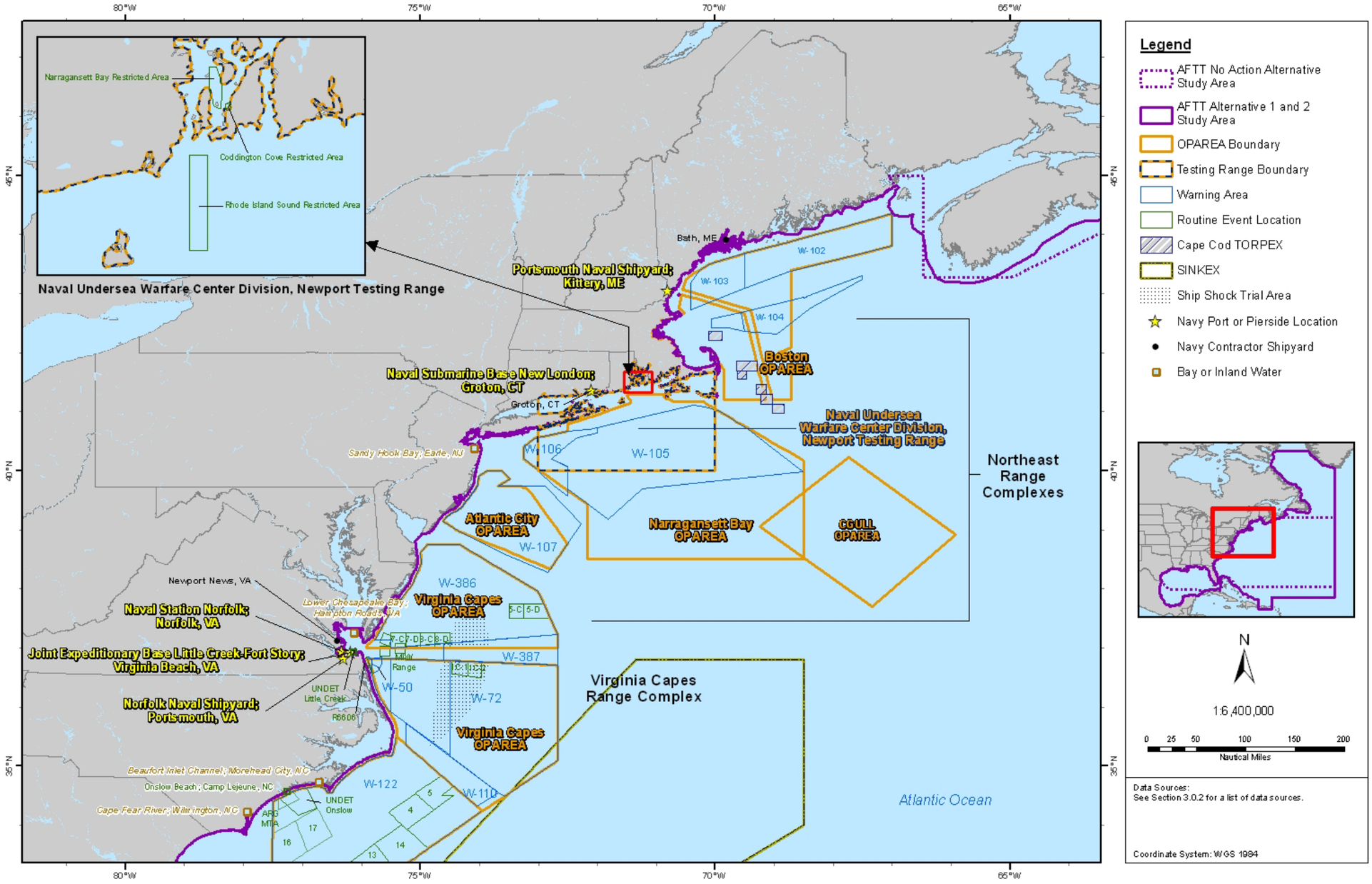

Figure 2.6-2: Mid-Atlantic Region Areas for Training and Testing

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; CT: Connecticut; NC: North Carolina; NJ: New Jersey; ME: Maine; OPAREA: Operating Area; SINKEX: Sinking Exercise; TORPEX: Torpedo Exercise; UNDET: Underwater Detonation; VA: Virginia

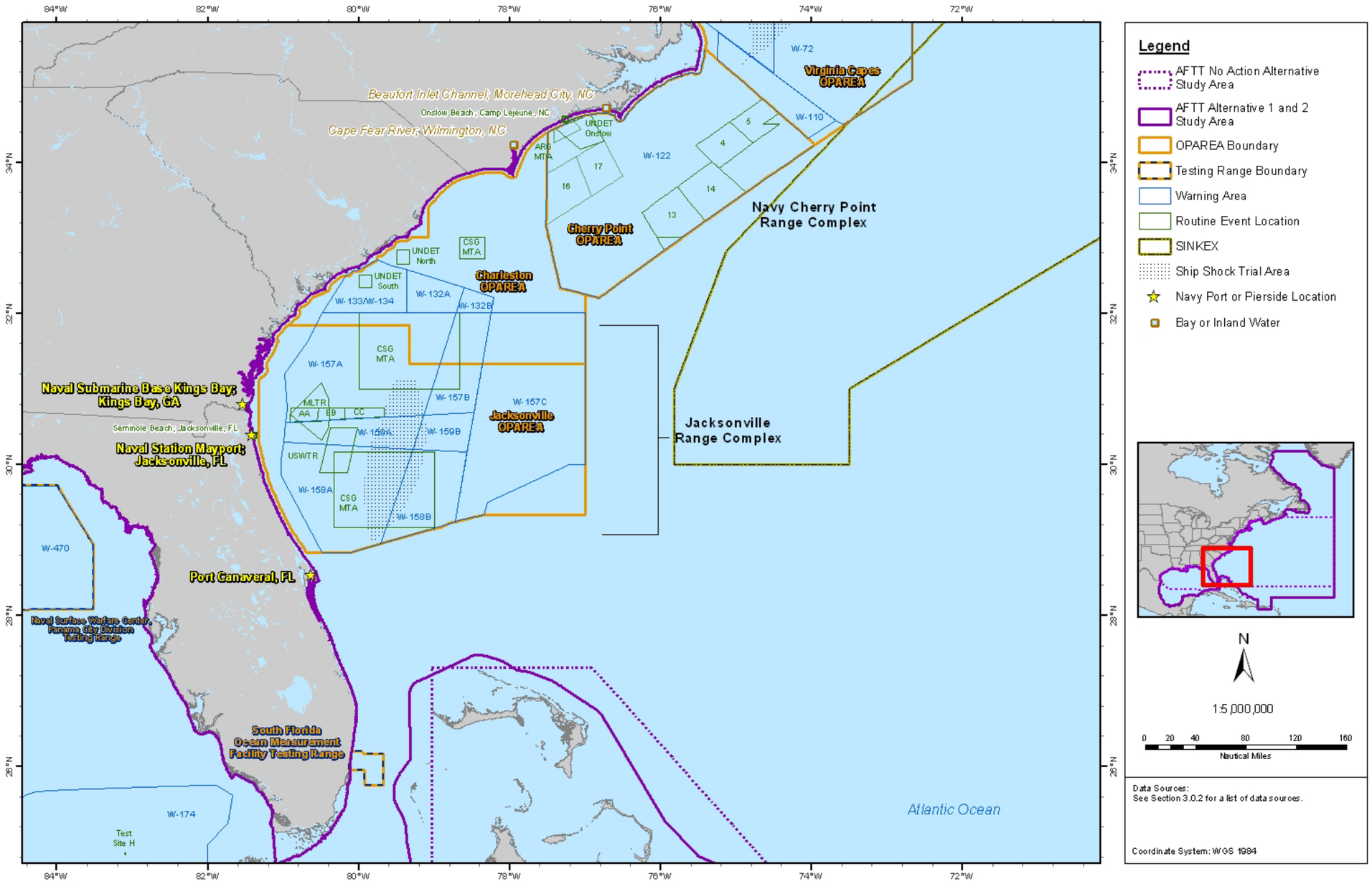

Figure 2.6-3: Southeast Atlantic Region Areas for Training and Testing

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; NC: North Carolina; OPAREA: Operating Area; SINKEX: Sinking Exercise; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

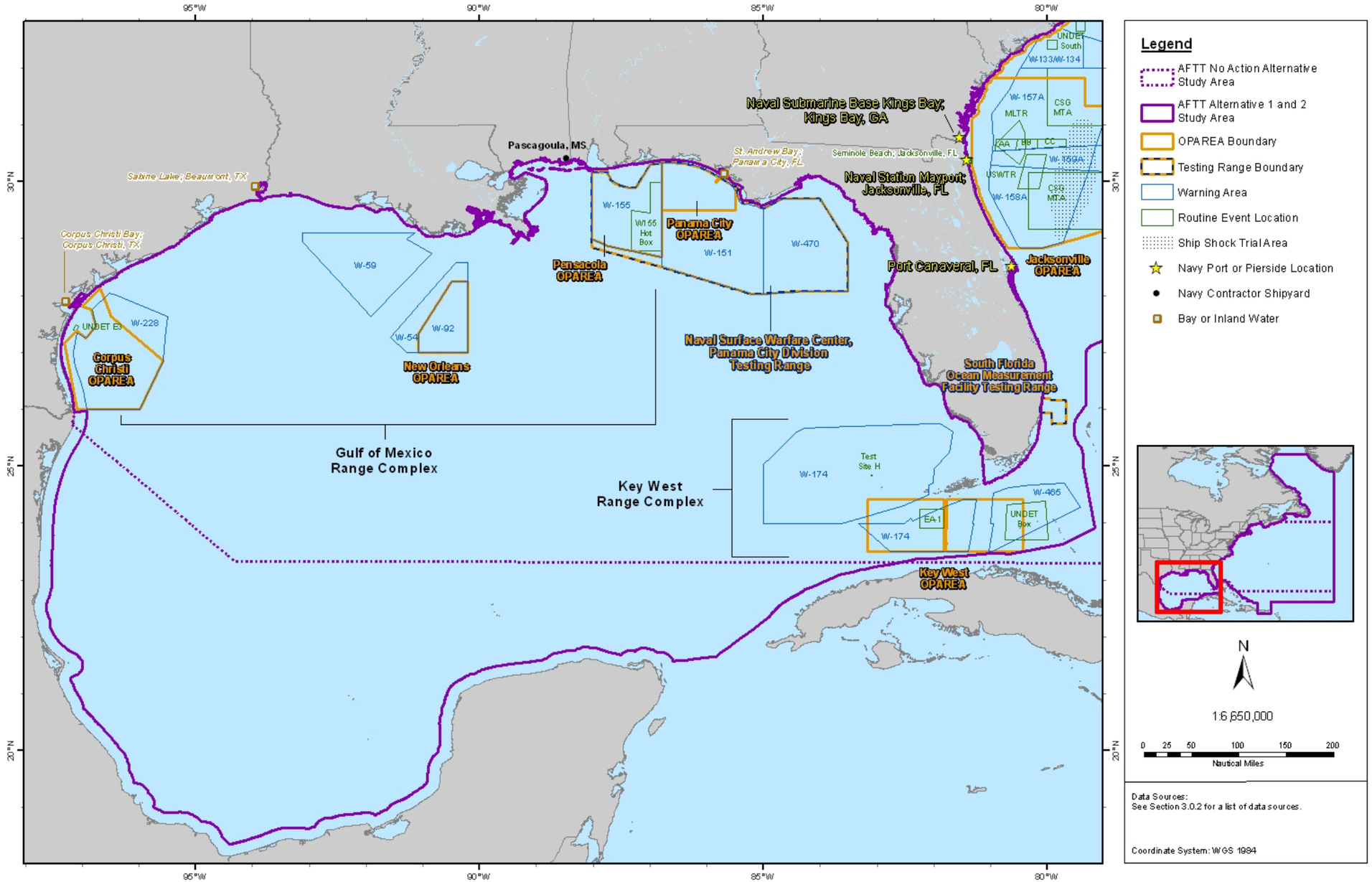

Figure 2.6-4: Gulf of Mexico Region Areas for Training and Testing

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MS: Mississippi; OPAREA: Operating Area; TX: Texas; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

2.7 ALTERNATIVE 1: EXPANSION OF THE STUDY AREA PLUS ADJUSTMENTS TO THE BASELINE AND ADDITIONAL WEAPONS, PLATFORMS, AND SYSTEMS

Alternative 1 would consist of the No Action Alternative plus the expansion of the Study Area, as well as adjustments to locations and tempo of training and testing activities, including the addition of platforms and systems.

- **Expansion of the overall study area.** The overall Study Area boundaries for Alternative 1 would be the area depicted in Figure 2.1-1 and described in Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area). This EIS/OEIS contains analyses of areas where Navy training and testing would continue as in the past, but were not considered in previous environmental analyses. This adjustment is not an expansion of where the Navy trains and tests, but is simply an expansion of the area to be analyzed. Previous EIS/OEISs were developed for a single range complex, testing range, or type of activity. This EIS/OEIS is combining all the ranges and activities into one document, which allows for additional areas to be analyzed, including:
    - Expanding north to the 65 degree north latitude line
    - Expanding south to the 20 degree north latitude line
    - Navy piers, Navy shipyards, and Navy-contractor shipyards
- **Adjustments to locations and tempo of training and testing activities.** This alternative includes changes to training and testing requirements necessary to accommodate the following:
    - Force structure changes, which include the relocation of ships, aircraft, and personnel to meet Navy needs. Training and testing requirements must adapt to meet these new forces.
    - Development and introduction of ships, aircraft, and weapon systems.
    - Current training and testing requirements not addressed in previous environmental documents.

Alternative 1 reflects adjustments to baseline activities necessary to support all current and proposed Navy at-sea training and testing activities. Locations identified within Tables 2.8-1 through 2.8-3 represent the areas where events are typically scheduled to be conducted. Generally, the range complex or testing range is identified, but for some activities, smaller areas within the range are identified. Events could occur outside of the specifically identified areas if environmental conditions are not favorable on a range, the range is unavailable due to other units training or testing, it poses a risk to civilian or commercial users, or to meet fleet readiness requirements.

2.7.1 PROPOSED ADJUSTMENTS TO BASELINE TRAINING ACTIVITIES

The proposed adjustments to baseline levels and types of training categorized by primary mission areas are as follows:

Anti-Air Warfare

- Expand areas within the VACAPES, Navy Cherry Point, JAX, and Key West Range Complexes where anti-air warfare events, such as air combat maneuvers and gunnery and missile exercises, would be conducted in order to allow for greater operational flexibility.
- Increase air combat maneuver events in the VACAPES Range Complex to allow use of improved range instrumentation.

- Reallocate the number of air-to-air missile events between the range complexes, and increase the number in VACAPES.
- Utilize new and different targets such as LUU-2 illumination flares and the BQM-34 Firebee in missile exercises.
- Utilize new and upgraded weapons such as the 57 mm (large-caliber) gun system and rolling airframe missile system.

Amphibious Warfare

- Support firing exercise (at sea) requirements by increasing the number of events and amount of high-explosive rounds used.
- Increase the flexibility to conduct firing exercises (at sea) outside of the established gunnery boxes located in the JAX OPAREA.
- Provide capability to conduct amphibious humanitarian aid/disaster relief events in the JAX Range Complex.

Strike Warfare

- Provide ability to conduct High Speed Anti-Radiation Missile exercise (HARMEX) in all warning areas in the VACAPES and Navy Cherry Point Range Complexes.

Anti-Surface Warfare

- Increase maritime security operations training in response to evolving requirements (e.g., anti-piracy training and increased force protection training at pier, in transit to and from port, and in nearshore waters).
- Increase gunnery, bombing, and missile events and the amount of high-explosive rounds used. Increased use of high-explosive munitions is needed for specific certification requirements and when non-explosive practice munitions are not available.
- Expand areas within the established JAX Range Complex where gunnery exercises may be conducted in order to allow for greater operational flexibility.
- Account for the entire suite of air-to-surface missiles (e.g., add analysis of the Harpoon missile).
- Utilize new weapons, such as the 57 mm turret-mounted gun on the Littoral Combat Ship, the upgraded 20 mm close-in weapon system that allows for its use in defending against surface craft, the 30 mm gun, and new precision guided missiles/rockets currently under development.

Anti-Submarine Warfare

- Increase number of events conducted and the amount of acoustic sensors used during those events.
- Account for the introduction of new anti-submarine warfare sensors into the fleet.
- Analyze anti-submarine warfare activities conducted on the Undersea Warfare Training Range.

Electronic Warfare

There are no substantive adjustments to electronic warfare training events that would require additional analysis.

Mine Warfare

- Conduct mine warfare training, which includes placement of temporary training mines, in additional areas to allow for deep water mine-hunting.
- Conduct additional coordinated unit level training events.

- Increase number of events conducted and the amount of time acoustic sensors are used during those events.
- Account for the introduction and use of new mine warfare sensors, neutralizers, and platforms, especially unmanned and remotely operated vehicles.
- Increase the number of high-explosive mine neutralization events to align with new mission training requirements.
- Expand areas in the VACAPES Range Complex, to include waters adjacent to W-50, for mine warfare events.

Naval Special Warfare

There are no substantive adjustments to naval special warfare training events that would require additional analysis.

Other Training

- Conduct civilian port defense training events in various ports and harbors.

2.7.2 PROPOSED ADJUSTMENTS TO BASELINE TESTING ACTIVITIES

New Ship Construction

- Conduct sea trials on new ship classes: DDG 1000, amphibious assault ships, and T-AGOs.
- Increase sea trials on existing platforms: VIRGINIA Class submarines, Littoral Combat Ship, aircraft carriers, Joint High Speed Vessels, and Landing Platform Dock.
- Conduct testing on new Littoral Combat Ship mission packages: anti-submarine warfare, surface warfare, and mine countermeasures. See Section 2.7.3.2 (Ships) discussion of the Littoral Combat Ship for more information.

Shock Trials

- Conduct shock trials on three platforms: DDG 1000, Littoral Combat Ship, and aircraft carrier.

Life Cycle Activities

- Increase the number of and locations for Combat System Ship Qualification Trials.
- Increase surface ship submarine sonar testing and maintenance.

Naval Sea Systems Command Range Activities

- Conduct additional stationary sonar source testing at Naval Surface Warfare Center, Panama City Division Testing Range.
- Increase the number of existing events conducted at Naval Undersea Warfare Center Division, Newport Testing Range and expand areas where testing occurs.
- Conduct additional unmanned aerial system testing at Naval Undersea Warfare Center Division, Newport Testing Range.
- Conduct testing activities at the South Florida Ocean Measurement Facility Testing Range.

Anti-Air Warfare

- Increase air platform weapons integration testing using only non-explosive practice munitions in the VACAPES Range Complex.

Anti-Surface Warfare

- Increase number of events conducted.

- Increase flexibility of locations used during testing.
- Develop and test new and existing anti-surface warfare systems.
- Increase air-to-surface missile tests occurring in the VACAPES and GOMEX Range Complexes.
- Decrease air-to-surface missile tests occurring in the JAX Range Complex.
- Increase air-to-surface gunnery tests occurring in the VACAPES and JAX Range Complexes and the addition of high-explosive rounds.
- Increase 2.75 in. (7 cm) rocket tests in the VACAPES and JAX Range Complexes and the addition of high-explosive rockets.
- Increase laser targeting tests occurring in the JAX Range Complex.
- Addition of high energy laser weapons tests in the VACAPES Range Complex.

Anti-Submarine Warfare

- Increase in anti-submarine warfare torpedo tests occurring in the VACAPES and JAX Range Complexes.
- Increase in functional checks of the AN/AQS-22 dipping sonar system (i.e., kilo dips) occurring in the Narragansett Bay and the VACAPES and JAX Range Complexes.
- Decrease in functional checks of the AN/AQS-22 dipping sonar system (i.e., kilo dips) occurring in the Navy Cherry Point Range Complex.
- Increase in anti-submarine warfare tracking test—helicopter events occurring in the Northeast, VACAPES, JAX, and GOMEX Range Complexes as well as other areas of the AFTT Study Area.
- Decrease in anti-submarine warfare tracking test—helicopter events occurring in the Navy Cherry Point Range Complex.
- Develop and test anti-submarine warfare sensors.

Electronic Warfare

- Increase in electronic system evaluation tests occurring in the VACAPES Range Complex and the addition of electronic system evaluation tests in the GOMEX Range Complex.
- Increase in chaff and flare tests occurring in the VACAPES and GOMEX Range Complexes.
- Decrease in chaff and flare tests occurring in the Navy Cherry Point and JAX Range Complexes.

Mine Warfare Testing

- Increase in airborne mine neutralization system tests of the AN/ASQ-235 in the Naval Surface Warfare Center, Panama City Division Testing Range.
- Decrease in airborne projectile-based mine clearance system tests in the VACAPES Range Complex and the addition of high-explosive mines.
- Increase in airborne projectile-based mine clearance system tests in the Naval Surface Warfare Center, Panama City Division Testing Range and the addition of high-explosive mines.
- Increase in airborne mine neutralization tests of the AN/ALQ-220 (OASIS) in the Naval Surface Warfare Center, Panama City Division Testing Range.
- Increase in airborne mine hunting tests of the AN/AQS-20A in the Naval Surface Warfare Center, Panama City Division Testing Range.
- Increase in airborne mine hunting tests of the AN/AES-1 (ALMDS) in the Naval Surface Warfare Center, Panama City Division Testing Range.
- Increase in mine laying test events occurring in the VACAPES and JAX Range Complexes.

Shipboard Protection Systems and Swimmer Defense Testing

- Increase number of events conducted.

Unmanned Vehicle Testing

- Increase number of events conducted.

Other Testing

- Addition of at-sea explosive testing.
- Addition of air platform shipboard integration tests in the Navy Cherry Point and JAX Range Complexes.

2.7.3 PROPOSED ADDITIONAL PLATFORMS AND SYSTEMS

The following is a representative list of additional platforms, weapons, and systems analyzed. The ships and aircraft will not be an addition to the fleet but, rather, would replace older ships and aircraft that are decommissioned and removed from the inventory. Information regarding Navy platforms and systems can be found on the Navy Fact File website: http://www.navy.mil/navydata/fact.asp.

2.7.3.1 Aircraft

F-35 Joint Strike Fighter

The F-35 Joint Strike Fighter Lightning II aircraft will complement the Navy's F/A-18E/F. The F-35 is projected to make up about one-third of the Navy's strike fighter inventory by 2020. The Marine Corps will have a variant of the F-35 with a short takeoff, vertical landing capability, which will replace the AV-8B. The Navy variant for aircraft carrier use is scheduled for delivery in 2015; the Marine Corps variant is scheduled for initial operating capability in 2012. The F-35 will operate similarly to the aircraft it replaces or complements. It will operate in the same areas and will be used in the same training exercises such as air-to-surface and air-to-air missile exercises, bombing exercises, and any other exercises where fixed-wing aircraft are used in training. No new activities will result from the introduction of the F-35.

EA-18G Airborne Electronic Attack Aircraft

The EA-18G will serve as the Navy's replacement for the aging fleet of EA-6Bs providing a capability to detect, identify, locate, and suppress hostile emitters. It will operate similarly to the EA-6B, and in the same training areas, but will provide greater speed and altitude capabilities. No new activities will result from the introduction of the EA-18G.

E-2D Airborne Early Warning

The E-2D Advanced Hawkeye is the carrier-based airborne early warning aircraft follow on variant of the E-2C Hawkeye. The E-2D will operate similarly to the E-2C, in the same training areas, with an increased on-station time as the new aircraft will include an in-flight refueling capability. Fleet integration is expected in 2015.

2.7.3.2 Ships

Aircraft Carrier (Gerald R. Ford Class)

The CVN 21 program is designing the replacement for the Nimitz class carriers. The new aircraft carriers' capabilities will be similar to those of the carriers they will replace, and they will train in the same operating areas as the predecessor aircraft carriers. The first aircraft carrier (CVN 78) is expected to be delivered in 2015. No new activities will result from the introduction of the CVN 21 class of aircraft carriers.

DDG 1000 Multi-Mission Destroyer (Zumwalt Class)

Developed under the DD(X) destroyer program, Zumwalt (DDG 1000) is the lead ship of a class of next-generation multi-mission destroyers tailored for land attack and littoral dominance. The DDG 1000 will operate similarly to the existing Arleigh Burke class of destroyers; however, it will provide greater capability in the nearshore sea space and will train more in that environment. Its onboard weapons and systems will include a 155-mm advanced gun system to replace the 5-in. gun system on current destroyers. This gun system will fire a new projectile (see Section 2.7.3.6, Munitions, for a description of the Long Range Land Attack Projectile) at greater distances.

The DDG 1000 will also be equipped with two new sonar systems; the AN/SQS-60 hull-mounted mid-frequency sonar, and the AN/SQS-61 hull-mounted high-frequency sonar.

The first ship of this class is expected to be delivered in 2016. This class will join the fleets and conduct training alongside existing DDG classes of ships. The introduction of DDG 1000 class would require an increase to training allowances in exercises currently being conducted by existing DDG class ships.

Littoral Combat Ship

The Littoral Combat Ship is a fast, agile, mission-focused platform designed for operation in nearshore environments yet capable of open-ocean operation. These ships are capable of speeds in excess of 40 knots. As a focused-mission ship, the Littoral Combat Ship is equipped to perform one primary mission at any given time; however, the mission orientation can be changed by changing out its mission packages. Mission packages are supported by special detachments that will deploy manned and unmanned vehicles and sensors in support of mine, undersea, and surface warfare missions. The first Littoral Combat Ships were delivered to the fleet in 2008 and 2010. These ships will train primarily in the Navy's existing nearshore operating areas.

Joint High Speed Vessel

The Joint High Speed Vessel will be capable of transporting personnel, equipment, and supplies 1,200 nm at an average speed of 35 knots. It will be able to transport company-sized units with their vehicles, or reconfigure to become a troop transport for an infantry battalion. The Joint High Speed Vessel, while performing a variety of lift and support missions, will be a non-combatant vessel that operates in permissive environments or in higher threat environments under the protection of combatant vessels and other joint forces.

Amphibious Combat Vehicle

The Marine Corps is developing a vehicle to replace the Amphibious Assault Vehicle. The Amphibious Combat Vehicle will be the expected replacement, which the Marine Corps hopes to have introduced to the Fleet Marine Force by 2020. The Amphibious Combat Vehicle will have the capability of transporting Marines from naval ships located beyond the horizon to shore and further inland.

2.7.3.3 Unmanned Vehicles and Systems

Unmanned Underwater Vehicle Systems

Unmanned underwater vehicles will support several high-priority missions including: (1) intelligence, surveillance, and reconnaissance; (2) mine countermeasures; (3) anti-submarine warfare; (4) oceanography; (5) communication/navigation network nodes; (6) payload delivery; (7) information operations; and (8) time-critical strike.

Sea Maverick Unmanned Underwater Vehicle

Sea Maverick is a fully autonomous underwater vehicle specifically designed to minimize impacts on the environment. It uses no active sonar, and has an advanced propeller system encased to prevent damage to sea beds and other marine life.

Unmanned Surface Vehicles

Unmanned surface vehicles are primarily autonomous systems designed to augment current and future platforms to help deter maritime threats. They will employ a variety of sensors designed to extend the reach of manned ships.

Spartan Unmanned Surface Vehicle

The Spartan is an unmanned surface vehicle with a dipping sonar system that will be supported by the Littoral Combat Ship. It will train in areas where current sonar training is conducted on Navy ranges.

Sea Horse Unmanned Surface Vehicle

The Sea Horse is an unmanned surface vehicle designed to provide force protection capabilities in harbors and bays.

Unmanned Aerial Systems

Unmanned aerial systems operate as intelligence, search, and reconnaissance sensors or as armed combat air systems.

MQ-8B Fire Scout

The Fire Scout vertical take-off and landing tactical aerial vehicle system is designed to operate from air-capable ships with initial deployment on a guided missile frigate, followed by final integration and test onboard the Littoral Combat Ship. This unmanned aerial system is capable of providing radio voice communications relay and has a baseline payload that includes electro-optical/infrared sensors and a laser designator that enables the system to find tactical targets, track and designate targets, accurately provide targeting data to strike platforms, and perform battle damage assessment. There is current testing to place a weapon system on the Fire Scout.

MQ-4C Triton Unmanned Aircraft System

The MQ-4C Triton Unmanned Aircraft System is a complimentary system to the P-8 aircraft, providing maritime reconnaissance support to the Navy. It will be equipped with electro-optical/infrared sensors, can remain on station for 30 hours, and fly at approximately 60,000 ft. (18.3 km).

2.7.3.4 Missiles/Rockets/Bombs

AGM-154 Joint Standoff Weapon

The Joint Standoff Weapon is a missile able to be launched at increased standoff distances, using global positioning system and inertial navigation for guidance. All Joint Standoff Weapon variants share a common body but can be configured for use against area targets or bunker penetration. This weapon would be integrated into strike warfare exercises as well as exercises where the use of this type of missile is required.

MK 54 Vertical Launch Anti-Submarine Rocket Missile

The Navy has designated the MK 54 torpedo to replace the MK 46 torpedo for rapid employment by surface ships. The missile is a rocket-propelled, three-stage weapon deployed on ships equipped with

the MK 41 Vertical Launching System. Once entering the water, the MK 54 torpedo will operate similarly to the MK 46 it replaces.

MK 54 Torpedo, High Altitude Anti-Submarine Warfare Capability

The high altitude anti-submarine warfare capability is a low-cost, self-contained air launch accessory kit that enables the MK 54 torpedo to be launched at high altitude. The torpedo then glides to its normal launch altitude close to the surface, and jettisons the air launch accessory kit prior to water entry at a pre-determined location. Once in the water, the MK 54 torpedo will operate similarly to the MK 46 that it replaces.

Guided Rocket Systems

Guided rocket systems include the low-cost guided imaging rocket (a guided infrared 2.75-in. [7-cm] rocket system) and the advanced precision kill weapon system (a laser-guided 2.75-in. [7-cm] rocket). The MH-60 helicopter is one platform expected to be equipped with these rockets.

Joint Air-to-Ground Missile

The Joint Air-to-Ground Missile is a proposed replacement and upgrade to existing Navy air-to-surface missiles currently in use. In addition to having a longer operating range than existing weapons, the Joint Air-to-Ground Missile could include a multi-mode seeker with a combination of a semi-active laser, passive infrared detection capabilities, and radar. The MH-60 helicopter and F/A-18 jet are Navy aircraft platforms from which this new missile would be fired.

2.7.3.5 Guns

Kinetic Energy Weapon

The electromagnetic kinetic energy weapon uses electrical energy to accelerate projectiles to supersonic velocities. The kinetic energy weapon will be operated from ships, firing projectiles toward land targets. Kinetic energy weapons do not require powders or explosives to fire the round and could have ranges as great as 300 mi. (483 km). At-sea demonstration is planned for 2016.

2.7.3.6 Munitions

Long Range Land Attack Projectile

The Long Range Land Attack Projectile is part of a family of 155-mm projectiles designed to be fired from the Advanced Gun System for the Navy's next-generation DDG 1000 destroyer. The Long Range Land Attack Projectile allows the DDG 1000 class to provide precision fire support to U.S. Marine Corps and U.S. Army forces from a safe distance offshore. This capability would be integrated into amphibious and strike warfare exercises.

2.7.3.7 Other Systems

High-Altitude Anti-Submarine Warfare

High-altitude anti-submarine warfare integrates new and modifies existing sensors to enhance the sonobuoy capability to conduct anti-submarine warfare at high altitude. Sonobuoy modifications include integrating global positioning system for precise sonobuoy positional information and a digital uplink/downlink for radio frequency interference management. New sensors include a meteorological sensing device (dropsonde) for sensing atmospheric conditions from the aircraft altitude to the surface.

Littoral Combat Ship Anti-Submarine Warfare Module

The anti-submarine warfare module provides a littoral anti-submarine warfare capability that includes active sonar. An increase to unit level and joint surface ship anti-submarine warfare exercises is to be expected upon introduction to the fleets, and training would continue on existing Navy ranges.

Littoral Combat Ship Mine Countermeasure Module

The mine countermeasure module brings together several systems to support bottom mapping, mine detection, mine neutralization, and mine clearance. An increase to surface ship mine warfare training is expected upon introduction to the fleets. This module would include mine detecting sonar and lasers, and neutralization techniques that involve underwater detonations.

Littoral Combat Ship Surface Warfare Module

The surface warfare module is designed to enable the Littoral Combat Ship to combat small, fast boat threats to the fleet. This module would include guns and missiles. An increase to anti-surface warfare training is expected upon introduction to the fleets.

High-Duty Cycle Sonar

High-duty cycle sonar technology provides improved detection performance and improved detection and classification decision time. This technology will be implemented as an alteration to the existing AN/SQQ-89A(V)15 surface ship combat system.

Littoral Combat Ship Variable Depth Sonar

The variable depth sonar system is a mid-frequency sonar system that will be towed by the Littoral Combat Ship and integrated into the Littoral Combat Ship anti-submarine warfare mission package.

SQS-60 and SQS-61 Sonar

The AN/SQS-60 and 61 are integrated hull-mounted sonar components of the DDG-1000 Zumwalt class destroyer. The SQS-60 is a mid-frequency active sonar and the SQS-61 is a high-frequency active sonar.

Submarine Communications at Speed and Depth

Using expendable buoys, the communications at speed and depth system allows acoustic two-way networked communications with submarines. Initial operating capability is planned for 2012.

High Energy Laser

The High Energy Laser System is being developed by the Navy as a new air-to-surface weapon to be operated from aircraft, such as the MH-60 helicopter. It will operate with at minimum of 25 kilowatts and would be intended to be used as a weapon to disable small surface vessels.

2.7.4 PROPOSED NEW ACTIVITIES

Alternative 1 includes some activities that were not analyzed in previous documents. Representative new activities considered within this analysis are as follows:

- The use of new and existing unmanned vehicles and their acoustic sensors, in support of homeland security and anti-terrorism/force protection. This type of training is critical in protecting our nation's military and civilian harbors, ports, and shipping lanes.
- Surface-to-surface missile exercises. These events, previously analyzed as part of sinking exercises, will now also be analyzed as stand-alone events.

- Requirement to conduct at-sea mine laying. These events were previously conducted at the now-closed Small Point Mining Range off the coast of Maine.
- Navy divers conducting mine-neutralization, without the use of explosives.
- Coordinated, unit level training with airborne mine countermeasures with multiple aircraft crews training as a team.
- Testing of the new high energy laser weapon.

2.8 ALTERNATIVE 2: INCLUDES ALTERNATIVE 1 PLUS INCREASED TEMPO OF TRAINING AND TESTING ACTIVITIES

Alternative 2 consists of all activities that would occur under Alternative 1 plus the establishment of new range capabilities, as well as modifications of existing capabilities; adjustments to type and tempo of training and testing; and establishment of additional locations to conduct activities within the Study Area. This alternative allows for potential range enhancements and infrastructure requirements (which may require separate NEPA documentation) by analyzing increased training and testing that could occur due to new range capabilities. This alternative allows for potential budget increases, strategic necessity, and future training and testing requirements. Tables 2.8-1, 2.8-2, and 2.8-3 provide a summary of the training and testing activities to be analyzed under Alternative 2. Alternative 2 is the Preferred Alternative.

2.8.1 PROPOSED ADJUSTMENTS TO ALTERNATIVE 1 TRAINING ACTIVITIES

The proposed adjustments to Alternative 1 levels and types of training are as follows:

Anti-Air Warfare

There are no substantive adjustments to anti-air warfare training events that would require additional analysis.

Amphibious Warfare

- Additional amphibious raid/humanitarian assistance operations at Naval Station Mayport in JAX OPAREA.

Strike Warfare

There are no substantive adjustments to strike warfare training events that would require additional analysis.

Anti-Surface Warfare

- Additional ship large-caliber gunnery exercises.

Anti-Submarine Warfare

There are no substantive adjustments to anti-submarine warfare training events that would require additional analysis.

Electronic Warfare

There are no substantive adjustments to electronic warfare training events that would require additional analysis.

Mine Warfare

There are no substantive adjustments to mine warfare training events that would require additional analysis.

Naval Special Warfare

There are no substantive adjustments to other training events that would require additional analysis.

Other Training

There are no substantive adjustments to naval special warfare training events that would require additional analysis.

2.8.2 PROPOSED ADJUSTMENTS TO ALTERNATIVE 1 TESTING ACTIVITIES

The proposed adjustments to Alternative 1 levels and types of testing are as follows:

New Ship Construction

- Increase number of sea trials for aircraft carriers, Joint High Speed Vessel, amphibious assault ships.
- Increase number of mission package test events.
- Increase post-homeporting testing based on additional ships constructed.

Shock Trials

There are no substantive adjustments to ship shock trials that would require additional analysis.

Life Cycle Activities

- Increase number of ship signature test events.

Naval Sea Systems Command Range Activities

- Increase number of testing events on each of the Naval Sea Systems Command's ranges.
- Contingency for increased mine countermeasure testing at South Florida Ocean Measurement Facility Testing Range.

Anti-Surface Warfare/Anti-Submarine Warfare

- Increase number of events conducted.
- Conduct kinetic energy weapon testing on vessels at-sea (e.g., on DDG 1000 vessels).

Mine Warfare Testing

- Increase number of events conducted.

Shipboard Protection Systems and Swimmer Defense Testing

- Increase number of events conducted.
- Increase flexibility in conducting all chemical/biological simulant testing in locations identified.

Unmanned Vehicle Testing

- Increase number of events conducted.
- Increase flexibility in conducting all underwater deployed unmanned aerial system testing in either location identified.

Other Testing

- Introduce MQ-4C Triton Unmanned Aircraft Systems and their use during maritime patrol aircraft anti-submarine warfare testing events.
- Increase number of events conducted overall, with a 10 percent increase in the tempo of all proposed Naval Air Systems Command testing activities.
- Increase flexibility in conducting all at-sea explosive testing in either location identified.

Table 2.8-1: Baseline and Proposed Training Activities

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Air Warfare (AAW)									
Air Combat Maneuver (ACM)	2,320	None*	VACAPES: W-72 (Air 2A/B, 3A/B)	3,200	None	VACAPES	3,200	None	VACAPES
	385	None*	Cherry Point: W-122 (Areas 1, 8, 15, 16)	1,155	None	Cherry Point	1,155	None	Cherry Point
	498	None*	JAX: W-157A (Area 3X, 4X)	1,270	None	JAX	1,270	None	JAX
	5,700	None	Key West: W-174A/B/C/E/F/G, W-465A/B, Bonefish ATCAA	5,700	None	Key West	5,700	None	Key West
Air Defense Exercise (ADEX)	595	None	VACAPES: W-386, W-72	595	None	VACAPES	595	None	VACAPES
	21	None	Cherry Point: W-122	5,166	None	Cherry Point	5,166	None	Cherry Point
	117	None	JAX: W-132, W-133, W-134, W-157, W-158	5,157	None	JAX	5,157	None	JAX
	80	None	GOMEX: W-151, W-155	85	None	GOMEX	85	None	GOMEX
Gunnery Exercise (Air-to-Air) – Medium-Caliber (GUNEX [A-A]) – Medium-Caliber	30	15,000 rounds	VACAPES: W-72A	120	96,000 rounds	VACAPES	120	96,000 rounds	VACAPES
	10	4,800 rounds	Cherry Point: W-122 (Areas 9, 10, 11, 12)	40	20,800 rounds	Cherry Point	40	20,800 rounds	Cherry Point
	23	8,250 rounds	JAX: W-157A, W-133 (Area 2X)	75	62,400 rounds	JAX	75	62,400 rounds	JAX
	36	36,000 rounds	Key West: W-174A	70	56,000 rounds	Key West	70	56,000 rounds	Key West
Missile Exercise (Air-to-Air) (MISSILEX [A-A])	160	160 missiles (48 HE)[1]	VACAPES: W-72A	40	40 HE missiles	VACAPES	40	40 HE missiles	VACAPES
	20	20 missiles (12 HE)	Cherry Point: W-122	43	43 HE missiles	Cherry Point	43	43 HE missiles	Cherry Point
	22	22 missiles (7 HE)	JAX: W-132, W-133, W-134, W-157, W-158	37	37 HE missiles	JAX	37	37 HE missiles	JAX
	N/A[2]	N/A	Key West	8	8 HE missiles	Key West	8	8 HE missiles	Key West
Gunnery Exercise (Surface-to-Air) – Large-Caliber (GUNEX [S-A]) – Large-Caliber	18	362 rounds	VACAPES: W-386, W-72	136	1,760 HE rounds	VACAPES	136	1,760 HE rounds	VACAPES
	13	292 rounds	JAX: Surface Gunnery Areas AA, BB, CC	84	1,100 HE rounds	JAX	84	1,100 HE rounds	JAX

A-A: Air-to-Air; AAW: Anti-Air Warfare; ACM: Air Combat Maneuver; ADEX: Air Defense Exercise; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; GUNEX: Gunnery Exercise; HE: High-Explosive; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MISSILEX: Missile Exercise; N/A: Not Analyzed; S-A: Surface-to-Air; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Air Warfare (AAW) (Continued)									
Gunnery Exercise (Surface-to-Air) – Medium-Caliber (GUNEX [S-A]) – Medium-Caliber	30	64,000 rounds	VACAPES: W-386, W-72	180	409,200 rounds	VACAPES	180	409,200 rounds	VACAPES
	N/A[2]	N/A	Cherry Point	5	11,000 rounds	Cherry Point	5	11,000 rounds	Cherry Point
	11	20,800 rounds	JAX: Surface Gunnery Areas AA, BB, CC	84	165,000 rounds	JAX	84	165,000 rounds	JAX
	N/A	N/A	Other AFTT Areas[3]	14	30,000 rounds	Other AFTT Areas	14	30,000 rounds	Other AFTT Areas
Missile Exercise (Surface-to-Air) (MISSILEX [S-A])	N/A	N/A	Northeast	4	4 HE missiles	Northeast	4	4 HE missiles	Northeast
	24	24 HE missiles[1]	VACAPES: W-386 (Air D, G, H, K)	32	32 HE missiles	VACAPES	32	32 HE missiles	VACAPES
	8	8 HE missiles	Cherry Point: W-122	8	8 HE missiles	Cherry Point	8	8 HE missiles	Cherry Point
	8	8 HE missiles	JAX: W-132, W-133, W-134, W-157, W-158, W-159	15	15 HE missiles	JAX	15	15 HE missiles	JAX
	N/A	N/A	GOMEX	8	8 HE missiles	GOMEX	8	8 HE missiles	GOMEX
Amphibious Warfare (AMW)									
Naval Surface Fire Support Exercise – Land-Based Target (FIREX [Land])[4]	30	3,000 rounds	Firing Point: Cherry Point Impact Area: Camp Lejeune Range G-10	30	2,030 rounds	Firing Point: Cherry Point Impact Area: Camp Lejeune Range G-10	30	2,030 rounds	Firing Point: Cherry Point Impact Area: Camp Lejeune Range G-10
Naval Surface Fire Support Exercise – At Sea (FIREX [At Sea])	22	1,540 rounds (858 HE)	VACAPES: 5C/D, 7C/D, 8C/D, 1C1/2	32	2,328 rounds (2,240 HE)	VACAPES	32	2,328 rounds (2,240 HE)	VACAPES
	2	140 rounds (78 HE)	Cherry Point: Area 4/5, 13/14	4	320 rounds (280 HE)	Cherry Point	4	320 rounds (280 HE)	Cherry Point
	10	700 rounds (390 HE)	JAX: Surface Gunnery Areas BB & CC	12	960 rounds (840 HE)	JAX	12	960 rounds (840 HE)	JAX
	8	800 rounds	GOMEX: Panama City OPAREA W-151 A/B, Pensacola OPAREA W-155A	2	160 rounds (140 HE)	GOMEX	2	160 rounds (140 HE)	GOMEX
Marine Expeditionary Unit (MEU) Certification Exercise (CERTEX)	N/A	N/A	Cherry Point	2	None*	Cherry Point	2	None*	Cherry Point
Amphibious Assault	10	None	Cherry Point: Onslow Bay	10	None	Cherry Point: Onslow Bay	10	None	Cherry Point: Onslow Bay
Amphibious Raid/ Humanitarian Assistance Operations	24	None	Cherry Point: Onslow Bay	36	None	Cherry Point: Onslow Bay	36	None	Cherry Point: Onslow Bay
	N/A	N/A	JAX	2	None	JAX	6	None	JAX: Mayport

AAW: Anti-Air Warfare; AMW: Amphibious Warfare; CERTEX: Certification Exercise; Cherry Point: Navy Cherry Point Range Complex; FIREX: Fire Support Exercise; GOMEX: Gulf of Mexico Range Complex; GUNEX: Gunnery Exercise; HE: High-Explosive; JAX: Jacksonville Range Complex; MEU: Marine Expeditionary Unit; MISSILEX: Missile Exercise; S-A: Surface-to-Air; N/A: Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[3] Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

[4] FIREX-Land impacts of ordnance on land-based targets are not being analyzed in this document (U.S. Marine Corps 2009). High-explosives are used without effect on the marine environment.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Strike Warfare (STW)									
High-Speed Anti-Radiation Missile Exercise (Air-to-Surface) (HARMEX [A-S])	26	26 HE missiles	VACAPES: W-386 (Air E, F, I, J)	12	12 HE missiles	VACAPES	12	12 HE missiles	VACAPES
	8	8 HE missiles[1]	Cherry Point: W-122 (Areas 18, 19, 20, 21)	8	8 HE missiles	Cherry Point	8	8 HE missiles	Cherry Point
Anti-Surface Warfare (ASUW)									
Maritime Security Operations (MSO)	N/A[2]	N/A	Northeast	2	None	Northeast	2	None	Northeast
	136	None	VACAPES	602	None	VACAPES	602	None	VACAPES
	68	None	Cherry Point	70	None	Cherry Point	70	None	Cherry Point
	150	None	JAX	152	None	JAX	152	None	JAX
	54	None	GOMEX: Pensacola, Panama City OPAREAs	54	None	GOMEX	54	None	GOMEX
Maritime Security Operations (MSO) – Anti-Swimmer Grenades	N/A	N/A	Northeast	2	52 HE grenades	Northeast	2	52 HE grenades	Northeast
	36	N/A	VACAPES:	4	74 HE grenades	VACAPES	4	74 HE grenades	VACAPES
	N/A	N/A	Cherry Point:	2	28 HE grenades	Cherry Point	2	28 HE grenades	Cherry Point
	96	80 HE grenades	JAX: Charleston OPAREA UNDET Boxes North and South	2	24 HE grenades	JAX	2	24 HE grenades	JAX
	8	20 HE grenades	GOMEX: Panama City OPAREA Corpus Christi UNDET Box E3	2	28 HE grenades	GOMEX	2	28 HE grenades	GOMEX
Gunnery Exercise (Surface-to-Surface) – Ship Small-Caliber (GUNEX [S-S] – Ship) Small-Caliber	120	261,600 rounds	VACAPES: W-386, W-72	1,224	2,750,000 rounds	VACAPES	1,224	2,750,000 rounds	VACAPES
	82	67,240 rounds	Cherry Point	150	212,240 rounds	Cherry Point	150	212,240 rounds	Cherry Point
	44	105,000 rounds	JAX: Surface Gunnery Areas AA, BB, CC	80	1,100,000 rounds	JAX	80	1,100,000 rounds	JAX
	8	2,400 rounds	GOMEX: Panama City, Pensacola OPAREAs	16	36,000 rounds	GOMEX	16	36,000 rounds	GOMEX
	N/A	N/A	Other AFTT Areas[3]	70	201,000 rounds	Other AFTT Areas	70	201,000 rounds	Other AFTT Areas
Gunnery Exercise (Surface-to-Surface) – Ship Medium-Caliber	120	137,400 rounds	VACAPES: W-386, W-72	500	46,260 rounds (5,000 HE)	VACAPES	500	46,260 rounds (5,000 HE)	VACAPES

ASUW: Anti-Surface Warfare; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; GUNEX: Gunnery Exercise; HARMEX: High-Speed Anti-Radiation Missile Exercise; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; MSO: Maritime Security Operations; N/A: Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; S-S: Surface-to-Surface; STW: Strike Warfare; UNDET: Underwater Detonation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[3] Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Surface Warfare (ASUW) (Continued)									
(GUNEX [S-S] – Ship) – Medium-Caliber	18	28,800 rounds	Cherry Point	63	35,100 rounds (600 HE)[1]	Cherry Point	63	35,100 rounds (600 HE)	Cherry Point
	44	26,400 rounds	JAX: Surface Gunnery Areas AA, BB, CC	200	21,240 rounds (2,000 HE)	JAX	200	21,240 rounds (2,000 HE)	JAX
	16	8,000 rounds	GOMEX: Panama City, Pensacola OPAREAs	32	3,840 rounds (320 HE)	GOMEX	32	3,840 rounds (320 HE)	GOMEX
	N/A[2]	N/A	Other AFTT Areas[3]	32	3,840 rounds (320 HE)	Other AFTT Areas	32	3,840 rounds (320 HE)	Other AFTT Areas
Gunnery Exercise (Surface-to-Surface) – Ship Large-Caliber (GUNEX [S-S] – Ship) – Large-Caliber	137	2,800 rounds	VACAPES: W-386, W-72	116	4,200 rounds (2,644 HE)	VACAPES	120	4,360 rounds (2,644 HE)	VACAPES
	34	1,330 rounds	Cherry Point OPAREA	24	1,400 rounds (586 HE)	Cherry Point	26	1,480 rounds (586 HE)	Cherry Point
	99	1,770 rounds	JAX: Surface Gunnery Areas AA, BB & CC	102	4,060 rounds (2,508 HE)	JAX	106	4,220 rounds (2,508 HE)	JAX
	16	440 rounds	GOMEX: Panama City, Pensacola OPAREAs	24	1,400 rounds (144 HE)	GOMEX	24	1,400 rounds (144 HE)	GOMEX
	N/A	N/A	Other AFTT Areas	16	553 rounds (96 HE)	Other AFTT Areas	18	633 rounds (96 HE)	Other AFTT Areas
Gunnery Exercise (Surface-to-Surface) – Boat Small-Caliber (GUNEX [S-S] – Boat) – Small-Caliber	N/A	N/A	Northeast	10	27,500 rounds	Northeast	10	27,500 rounds	Northeast
	36	220,000 rounds	VACAPES: W-50C, R-6606	202	286,600 rounds	VACAPES	202	286,600 rounds	VACAPES
	N/A	N/A	Cherry Point	32	135,500 rounds	Cherry Point	32	135,500 rounds	Cherry Point
	192	93,300 rounds	JAX: Charleston OPAREA UNDET Boxes North and South	200	123,800 rounds	JAX	200	123,800 rounds	JAX
	10	37,200 rounds	GOMEX: Panama City OPAREA Corpus Christi UNDET Box E3	10	37,200 rounds	GOMEX	10	37,200 rounds	GOMEX
	N/A	N/A	Other AFTT Areas[1]	18	26,500 rounds	Other AFTT Areas	18	26,500 rounds	Other AFTT Areas
Gunnery Exercise (Surface-to-Surface) – Boat Medium-Caliber	N/A	N/A	Northeast	2	700 rounds	Northeast	2	700 rounds	Northeast
	36	600 rounds	VACAPES: W-50C, R-6606	204	127,536 rounds (936 HE)	VACAPES	204	127,536 rounds (936 HE)	VACAPES

ASUW: Anti-Surface Warfare; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; GUNEX: Gunnery Exercise; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; N/A:Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; S-S: Surface-to-Surface; UNDET: Underwater Detonation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[3] Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Surface Warfare (ASUW) (Continued)									
(GUNEX [S-S] – Boat) – Medium-Caliber	N/A[2]	N/A	Cherry Point: W-122	26	64,000 rounds (626 HE)[1]	Cherry Point	26	64,000 rounds (626 HE)	Cherry Point
	96	12,700 rounds	JAX: Charleston OPAREA UNDET Boxes North and South	194	13,480 rounds (120 HE)	JAX	194	13,480 rounds (120 HE)	JAX
	4	2,880	GOMEX: Panama City OPAREA Corpus Christi UNDET Box E3	8	2,900 rounds (32 HE)	GOMEX	8	2,900 rounds (32 HE)	GOMEX
Missile Exercise (Surface-to-Surface) (MISSILEX [S-S])	N/A	N/A	VACAPES	10	10 (8 HE)	VACAPES	10	10 (8 HE)	VACAPES
	N/A	N/A	JAX	10	10 (8 HE)	JAX	10	10 (8 HE)	JAX
Gunnery Exercise (Air-to-Surface) – Small-Caliber (GUNEX [A-S]) – Small-Caliber	522	818,000 rounds	VACAPES: W-72A, W-50C, W-386 (Air K)	619	821,000 rounds	VACAPES	619	821,000 rounds	VACAPES
	120	132,000 rounds	Cherry Point: W-122 (Areas 1, 2, 3, 8, 9, 10, 15, 16, 17)	130	196,000 rounds	Cherry Point	130	196,000 rounds	Cherry Point
	168	304,140 rounds	JAX: W-132, W-133, W-134, W-157, W-158	262	310,700 rounds	JAX	262	310,700 rounds	JAX
Gunnery Exercise [Air-to-Surface] – Medium-Caliber (GUNEX [A-S]) – Medium-Caliber	11	7,000 rounds	VACAPES: W-386 (Air K)	220	176,000 rounds (44,000 HE)	VACAPES	220	176,000 rounds (44,000 HE)	VACAPES
	20	4,800 rounds	Cherry Point: W-122	210	104,800 rounds (20,000 HE)	Cherry Point	210	104,800 rounds (20,000 HE)	Cherry Point
	N/A	N/A	JAX	245	198,400 rounds (44,000 HE)	JAX	245	198,400 rounds (44,000 HE)	JAX
	40	24,000 rounds	GOMEX: Pensacola OPAREA W-155 Hotbox	40	24,000 rounds (6,000 HE)	GOMEX	40	24,000 rounds (6,000 HE)	GOMEX
Missile Exercise (Air-to-Surface) – Rocket (MISSILEX [A-S]) – Rocket	97	3,700 rockets	VACAPES: W-386 (Air-K), W-72A	100	3,800 HE rockets	VACAPES	100	3,800 HE rockets	VACAPES
	N/A	N/A	JAX OPAREA	100	3,800 HE rockets	JAX	100	3,800 HE rockets	JAX
	N/A	N/A	GOMEX	10	380 HE rockets	GOMEX	10	380 HE rockets	GOMEX
Missile Exercise (Air-to-Surface) (MISSILEX [A-S])	80	80 HE missiles	VACAPES: W-386 (Air-K), W-72A	98	98 HE missiles	VACAPES	98	98 HE missiles	VACAPES
	16	16 missiles (14 HE)	Cherry Point: W-122 (16,17)	32	32 HE missiles	Cherry Point	32	32 HE missiles	Cherry Point
	73	73 HE missiles	JAX: W-157A, W-159A (Missile Laser Training Area)	118	118 HE missiles	JAX	118	118 HE missiles	JAX

A-S: Air-to-Surface; ASUW: Anti-Surface Warfare; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; GUNEX: Gunnery Exercise; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; MISSILEX: Missile Exercise; N/A: Not Analyzed; OPAREA: Operating Area; S-S: Surface-to-Surface; UNDET: Underwater Detonation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Surface Warfare (ASUW) (Continued)									
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	266	575 bombs (20 HE)[1]	VACAPES: W-386 (Air-K, 7D & part of 8C), W-72A/B	359	674 bombs (64 HE)	VACAPES	359	674 bombs (64 HE)	VACAPES
	88	811 bombs	Cherry Point: W-122	88	1,195 bombs (32 HE)	Cherry Point	88	1,195 bombs (32 HE)	Cherry Point
	155	696 bombs	JAX: W-157A/B, W-158A/B	417	1,293 bombs (32 HE)	JAX	417	1,293 bombs (32 HE)	JAX
	49	296 bombs (4 HE)	GOMEX: Pensacola OPAREA, W-151 A/C, W-155B	66	339 bombs (4 HE)	GOMEX	66	339 bombs (4 HE)	GOMEX
Laser Targeting	272	None	VACAPES: W-386 (Air-K), W-72A	272	None	VACAPES	272	None	VACAPES
	303	None	JAX: W-132 W-133, W-134, W-157, W-158	315	None	JAX	315	None	JAX
Sinking Exercise (SINKEX)	6	< 50,000 lb. NEW	Other AFTT Areas[3]: SINKEX box	1	1 HE bomb; 11 HE missiles; 700 HE rounds; 1 HE torpedo (representative scenario)	Other AFTT Areas: SINKEX box	1	1 HE bomb; 11 HE missiles; 700 HE rounds; 1 HE torpedo (representative scenario)	Other AFTT Areas: SINKEX box
Anti-Submarine Warfare (ASW)									
Tracking Exercise/ Torpedo Exercise – Submarine (TRACKEX/ TORPEX – Sub)	30		Northeast	24		Northeast	24		Northeast
	10		VACAPES	8		VACAPES	8		VACAPES
	14		Cherry Point	1		Cherry Point	1		Cherry Point
	45		JAX[7]	25		JAX[7]	25		JAX[7]
	1		Gulf of Mexico	0		Gulf of Mexico	0		Gulf of Mexico
	0		Other AFTT Areas[3]	44		Other AFTT Areas	44		Other AFTT Areas
	100	72 torpedoes[5]	TOTAL	102	80 torpedoes[5]	TOTAL	102	80 torpedoes[5]	TOTAL
Tracking Exercise/ Torpedo Exercise – Surface (TRACKEX/ TORPEX – Surface)	0		Northeast	3		Northeast	3		Northeast
	69		VACAPES	201		VACAPES	201		VACAPES
	91		Cherry Point	47		Cherry Point	47		Cherry Point
	292		JAX[7]	412		JAX[7]	412		JAX[7]
	5		Gulf of Mexico	3		Gulf of Mexico	3		Gulf of Mexico
	0		Other AFTT Areas	98		Other AFTT Areas	98		Other AFTT Areas
	457	18 torpedoes[5]	TOTAL	764	18 torpedoes[5]	TOTAL	764	18 torpedoes[5]	TOTAL

A-S: Air-to-Surface; ASW: Anti-Submarine Warfare; ASUW: Anti-Surface Warfare; BOMBEX: Bombing Exercise; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; HE: High-Explosive; JAX: Jacksonville Range Complex; Northeast: Northeast Range Complexes; SINKEX: Sinking Exercise; TORPEX: Torpedo Exercise; TRACKEX: Tracking Exercise; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

[5] Number of torpedoes represents total for entire AFTT Study Area for each activity.

[7] Training activities occurring on Undersea Warfare Training Range can be found in Appendix A at A.1.9.9 and Appendix H

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Anti-Submarine Warfare (ASW) (Continued)									
Tracking Exercise/ Torpedo Exercise – Helicopter (TRACKEX/ TORPEX – Helo)	25		VACAPES	12		VACAPES	12		VACAPES
	25		Cherry Point	12		Cherry Point	12		Cherry Point
	115		JAX[7]	384		JAX[7]	384		JAX[7]
	0		Other AFTT Areas[3]	24		Other AFTT Areas	24		Other AFTT Areas
	165	18 torpedoes[5]	TOTAL	432	18 torpedoes[5]	TOTAL	432	18 torpedoes[5]	TOTAL
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft (TRACKEX/TORPEX – MPA)	238		Northeast	79		Northeast	79		Northeast
	79		VACAPES	158		VACAPES	158		VACAPES
	111		Cherry Point	40		Cherry Point	40		Cherry Point
	356		JAX[7]	475		JAX[7]	475		JAX[7]
	7		Gulf of Mexico	0		Gulf of Mexico	0		Gulf of Mexico
	791	18 torpedoes[5]	TOTAL	752	18 torpedoes[5]	TOTAL	752	18 torpedoes[5]	TOTAL
Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys (TRACKEX–MPA Sonobuoy)	34	340 HE sonobuoys[1]	Northeast	34	170 HE sonobuoys	Northeast	34	170 HE sonobuoys	Northeast
	34	340 HE sonobuoys	VACAPES	68	340 HE sonobuoys	VACAPES	68	340 HE sonobuoys	VACAPES
	34	340 HE sonobuoys	Cherry Point	16	80 HE sonobuoys	Cherry Point	16	80 HE sonobuoys	Cherry Point
	34	340 HE sonobuoys	JAX[7]	202	1,010 HE sonobuoys	JAX[7]	202	1,010 HE sonobuoys	JAX[7]
	34	340 HE sonobuoys	Gulf of Mexico	0	None	Gulf of Mexico	0	None	Gulf of Mexico
	170		TOTAL	320		TOTAL	320		TOTAL
Anti-Submarine Warfare Tactical Development Exercise	4	None*	JAX	4	None*	JAX	4	None*	JAX
Integrated Anti-Submarine Warfare Course	0.2	None*	VACAPES	0	None*	VACAPES	0	None*	VACAPES
	1.4	None*	Cherry Point	2	None*	Cherry Point	2	None*	Cherry Point
	2.4	None*	JAX	2	None*	JAX	2	None*	JAX
	1	None*	Gulf of Mexico	1	None*	Gulf of Mexico	1	None*	Gulf of Mexico
Group Sail	3	None	VACAPES	5	35 HE sonobuoys	VACAPES	5	35 HE sonobuoys	VACAPES
	4	None	Cherry Point	5	35 HE sonobuoys	Cherry Point	5	35 HE sonobuoys	Cherry Point
	13	None	JAX	10	70 HE sonobuoys	JAX	10	70 HE sonobuoys	JAX
Submarine Command Course (SCC) Operations	0.4	None	Northeast	For Alternatives 1 and 2 this event is included in TRACKEX/TORPEX – SUB training event.					
	1.6	None	JAX						
ASW For Composite Training Unit Exercise (COMPTUEX)	4	44 HE sonobuoys	VACAPES/ Cherry Point/ JAX	4	280 HE sonobuoys	VACAPES/ Cherry Point/ JAX	4	280 HE sonobuoys	VACAPES/ Cherry Point/ JAX
	1	11 HE sonobuoys	Gulf of Mexico	1	70 HE sonobuoys	Gulf of Mexico	1	70 HE sonobuoys	Gulf of Mexico
ASW For Joint Task Force Exercise (JTFEX)/ Sustainment Exercise (SUSTAINEX)	2	15 HE sonobuoys	VACAPES/ Cherry Point/ JAX	4	28 HE sonobuoys	VACAPES/ Cherry Point/ JAX	4	28 HE sonobuoys	VACAPES/ Cherry Point/ JAX

ASW: Anti-Submarine Warfare; Cherry Point: Navy Cherry Point Range Complex; COMPTUEX: Composite Training Unit Exercise; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; JTFEX: Joint Task Force Exercise; MPA: maritime patrol aircraft; Northeast: Northeast Range Complexes; SCC: Submarine Command Course; SUSTAINEX: Sustainment Exercise; TORPEX: Torpedo Exercise; TRACKEX: Tracking Exercise; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

[5] Number of torpedoes represents total for entire AFTT Study Area for each activity.

[7] Training activities occurring on Undersea Warfare Training Range can be found in Appendix A at A.1.9.9

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Electronic Warfare (EW)									
Electronic Warfare Operations (EW Ops)	302	None	VACAPES: W-386 (Air-K), W-72	302	None	VACAPES	302	None	VACAPES
	2,620	None	Cherry Point: W-122	2,620	None	Cherry Point	2,620	None	Cherry Point
	181	None	JAX: W-132, W-133, W-134, W-157, W-158	181	None	JAX	181	None	JAX
Counter Targeting Flare Exercise (FLAREX)	80	None	VACAPES: W-386, W-72	104	None	VACAPES	104	None	VACAPES
	107	None	Cherry Point: W-122 (Areas 1, 8, 15, 16)	377	None	Cherry Point	377	None	Cherry Point
	94	None	JAX: W-157A (Areas 3X, 4X)	318	None	JAX	318	None	JAX
	368	None	GOMEX: Panama City OPAREA, W-151 A/B	368	None	GOMEX	368	None	GOMEX
	900	None	Key West: W-174 A/B/C/E/F/G, W-465A/B, Bonefish ATCAA	900	None	Key West	900	None	Key West
Counter Targeting Chaff Exercise (CHAFFEX) – Ship	28	None	VACAPES: W-386, W-72	37	None	VACAPES	37	None	VACAPES
	74	None	Cherry Point: W-122 (1, 8, 15, 16)	74	None	Cherry Point	74	None	Cherry Point
	74	None	JAX: W-157A (Areas 3X, 4X)	78	None	JAX	78	None	JAX
	14	None	GOMEX: W-151 A/B, W-155 A/B	18	None	GOMEX	18	None	GOMEX
Counter Targeting Chaff Exercise (CHAFFEX) – Aircraft	1,981	None	VACAPES: W-386, W-72	157	None	VACAPES	157	None	VACAPES
	572	None	Cherry Point: W-122 (Areas 1, 8, 15, 16)	686	None	Cherry Point	686	None	Cherry Point
	424	None	JAX: W-157A (Areas 3X, 4X)	532	None	JAX	532	None	JAX
	368	None	GOMEX: W-151 A/B, W-155 A/B	62	None	GOMEX	62	None	GOMEX
	3,000	None	Key West: W-174A/B/C/E/F/G, W-465A/B	3,000	None	Key West	3,000	None	Key West

Bonefish ATCAA: Bonefish Air Traffic Control Assigned Airspace; CHAFFEX: Counter Targeting Chaff Exercise; Cherry Point: Navy Cherry Point Range Complex; EW Ops: Electronic Warfare Operations; FLAREX: Flare Exercise; GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Mine Warfare (MIW)									
Mine Countermeasures Exercise (MCM) – Ship Sonar	0	None	VACAPES: W-50, Lower Chesapeake Bay	48	None	VACAPES	48	None	VACAPES
	0	None	JAX: CSG Mine Training Area	48	None	JAX	48	None	JAX
	0	N/A	GOMEX	20	None	GOMEX	20	None	GOMEX
Mine Neutralization – Explosive Ordnance Disposal (EOD)	24	24 HE charges[1]	VACAPES: W-50	524	524 HE charges	VACAPES	524	524 HE charges	VACAPES
	N/A	N/A	VACAPES: Little Creek	30	1,518 HE charges of varying sizes	VACAPES: Little Creek	30	1,518 HE charges are of varying sizes	VACAPES: Little Creek
	20	20 HE charges	Cherry Point: Onslow Bay UNDET Area	16	16 HE charges	Cherry Point	16	16 HE charges	Cherry Point
	12	12 HE charges	JAX: Charleston OPAREA UNDET Areas	20	20 HE charges	JAX	20	20 HE charges	JAX
	0	None	GOMEX	16	16 HE charges	GOMEX	16	16 HE charges	GOMEX
	N/A[2]	N/A	Key West	12	12 HE charges	Key West	12	12 HE charges	Key West
Underwater Mine Countermeasure (UMCM) Raise, Tow, Beach, and Exploitation Operations	N/A	N/A	VACAPES	290	None	VACAPES	290	None	VACAPES
	N/A	N/A	Cherry Point	24	None	Cherry Point	24	None	Cherry Point
	N/A	N/A	JAX	56	None	JAX	56	None	JAX
	N/A	N/A	GOMEX	56	None	GOMEX	56	None	GOMEX
Airborne Mine Countermeasure (AMCM) – Towed Mine Neutralization	980	None	VACAPES: W-50, Lower Chesapeake Bay	880	None	VACAPES	880	None	VACAPES
	183	None	Cherry Point: ARG Mine Training Area	183	None	Cherry Point	183	None	Cherry Point
	134	None	JAX: CSG Mine Training Areas	155	None	JAX	155	None	JAX
	N/A	N/A	GOMEX	94	None	GOMEX	94	None	GOMEX
Airborne Mine Countermeasure (AMCM) – Mine Detection	1,232	None	VACAPES: MIW Sonar Training Areas	1,540	None	VACAPES	1,540	None	VACAPES
	393	None	Cherry Point: ARG Mine Training Area	371	None	Cherry Point	371	None	Cherry Point
	322	None	JAX: CSG Mine Training Area	317	None	JAX	317	None	JAX
	N/A	N/A	GOMEX	310	None	GOMEX	310	None	GOMEX

AMCM: Airborne Mine Countermeasures; ARG: Amphibious Ready Group; Cherry Point: Navy Cherry Point Range Complex; CSG: Carrier Strike Group; EOD: Explosive Ordnance Disposal; GOMEX: Gulf of Mexico Range Complex; HE: High-Explosive; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MCM: Mine Countermeasure Exercise; MIW: Mine Warfare; N/A: Not Analyzed; OPAREA: Operating Area; UMCM – Underwater Mine Countermeasures; UNDET: Underwater Detonation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Mine Countermeasure (MCM) – Mine Neutralization Small- and Medium-Caliber	110	2,750 rounds	VACAPES: W-50	110	2,750 rounds	VACAPES	110	2,750 rounds	VACAPES
	27	675 rounds	Cherry Point: Onslow Bay UNDET Area	27	675 rounds	Cherry Point	27	675 rounds	Cherry Point
	27	675 rounds	JAX: Charleston OPAREA UNDET Areas	27	675 rounds	JAX	27	675 rounds	JAX
Mine Countermeasure (MCM) – Mine Neutralization – Remotely Operated Vehicle	210	210 neutralizers (30 HE)[1]	VACAPES: W-50	630	630 neutralizers (60 HE)	VACAPES	630	630 neutralizers (60 HE)	VACAPES
	27	27 neutralizers	Cherry Point: Onslow Bay UNDET Area	71	71 neutralizers	Cherry Point	71	71 neutralizers	Cherry Point
	27	27 neutralizers	JAX: Charleston OPAREA UNDET Areas	71	71 neutralizers	JAX	71	71 neutralizers	JAX
	N/A[2]	N/A	GOMEX	132	132 neutralizers (20 HE)	GOMEX	132	132 neutralizers (20 HE)	GOMEX
Mine Laying	N/A	N/A	VACAPES	4	48 mine shapes	VACAPES	4	48 mine shapes	VACAPES
	N/A	N/A	Cherry Point	2	24 mine shapes	Cherry Point	2	24 mine shapes	Cherry Point
	N/A	N/A	JAX	1	12 mine shapes	JAX	1	12 mine shapes	JAX
Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises	N/A	N/A	VACAPES	2	None	VACAPES	2	None	VACAPES
	N/A	N/A	Cherry Point	2	None	Cherry Point	2	None	Cherry Point
	N/A	N/A	JAX	2	None	JAX	2	None	JAX
	N/A	N/A	GOMEX	2	None	GOMEX	2	None	GOMEX
Civilian Port Defense	N/A	N/A	N/A	1 event every other year (3 total)	4 HE charges	Occurs in a different area each year in waters around Earle, NJ; Groton, CT; Hampton Roads, VA; Morehead City, NC; Wilmington, NC; Kings Bay, GA; Mayport, FL; Beaumont, TX; Corpus Christi, TX	1 event every other year (3 total)	4 HE charges	Occurs in a different area each year in waters around Earle, NJ; Groton, CT; Hampton Roads, VA; Morehead City, NC; Wilmington, NC; Kings Bay, GA; Mayport, FL; Beaumont, TX; Corpus Christi, TX
Major Exercises									
Composite Training Unit Exercise (COMPTUEX)[6]	5		VACAPES/ Cherry Point/ JAX/ GOMEX	5		VACAPES/ Cherry Point/ JAX/ GOMEX	5		VACAPES/ Cherry Point/ JAX/ GOMEX
Joint Task Force Exercise (JTFX)/ Sustainment Exercise (SUSTAINEX)[6]	2		VACAPES/ Cherry Point/ JAX	4		VACAPES/ Cherry Point/ JAX	4		VACAPES/ Cherry Point/ JAX

Cherry Point: Navy Cherry Point Range Complex; COMPTUEX: Composite Training Unit Exercise; GOMEX: Gulf of Mexico Range Complex; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; JTFX: Joint Task Force Exercise; MCM: Mine Countermeasure Exercise; N/A: Not Analyzed; OPAREA: Operating Area; SUSTAINEX: Sustainment Exercise; UNDET: Underwater Detonation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[6] Numbers for ordnance included in unit level training and composite training activities for each alternative.

Table 2.8-1: Baseline and Proposed Training Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location	No. of events (per year)	Ordnance* (Number per year)	Location
Other Training Activities									
Search and Rescue (SAR)	42	None	JAX: Seminole Beach	42	None	JAX	42	None	JAX
Precision Anchoring	N/A[2]	N/A	VACAPES	640	None	VACAPES	640	None	VACAPES
	168	None	JAX	210	None	JAX	210	None	JAX
	N/A	N/A	GOMEX	8	None	GOMEX	8	None	GOMEX
Elevated Causeway System (ELCAS)	N/A	N/A	N/A	1	None	VACAPES: Joint Expeditionary Base, Little Creek and Fort Story Cherry Point: Camp Lejeune (either location)	1	None	VACAPES: Joint Expeditionary Base, Little Creek and Fort Story Cherry Point: Camp Lejeune (either location)
Submarine Navigational (SUB NAV)	165	None	Northeast	169	None	Northeast	169	None	Northeast
	78	None	VACAPES	84	None	VACAPES	84	None	VACAPES
	57	None	JAX	29	None	JAX	29	None	JAX
Submarine Under Ice Certification	N/A	N/A	Northeast	9	None	Northeast	9	None	Northeast
	N/A	N/A	VACAPES	9	None	VACAPES	9	None	VACAPES
	N/A	N/A	Cherry Point	3	None	Cherry Point	3	None	Cherry Point
	N/A	N/A	JAX	3	None	JAX	3	None	JAX
Surface Ship Object Detection	68	None	VACAPES	80	None	VACAPES	80	None	VACAPES
	40	None	JAX	64	None	JAX	64	None	JAX
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	61	None	VACAPES	358	None	VACAPES	358	None	VACAPES
	82	None	Cherry Point	110	None	Cherry Point	110	None	Cherry Point
	263	None	JAX	324	None	JAX	324	None	JAX
	4	None	GOMEX	0	None	GOMEX	0	None	GOMEX
	N/A	N/A	Other AFTT Areas[3]	32	None	Other AFTT Areas	32	None	Other AFTT Areas
Submarine Sonar Maintenance (in OPAREAs and Ports)	66	None	Northeast	132	None	Northeast	132	None	Northeast
	34	None	VACAPES	68	None	VACAPES	68	None	VACAPES
	0	None	Cherry Point	0	None	Cherry Point	0	None	Cherry Point
	0	None	JAX	8	None	JAX	8	None	JAX
	N/A	N/A	Other AFTT Areas	12	None	Other AFTT Areas	12	None	Other AFTT Areas

Cherry Point: Navy Cherry Point Range Complex; ELCAS: Elevated Causeway System; GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; N/A: Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; SAR: Search and Rescue; SUB NAV: Submarine Navigation; VACAPES: Virginia Capes Range Complex

* All major exercise munitions are distributed among the individual unit events.

[2] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[3] Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

Table 2.8-2: Baseline and Proposed Naval Air Systems Command Testing Activities

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Anti-Air Warfare (AAW)									
Air Combat Maneuver (ACM)	500	None	VACAPES, JAX, Cherry Point, GOMEX	500	None	AFTT Study Area	550	None	AFTT Study Area
Air Platform/ Vehicle Test	1,460	None	VACAPES (W-386, W-387A, W-72A, W-72B, but could include other Warning/Restricted Areas	1,460	None	VACAPES	1,477	None	VACAPES
	172	None	JAX	172	None	JAX	189	None	JAX
	10	None	Key West	10	None	Key West	12	None	Key West
	25	None	GOMEX	25	None	GOMEX	28	None	GOMEX
	425	None	AFTT Study Area	425	None	AFTT Study Area	468	None	AFTT Study Area
Air Platform Weapons Integration Test	150	42 missiles, 130 rockets, 12,000 medium-caliber projectiles, 300 bombs	VACAPES: W-386, W-72A, R-6604	650	240 missiles, 1,000 rockets, 40,000 medium-caliber projectiles, 400 bombs	VACAPES	715	264 missiles, 1,100 rockets, 44,000 medium-caliber projectiles, 440 bombs	VACAPES
Air to Air Weapons System Test	60	2 missiles, 9,000 medium-caliber projectiles	VACAPES: W-386 (85%), W-72 (10%), R-6604 (5%)	60	40 missiles, 9,000 medium-caliber projectiles	VACAPES	66	55 missiles, 10,000 medium-caliber projectiles	VACAPES
Air to Air Missile Test	50	50 missiles	VACAPES: W-386 (85%), W-72 (10%), R-6604 (5%)	75	75 missiles	VACAPES	83	83 missiles	VACAPES
Air to Air Gunnery Test Medium-Caliber	50	8,970 rounds	VACAPES: W-386 (85%), W-72 (10%), R-6604 (5%)	50	8,970 rounds	VACAPES	55	9,870 rounds	VACAPES
Intelligence, Surveillance, and Reconnaissance Test	35	None	VACAPES, Cherry Point, JAX	35	None	AFTT Study Area	39	None	AFTT Study Area
Anti-Surface Warfare (ASUW)									
Air-to-Surface Missile Test	39	39 missiles (5 HE)[1]	VACAPES: W-386 (85%), W-72 (10%), R-6604 (5%)	168	201 missiles (28 HE)	VACAPES	185	223 missiles (31 HE)	VACAPES
	10	10 missiles (5 HE)	JAX	41	58 missiles (16 HE)	JAX	44	65 missiles (18 HE)	JAX
	None	None	GOMEX	8	8 missiles	GOMEX	10	10 missiles	GOMEX
Air-to-Surface Gunnery Test	30	12,000 rounds	VACAPES: W-386 (85%), W-72 (10%), R-6604 (5%)	100	40,000 rounds (10,000 HE)	VACAPES	110	44,000 rounds (11,000 HE)	VACAPES
	20	16,000 rounds	JAX	50	40,000 rounds (10,000 HE)	JAX	55	44,000 rounds (11,000 HE)	JAX
Rocket Test	30	134 rockets	VACAPES: W-386 (Air G & H)	242	1,081 rockets (184 HE)	VACAPES	266	1,189 rockets (202 HE)	VACAPES
	10	113 rockets	JAX	60	680 (184 HE)	JAX	66	748 rockets (202 HE)	JAX
Air-to-Surface Bombing Test	150	355 bombs	VACAPES: W-386 (85%) W-72 (15%)	150	423 bombs	VACAPES	165	465 bombs	VACAPES
Laser Targeting Test	10	None	VACAPES	250	None	VACAPES	275	None	VACAPES
	2	None	JAX	55	None	JAX	61	None	JAX
High Energy Laser Weapons Test	None	None	None	98	None	VACAPES	108	None	VACAPES

AAW: Anti-Air Warfare; ACM: Air Combat Maneuver; ASUW: Anti-Surface Warfare; Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; HE: High-Explosive; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; VACAPES: Virginia Capes Range Complex

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] None indicates that these activities have not previously occurred.

Table 2.8-2: Baseline and Proposed Naval Air Systems Command Testing Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Electronic Warfare (EW)									
Electronic System Evaluation	151	None	VACAPES: W-386 (85%), W-72 (15%)	610	None	VACAPES	671	None	VACAPES
	None[2]	None	GOMEX	19	None	GOMEX	21	None	GOMEX
Chaff Test	150	None	VACAPES: W-386 (85%), W-72 (15%)	600	None	VACAPES	670	None	VACAPES
	10	None	Cherry Point	600	None	Cherry Point	670	None	Cherry Point
	10	None	JAX	600	None	JAX	670	None	JAX
	10	None	GOMEX	185	None	GOMEX	204	None	GOMEX
Flare Test	150	None	VACAPES: W-386 (85%), W-72 (15%)	600	None	VACAPES	670	None	VACAPES
	10	None	Cherry Point	600	None	Cherry Point	670	None	Cherry Point
	10	None	JAX	600	None	JAX	670	None	JAX
	10	None	GOMEX	45	None	GOMEX	50	None	GOMEX
Anti-Submarine Warfare (ASW)									
ASW Torpedo Test	13	13 torpedoes	VACAPES	184	184 torpedoes	VACAPES	202	202 torpedoes	VACAPES
	8	10 torpedoes	JAX	36	40 torpedoes	JAX	40	45 torpedoes	JAX
Kilo Dip	1	None	Narragansett Bay	2	None	Northeast	3	None	Northeast
	20	None	VACAPES, W-386 & W-72	32	None	VACAPES	35	None	VACAPES
	1	None	Cherry Point	0	None	Cherry Point	0	None	Cherry Point
	2	None	JAX: W-157, W-158, W-159	4	None	JAX	5	None	JAX
Sonobuoy Lot Acceptance Test	None	None	Key West	33	1,312 HE sonobuoys[1]	Key West	39	1,512 HE sonobuoys	Key West
ASW Tracking Test – Helicopter	2	None	Northeast	86	96 HE sonobuoys	Northeast	95	106 HE sonobuoys	Northeast
	50	None	VACAPES, W-386 & W-72	204	624 HE sonobuoys	VACAPES	224	686 HE sonobuoys	VACAPES
	2	None	Cherry Point	0	None	Cherry Point	0	None	Cherry Point
	10	None	JAX: W-157, W-158, W-159	75	None	JAX	83	None	JAX
	None	None	GOMEX	24	None	GOMEX	26	None	GOMEX
ASW Tracking Test – Maritime Patrol Aircraft	10	224 HE sonobuoys	Northeast	10	224 HE sonobuoys	Northeast	18	408 HE sonobuoys	Northeast
	8	172 HE sonobuoys	VACAPES	8	172 HE sonobuoys	VACAPES	12	264 HE sonobuoys	VACAPES
	7	152 HE sonobuoys	JAX	7	152 HE sonobuoys	JAX	11	244 HE sonobuoys	JAX
	5	112 HE sonobuoys	GOMEX	5	112 HE sonobuoys	GOMEX	9	204 HE sonobuoys	GOMEX
	5	112 HE sonobuoys	Cherry Point	5	112 HE sonobuoys	Cherry Point	9	204 HE sonobuoys	Cherry Point
	5	184 HE sonobuoys	Other AFTT Areas[3]	8	184 HE sonobuoys	Other AFTT Areas	16	368 HE sonobuoys	Other AFTT Areas

ASW: Anti-Submarine Warfare; Cherry Point: Navy Cherry Point Range Complex; EW: Electronic Warfare; GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; VACAPES: Virginia Capes Range Complex

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] None indicates that these activities have not previously occurred.

[3] Other AFTT Areas are areas outside of named operating areas but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

Table 2.8-2: Baseline and Proposed Naval Air Systems Command Testing Activities (Continued)

Range Activity	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Mine Warfare (MIW)									
Airborne Mine Neutralization Systems (AMNS) Test	30	120 neutralizers (90 HE)[1]	VACAPES; (W-50, W-72)	30	120 neutralizers (90 HE)	VACAPES	33	144 neutralizers (99 HE)	VACAPES
	5	None	SFOMF	0	None	SFOMF	0	None	SFOMF
	50	8 HE mines, 120 neutralizers (40 HE)	NSWC PCD[4]	120	8 HE mines, 264 neutralizers (144 HE)	NSWC PCD	132	8 HE mines, 290 neutralizers (150 HE)	NSWC PCD
Airborne Projectile-Based Mine Clearance System	12	240 rounds	VACAPES: W-50	5	100 rounds 5 HE mines	VACAPES	6	120 rounds 6 HE mines	VACAPES
	12	700 rounds	NSWC PCD	210	12,380 rounds 20 mines (4 HE)	NSWC PCD	231	13,618 rounds 20 mines (4 HE)	NSWC PCD
Airborne Towed Minesweeping Test	30	None	VACAPES; W-50 & W-72	30	None	VACAPES	33	No HE mines	VACAPES
	50	8 mines (4 HE)	NSWC PCD	65	8 mines (4 HE)	NSWC PCD	72	8 mines (4 HE)	NSWC PCD
Airborne Towed Minehunting Sonar Test	50	None	VACAPES; W-50 & W-72	50	None	VACAPES	55	None	VACAPES
	25	None	NSWC PCD	90	None	NSWC PCD	100	None	NSWC PCD
	30	None	SFOMF	0	None	SFOMF	0	None	SFOMF
Airborne Laser-Based Mine Detection System Test	30	None	VACAPES, W-50 or W-72	30	None	VACAPES	33	None	VACAPES
	50	None	NSWC PCD	110	None	NSWC PCD	121	None	NSWC PCD
Mine Laying Test	None[2]	None	VACAPES	5	50 mine shapes	VACAPES	6	60 mine shapes	VACAPES
	5	50 mine shapes	JAX	5	50 mine shapes	JAX	6	60 mine shapes	JAX
Other Testing Activities									
Test and Evaluation (T&E) Catapult Launch	8,700	None	VACAPES, Cherry Point, JAX	8,700	None	AFTT Study Area	9,570	None	AFTT Study Area
Air Platform Shipboard Integrate Test	63	None	VACAPES: W-386, W-72	63	None	VACAPES	69	None	VACAPES
	30	None	Cherry Point	30	None	Cherry Point	33	None	Cherry Point
	30	None	JAX	30	None	JAX	33	None	JAX
Shipboard Electronic Systems Evaluation	10	None	VACAPES: W-386, W-72	20	None	VACAPES	22	None	VACAPES
	2	None	Cherry Point	2	None	Cherry Point	3	None	Cherry Point
	2	None	JAX	2	None	JAX	3	None	JAX
Maritime Security	10	None	VACAPES: W-386, W-72	10	None	VACAPES	11	None	VACAPES
	10	None	Cherry Point	10	None	Cherry Point	11	None	Cherry Point
	10	None	JAX	10	None	JAX	11	None	JAX

AMNS: Airborne Mine Neutralization System; Cherry Point: Navy Cherry Point Range Complex; HE: High-Explosive; JAX: Jacksonville Range Complex; MIW: Mine Warfare; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; T&E: Test and Evaluation; VACAPES: Virginia Capes Range Complex

[1] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[2] None indicates that these activities have not previously occurred.

[4] The No Action Alternative events for this activity occurring at Naval Surface Warfare Center, Panama City Division Testing Range are included within the Naval Sea Systems Command Table 2.8-3 under the NSWC PCD No Action Alternative activities.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities

Event Name		No Action Alternative			Alternative 1			Alternative 2		
		No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Ship Construction and Maintenance										
New Ship Construction										
Surface Combatant Sea Trials	Pierside Sonar Testing	N/A[1]	N/A	N/A	5	None	Pierside: Bath, ME	5	None	Pierside: Bath, ME
					3	None	Pierside: Pascagoula, MS	3	None	Pierside: Pascagoula, MS
					2	None	Pierside: Norfolk, VA	2	None	Pierside: Norfolk, VA
					2	None	Pierside: Mayport, FL	2	None	Pierside: Mayport, FL
	Propulsion Testing	2	None	Boston Area Complex	5	None	Northeast	5	None	Northeast
		2	None	GOMEX W-155B	2	None	Gulf of Mexico	2	None	Gulf of Mexico
		N/A	N/A	VACAPES	2	None	VACAPES	2	None	VACAPES
		N/A	N/A	JAX	2	None	JAX	2	None	JAX
	Gun Testing	2	52 large-caliber rounds	Northeast: CGULL OPAREA	4	104 large-caliber rounds; 2,800 medium-caliber rounds	Northeast	4	104 large-caliber rounds; 2,800 medium-caliber rounds	Northeast
		2	52 large-caliber rounds	GOMEX W-151C	2	52 large-caliber rounds; 1,400 medium-caliber rounds	Gulf of Mexico	2	52 large-caliber rounds; 1,400 medium-caliber rounds	Gulf of Mexico
		N/A	N/A	VACAPES	2	52 large-caliber rounds; 1,400 medium-caliber rounds	VACAPES	2	52 large-caliber rounds; 1,400 medium-caliber rounds	VACAPES
		N/A	N/A	JAX	2	52 large-caliber rounds; 1,400 medium-caliber rounds	JAX	2	52 large-caliber rounds; 1,400 medium-caliber rounds	JAX
	Missile Testing	2	4 missiles	Northeast: CGULL OPAREA	4	8 HE missiles[2]	Northeast	4	8 HE missiles	Northeast
		2	4 missiles	GOMEX W-151C	2	4 HE missiles	Gulf of Mexico	2	4 HE missiles	Gulf of Mexico
		N/A	N/A	VACAPES	2	4 HE missiles	VACAPES	2	4 HE missiles	VACAPES
		N/A	N/A	JAX	2	4 HE missiles	JAX	2	4 HE missiles	JAX
	Decoy Testing	2	None	Northeast: CGULL OPAREA	4	None	Northeast	4	None	Northeast
		2	None	GOMEX W-151C	2	None	Gulf of Mexico	2	None	Gulf of Mexico
		N/A	N/A	VACAPES	2	None	VACAPES	2	None	VACAPES
		N/A	N/A	JAX	2	None	JAX	2	None	JAX
	Surface Warfare Testing – Large-Caliber	2	96 rounds	Northeast: CGULL OPAREA	4	192 rounds	Northeast	4	192 rounds	Northeast
		2	96 rounds	GOMEX W-151C	2	96 rounds	Gulf of Mexico	2	96 rounds	Gulf of Mexico
		N/A	N/A	VACAPES	2	96 rounds	VACAPES	2	96 rounds	VACAPES
		N/A	N/A	JAX	2	96 rounds	JAX	2	96 rounds	JAX
	Anti-Submarine Warfare Testing	2	None	Northeast: CGULL OPAREA	4	None	Northeast	4	None	Northeast
		2	None	GOMEX W-151C	2	None	Gulf of Mexico	2	None	Gulf of Mexico
		N/A	N/A	VACAPES	2	None	VACAPES	2	None	VACAPES
		N/A	N/A	JAX	2	None	JAX	2	None	JAX

FL: Florida; GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; ME: Maine; MS: Mississippi; N/A: Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name		No Action Alternative			Alternative 1			Alternative 2		
		No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
New Ship Construction (Continued)										
Aircraft Carrier Sea Trials	Propulsion Testing	N/A[1]	N/A	N/A	4 events total	None	VACAPES	4 events total	None	VACAPES
	Gun Testing – Small-Caliber	N/A	N/A	N/A	100 events total	10,000 rounds total	VACAPES	100 events total	10,000 rounds total	VACAPES
							Cherry Point			Cherry Point
							JAX			JAX
	Gun Testing – Medium-Caliber	N/A	N/A	N/A	410 events total	67,200 rounds (600 HE)[2] total	VACAPES	410 events total	67,200 rounds (600 HE) total	VACAPES
							Cherry Point			Cherry Point
							JAX			JAX
	Missile Testing	N/A	N/A	N/A	17 events total	17 HE missiles total	VACAPES	17 events total	17 HE missiles total	VACAPES
	Bomb Testing	N/A	N/A	N/A	120 events total	240 bombs total	JAX	120 events total	240 bombs total	JAX
Submarine Sea Trials	Pierside Sonar Testing	N/A	N/A	N/A	3	None	Pierside: Groton, CT	3	None	Pierside: Groton, CT
					3	None	Pierside: Newport News, VA	3	None	Pierside: Newport News, VA
	Propulsion Testing	N/A	N/A	N/A	4	None	Northeast	4	None	Northeast
					4	None	VACAPES	4	None	VACAPES
					4	None	JAX	4	None	JAX
	Weapons System Testing	N/A	N/A	N/A	4	None	Northeast	4	None	Northeast
					4	None	VACAPES	4	None	VACAPES
					4	None	JAX	4	None	JAX
	Anti-Submarine Warfare Testing	N/A	N/A	N/A	4	None	Northeast	4	None	Northeast
					4	None	VACAPES	4	None	VACAPES
					4	None	JAX	4	None	JAX
Other Class Ship Sea Trials	Propulsion Testing	N/A	N/A	N/A	14	None	AFTT Study Area	14	None	AFTT Study Area
		1	None	VACAPES	2	None	VACAPES	3	None	VACAPES
		3	None	GOMEX	27	None	Gulf of Mexico	30	None	Gulf of Mexico
	Gun Testing – Small-Caliber	N/A	N/A	N/A	2	2,000 rounds	VACAPES	3	3,000 rounds	VACAPES
		2	2,000 rounds	GOMEX	24	24,000 rounds	Gulf of Mexico	28	28,000 rounds	Gulf of Mexico
ASW Mission Package Testing	Shipboard	None[3]	None	None	16	16 torpedoes	JAX	16	16 torpedoes	JAX
	Airborne	None	None	None	8	8 torpedoes	VACAPES	8	8 torpedoes	VACAPES
SUW Mission Package Testing	Gun Testing – Small-Caliber	None	None	None	4	2,000 rounds	AFTT Study Area	5	2,500 rounds	AFTT Study Area
	Gun Testing – Medium-Caliber				4	5,600 rounds (2,800 HE)	AFTT Study Area	5	7,000 rounds (3,500 HE)	AFTT Study Area
	Gun Testing – Large-Caliber				4	5,600 rounds (3,920 HE)	AFTT Study Area	5	7,000 rounds (4,900 HE)	AFTT Study Area
	Missile/Rocket Testing				13 (either location)	26 missiles/rockets (13 HE)	VACAPES	15 (either location)	30 missiles/rockets (15 HE)	VACAPES
							JAX			JAX
MCM Mission Package Testing		None	None	None	6 (either location)	96 neutralizers (48 HE)	JAX	8 (either location)	128 neutralizers (64 HE)	JAX
							VACAPES			VACAPES

ASW: Anti-submarine Warfare; Cherry Point: Navy Cherry Point Range Complex; CT: Connecticut; GOMEX: Gulf of Mexico Range Complex; HE: High-Explosive; JAX: Jacksonville Range Complex; MCM: Mine Countermeasures; N/A: Not Analyzed; SUW: Surface Warfare; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] None indicates that an event has not previously occurred.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
New Ship Construction (Continued)									
Post-Homeporting Testing (all classes)	None[3]	None	None	4	None	Northeast	4	None	Northeast
				20	None	VACAPES	22	None	VACAPES
				20	None	JAX	22	None	JAX
Shock Trials									
Aircraft Carrier Full Ship Shock Trial	N/A[1]	N/A	N/A	1 event total[4]	4 charges total[2]	VACAPES (ship shock box) JAX (ship shock box) (either location)	1 event total	4 charges total	VACAPES (ship shock box) JAX (ship shock box) (either location)
DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial	N/A	N/A	N/A	1 event total	4 charges total	VACAPES (ship shock box) JAX (ship shock box) (either location)	1 event total	4 charges total	VACAPES (ship shock box) JAX (ship shock box) (either location)
Littoral Combat Ship Full Ship Shock Trial	N/A	N/A	N/A	2 events total	4 charges/ event	VACAPES (ship shock box) JAX (ship shock box) (either location)	2 events total	4 charges/ event	VACAPES (ship shock box) JAX (ship shock box) (either location)
Life Cycle Activities									
Ship Signature Testing	N/A	N/A	N/A	1	None	VACAPES	2	None	VACAPES
				4	None	Pierside: Little Creek, VA	5	None	Pierside: Little Creek, VA
				1	None	Gulf of Mexico	2	None	Gulf of Mexico
Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)	N/A	N/A	N/A	10	None	VACAPES	10	None	VACAPES
				6	None	JAX	6	None	JAX
Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)	N/A	N/A	N/A	10	None	Northeast	12	None	Northeast
				14	None	VACAPES	16	None	VACAPES
Combat System Ship Qualification Trial (CSSQT) – In-Port Maintenance Period	N/A	N/A	N/A	6	None	Pierside: Norfolk, VA	6	None	Pierside: Norfolk, VA
				6	None	Pierside: Mayport, FL	6	None	Pierside: Mayport, FL
Combat System Ship Qualification Trial (CSSQT) – Air Defense (AD)	N/A	N/A	N/A	12	24,000 medium-caliber rounds, 240 large-caliber rounds (60 HE), 74 missiles (38 HE)	VACAPES	12	24,000 medium-caliber rounds, 240 large-caliber rounds (60 HE), 74 missiles (38 HE)	VACAPES
				3	6,000 medium-caliber rounds, 60 large-caliber rounds, 18 missiles (9 HE)	JAX	3	6,000 medium-caliber rounds, 60 large-caliber rounds, 18 missiles (9 HE)	JAX

AD: Air Defense; CSSQT: Combat System Ship Qualification Trial; DDG: Guided Missile Destroyer; FL: Florida; HE: High-Explosive; JAX: Jacksonville Range Complex; N/A: Not Analyzed; Northeast: Northeast Range Complexes; OPAREA: Operating Area; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline. However, shock trials have been conducted, with associated Executive Order 12114 documentation, for previous classes of ships.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] None indicates that an event has not previously occurred.

[4] One aircraft carrier ship shock trial will occur during the five year period.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Life Cycle Activities (Continued)									
Combat System Ship Qualification Trial (CSSQT) – Surface Warfare (SUW)	N/A[1]	N/A	N/A	15	4,020 large-caliber rounds (1,737 HE)[2], 18,000 medium-caliber rounds, 9 missiles	VACAPES	15	4,020 large-caliber rounds (1,737 HE), 18,000 medium-caliber rounds, 9 missiles	VACAPES
				3	900 large-caliber rounds (339 HE), 6,000 medium-caliber rounds, 3 missiles	JAX	3	900 large-caliber rounds (339 HE), 6,000 medium-caliber rounds, 3 missiles	JAX
				3	900 large-caliber rounds (339 HE), 6,000 medium-caliber rounds, 3 missiles	Key West	3	900 large-caliber rounds (339 HE), 6,000 medium-caliber rounds, 3 missiles	Key West
Combat System Ship Qualification Trial (CSSQT) – Undersea Warfare (USW)	N/A	N/A	N/A	3	24 torpedoes	VACAPES	3	24 torpedoes	VACAPES
	N/A	N/A	N/A	6	48 torpedoes	JAX	6	48 torpedoes	JAX
Naval Sea Systems Command Range Activities									
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)									
Air Operations	1,116 hours/year	None	NSWC PCD	NSWC PCD Range activities re-categorized as events/year rather than hours/year. See new events below for Alternative 1 and Alternative 2.					
Surface Operations	7,443 hours/year	None	NSWC PCD						
Subsurface Operations	966 items/ 1,620 hours/year	N/A	NSWC PCD						
Sonar Operations	1,080 hours/year	None	NSWC PCD						
Electromagnetic Operations	735 hours/year	None	NSWC PCD						
Laser Operations	1,053 hours/year	None	NSWC PCD						
Ordnance Operations	73 items/year	51 detonations of 1-10 lb. 3 detonations of 11-75 lb. 16 detonations of 76-600 lb. 3 line charges	NSWC PCD						
Projectile Firing	10,872 items/year	6,000 small-caliber, 4,572 medium-caliber, and 300 large-caliber rounds	NSWC PCD						
Unmanned Underwater Vehicle Demonstrations	1 event total	None	NSWC PCD	1 event total	None	NSWC PCD	1 event total	None	NSWC PCD
Mine Detection and Classification Testing	NSWC PCD Range No Action Alternative activities categorized above as hours/year or items/year rather than events/year.			71[5]	None	NSWC PCD	81[5]	None	NSWC PCD
Mine Countermeasure / Neutralization Testing				13[5]	17 HE charges	NSWC PCD	15[5]	21 HE charges	NSWC PCD
Stationary Source Testing				10	None	NSWC PCD	11	None	NSWC PCD

CSSQT: Combat System Ship Qualification Trial; HE: High-Explosive (indicated by shaded cells); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; N/A: Not Analyzed; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SUW: Surface Warfare; USW: Undersea Warfare; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[5] Naval Air Systems Command activities conducted at Naval Surface Warfare Center, Panama City Division Testing Range under Alternative 1 and Alternative 2 are included in the Naval Air Systems Command Activity Table 2.8-2.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name		No Action Alternative			Alternative 1			Alternative 2		
		No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD) (Continued)										
Special Warfare Testing		NSWC PCD Range No Action Alternative activities categorized above as hours/year or items/year rather than events/year.			100	None	NSWC PCD	110	None	NSWC PCD
Unmanned Underwater Vehicle Testing					70	None	NSWC PCD	88	None	NSWC PCD
Ordnance Testing	Line Charge Testing				3	3 HE charges[3]	NSWC PCD	4	4 HE charges	NSWC PCD
	Gun Testing – Small-Caliber				6	6,000 rounds	NSWC PCD	7	7,000 rounds	NSWC PCD
	Gun Testing – Medium-Caliber				93	4,650 rounds	NSWC PCD	102	5,100 rounds	NSWC PCD
	Gun Testing – Large-Caliber				30	300 rounds (40 HE)	NSWC PCD	33	330 rounds (50 HE)	NSWC PCD
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)										
Launcher Testing		30	None	Narragansett Bay and surrounding waters	35	None	NUWCDIVNPT	39	None	NUWCDIVNPT
Torpedo Testing		18	18 torpedoes	Narragansett Bay and surrounding waters	24	24 torpedoes	Narragansett Bay and Rhode Island Sound Restricted Areas	30	30 torpedoes	Narragansett Bay and Rhode Island Sound Restricted Areas
Towed Equipment Testing		25	None	Narragansett Bay and surrounding waters	30	None	NUWCDIVNPT	33	None	NUWCDIVNPT
Unmanned Underwater Vehicle Testing		47	None	Narragansett Bay and surrounding waters	111	None	NUWCDIVNPT	123	None	NUWCDIVNPT
Unmanned Surface Vehicle Testing		80	None	Narragansett Bay and surrounding waters	120	None	NUWCDIVNPT	132	None	NUWCDIVNPT
Unmanned Aerial System Testing		None	None	NUWCDIVNPT	15	None	NUWCDIVNPT	17	None	NUWCDIVNPT
Semi-Stationary Equipment Testing		103	None	Narragansett Bay and surrounding waters	140	None	NUWCDIVNPT	154	None	NUWCDIVNPT
Unmanned Underwater Vehicle Demonstrations		1 event total	None	Narragansett Bay	1 event total	None	NUWCDIVNPT	1 event total	None	NUWCDIVNPT
Pierside Integrated Swimmer Defense		5	None	NUWCDIVNPT	5	None	Pierside: Newport, RI	6	None	Pierside: Newport, RI
South Florida Ocean Measurement Facility Testing Range (SFOMF)										
Signature Analysis Activities		N/A[1]	N/A	N/A	16	None	SFOMF	18	None	SFOMF
Mine Testing Activities		N/A	N/A	N/A	21	None	SFOMF	33	None	SFOMF
Surface Testing Activities		N/A	N/A	N/A	30	None	SFOMF	33	None	SFOMF
Subsurface Testing Activities		N/A	N/A	N/A	30	None	SFOMF	33	None	SFOMF
Unmanned Underwater Vehicle Demonstrations		N/A	N/A	N/A	1 event total	None	SFOMF	1 event total	None	SFOMF

HE: High-Explosive (indicated by shaded cells); N/A: Not Analyzed; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; RDT&E: Research, Development, Test, and Evaluation; RI: Rhode Island; SFOMF: South Florida Ocean Measurement Facility Testing Range

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] None indicates that an event has not previously occurred.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Additional Activities at Locations Outside of Naval Sea System Command Ranges									
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing									
Missile Testing	N/A[1]	N/A	N/A	11	11 missiles	VACAPES	12	12 missiles	VACAPES
				1	1 missile	AFTT Study Area	1	1 missile	AFTT Study Area
Kinetic Energy Weapon Testing	None[3]	None	None	50	2,000 projectiles	VACAPES	55	2,200 projectiles	VACAPES
	None	None	None	1 event total	5,000 projectiles	AFTT Study Area	1 event total	5,000 projectiles	AFTT Study Area
Electronic Warfare Testing	N/A	N/A	N/A	96	None	Pierside: Norfolk, VA	106	None	Pierside: Norfolk, VA
				96	None	Pierside: Groton, CT	106	None	Pierside: Groton, CT
				65	None	Northeast	71	None	Northeast
Torpedo (Non-Explosive) Testing	1	8 torpedoes	Northeast	4	60 torpedoes	Northeast	4	60 torpedoes	Northeast
	2	32 torpedoes	JAX	11	284 torpedoes	JAX	13	347 torpedoes	JAX
	1	35 torpedoes	Boston Area Complex: Cape Cod TORPEX boxes[6]	3	96 torpedoes	Boston Area Complex: Cape Cod TORPEX boxes[6]	3	96 torpedoes	Boston Area Complex: Cape Cod TORPEX boxes[6]
	N/A	N/A	Gulf of Mexico	2	56 torpedoes	Gulf of Mexico	2	56 torpedoes	Gulf of Mexico
	N/A	N/A	VACAPES	3	52 torpedoes	VACAPES	4	69 torpedoes	VACAPES
Torpedo (Explosive) Testing	2	20 torpedoes (8 HE torpedoes)[2]	Other AFTT Areas: SINKEX box	2	28 torpedoes (8 HE torpedoes)	AFTT Study Area	2	28 torpedoes (8 HE torpedoes)	AFTT Study Area
Countermeasure Testing	N/A	N/A	N/A	1	None	AFTT Study Area	1	None	AFTT Study Area
	N/A	N/A	N/A	2	93 torpedoes	Boston Area Complex: Cape Cod TORPEX boxes/VACAPES/ GOMEX (any location)	2	93 torpedoes	Boston Area Complex: Cape Cod TORPEX boxes/VACAPES/GOM EX (any location)
Pierside Sonar Testing	4 (either location)	None	Pierside: Kings Bay, GA	1	None	Pierside: Portsmouth, NH	2	None	Pierside: Portsmouth, NH
				3	None	Pierside: Groton, CT	4	None	Pierside: Groton, CT
				6	None	Pierside: Norfolk, VA	8	None	Pierside: Norfolk, VA
			Pierside: Port Canaveral, FL	2	None	Pierside: Kings Bay, GA	3	None	Pierside: Kings Bay, GA
				3	None	Pierside: Mayport, FL	4	None	Pierside: Mayport, FL
				1	None	Pierside: Port Canaveral, FL	2	None	Pierside: Port Canaveral, FL
At-Sea Sonar Testing	N/A	N/A	N/A	4	None	AFTT Study Area	5	None	AFTT Study Area
	6 (either location)	None	VACAPES	2	None	VACAPES	3	None	VACAPES
			Northeast	1	None	Northeast	2	None	Northeast
				3	None	JAX	5	None	JAX

ASW: Anti-Submarine Warfare; ASUW: Anti-Surface Warfare; Cherry Point: Navy Cherry Point Range Complex; CT: Connecticut; FL: Florida; GA: Georgia; HE: High-Explosive; JAX: Jacksonville Range Complex; N/A: Not Analyzed; Northeast: Northeast Range Complexes; NH: New Hampshire; SINKEX: Sinking Exercise; TORPEX: Torpedo Exercise; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] None indicates that an event has not previously occurred.

[6] Torpedo testing in the Cape Cod torpedo exercise boxes is specific to this area.

Table 2.8-3: Baseline and Proposed Naval Sea Systems Command Testing Activities (Continued)

Event Name	No Action Alternative			Alternative 1			Alternative 2		
	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location	No. of events (per year)	Ordnance (Number per year)	Location
Mine Warfare (MIW) Testing									
Mine Detection and Classification Testing	N/A[1]	N/A	N/A	7	None	VACAPES	8	None	VACAPES
	N/A	N/A	N/A	58	None	JAX	58	None	JAX
Mine Countermeasure/Neutralization Testing	N/A	N/A	N/A	6	12 HE charges[2]	VACAPES	7	14 HE charges	VACAPES
				6	12 HE charges, 6 HE mines	Gulf of Mexico	7	14 HE charges, 7 HE mines	Gulf of Mexico
Shipboard Protection Systems and Swimmer Defense Testing									
Pierside Integrated Swimmer Defense	5	None	Pierside: Little Creek, VA	2	None	Pierside: Little Creek, VA	3	None	Pierside: Little Creek, VA
Shipboard Protection Systems Testing	1	800 small-caliber rounds	VACAPES	3	None	Pierside: Norfolk, VA	4	None	Pierside: Norfolk, VA
				3	1,000 small-caliber rounds	VACAPES	4	1,300 small-caliber rounds	VACAPES
Chemical/Biological Simulant Testing	220	None	VACAPES	220	None	VACAPES	968 (any location)	None	VACAPES
				220	None	Northeast		None	Northeast
				220	None	Cherry Point		None	Cherry Point
				220	None	JAX		None	JAX
Unmanned Vehicle Testing									
Underwater Deployed Unmanned Aerial System Testing	N/A	N/A	N/A	13	None	VACAPES	30 (either location)	None	VACAPES
	N/A	N/A	N/A	13	None	Northeast			Northeast
Unmanned Vehicle Development and Payload Testing	N/A	N/A	N/A	20	None	Northeast	22	None	Northeast
				20	None	VACAPES	22	None	VACAPES
				20	None	Cherry Point	22	None	Cherry Point
				20	None	JAX	22	None	JAX
				21	None	Gulf of Mexico	23	None	Gulf of Mexico
Other Testing									
Special Warfare	2	None	Key West	3	None	Key West	4	None	Key West
Radio-Frequency Communications Testing	N/A	N/A	N/A	12	None	Northeast	13	None	Northeast
Hydrodynamic Testing	None[3]	None	None	1	None	AFTT Study Area	2	None	AFTT Study Area
At-Sea Explosives Testing	None	None	None	2	20 HE charges	Gulf of Mexico	4 (either location)	40 HE charges at either location	Gulf of Mexico
			None	2	20 HE charges	JAX			JAX

Cherry Point: Navy Cherry Point Range Complex; CT: Connecticut; FL: Florida; GA: Georgia; HE: High-Explosive; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MIW: Mine Warfare; N/A: Not Analyzed; Northeast: Northeast Range Complexes; VA: Virginia; VACAPES: Virginia Capes Range Complex

[1] N/A stands for Not Analyzed. This event was not analyzed as part of the baseline.

[2] Shaded cells indicate "High-Explosive" (HE) ordnance is expended during event. If only a portion of the ordnance expended is HE, the total number of HE is listed in parentheses.

[3] None indicates that an event has not previously occurred.

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3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.0 INTRODUCTION

This chapter describes existing environmental conditions in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) as well as the analysis of resources potentially impacted by the Proposed Action described in Chapter 2 (Description of Proposed Action and Alternatives). The Study Area is described in Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area). Depending on the frame of reference, the term "Study Area" is used to describe both the "No Action Alternative Study Area" and the "Alternatives 1 and 2 Study Area" depicted in Figure 2.1-1. Because of the immense Study Area and the broad range of Navy training and testing activities in the Proposed Action (Tables 2.8-1 through 2.8-3), this chapter is very lengthy. Therefore, Section 3.0 addresses issues that apply to many or all of the resources. The resource sections refer back to subsections in Section 3.0 for the general information contained here.

Section 3.0.1 (Regulatory Framework) presents the regulatory framework for the analyses of the resources in Chapter 3. It briefly describes each law, executive order, and directive used to develop the analyses. Other laws and regulations are listed in Chapter 6 (Additional Regulatory Considerations). Section 3.0.2 (Data Sources and Best Available Data) lists the sources of data used in the analysis.

The Study Area covers a broad range of ecosystems where Navy training and testing is proposed, so Section 3.0.3 (Ecological Characterization of the Study Area) describes areas known as large marine ecosystems and open ocean areas. The Study Area contains large portions of seven large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotia Shelf, Northeast United States (U.S.) Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea) and three open ocean areas (North Atlantic Gyre, Labrador Current, and Gulf Stream). Figure 3.0-1 is an overview map of the entire Study Area overlain with the Navy's range complexes and test ranges. Figures 3.0-2, 3.0-3, and 3.0-4 contain more details of the range complexes and testing ranges and some of the Navy's activity areas. In addition to these descriptions, Section 3.0.3 (Ecological Characterization of the Study Area) presents information on ocean bathymetry, currents, and fronts. These topics have general applicability to the resources analyzed.

One of the major issues addressed in this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) is the effect of sound in the water on biological resources. Section 3.0.4 (Acoustic and Explosives Primer) presents a primer on sound in water and in air. The primer explains how sound propagates through air and water; defines terms used in the analysis; and describes the physical properties of sound, metrics used to characterize sound exposure, and frequencies produced during Navy training and testing activities.

Section 3.0.5 (Overall Approach to Analysis) describes a general approach to the analysis. It identifies the resources considered for the analysis, as well as those resources eliminated from further consideration. Each Navy training and testing activity was examined to determine which environmental stressors could adversely impact a resource; these stressors were grouped into categories for ease of presentation (Table 3.0-7). Table 3.0-8 associates the stressor categories with training and testing activities. A detailed description of each stressor category is contained in Section 3.0.5.3 (Identification of Stressors for Analysis). Descriptions of stressors that only apply to one resource are found in the associated resource section. Lastly, the general approach section contains the methods used in the biological resource sections. These methods are also organized by stressor categories.

The sections following 3.0 analyze each resource. The physical resources (sediments and water quality and air quality) are presented first (Sections 3.1 and 3.2, respectively). Any potential impacts on these resources were considered as potential secondary stressors on the remaining resources to be described: marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, and fish (Sections 3.3 through 3.9). Following the biological resource sections are human resource sections: cultural, socioeconomics, and public health and safety (Sections 3.10, 3.11, and 3.12).

The Navy has made changes to this Final EIS/OEIS based on comments received during the public comment period. Changes include factual corrections, additions to existing information, and improvements or modifications to the analyses presented in the Draft EIS/OEIS. A summary of public comments received and the Navy's response to these comments is provided in Appendix E (Public Comments and Responses). While these comments provided valuable guidance and additional information, none of the changes between the Draft and Final EIS/OEIS resulted in substantive changes to the Proposed Action, alternatives, or the conclusions of the environmental consequences of the Proposed Action.

3.0.1 REGULATORY FRAMEWORK

In accordance with the Council on Environmental Quality regulations for implementing the requirements of the National Environmental Policy Act (NEPA), other planning and environmental review procedures are integrated to the fullest extent possible. This section provides a brief overview of the primary federal statutes (3.0.1.1), executive orders (3.0.1.2), and guidance (3.0.1.3) that form the regulatory framework for the evaluation of resources in Chapter 3 (Affected Environment and Environmental Consequences). This section also describes how each applies to the analysis of environmental consequences. Chapter 6 (Additional Regulatory Considerations) provides a summary listing and status of compliance with the applicable environmental laws, regulations, and executive orders that were considered in preparing this EIS/OEIS. More detailed information on the regulatory framework, including other statutes not listed here, may be presented as necessary in each resource section. Although all the environmental laws, regulations, and executive orders provided in Chapter 6 were evaluated in this EIS/OEIS, some were included in regulatory determinations for resources during the analysis of impacts. More detailed discussions of selected regulations are included below to provide insight into the criteria used in the analyses.

3.0.1.1 Federal Statutes

Abandoned Shipwreck Act

The 1987 Abandoned Shipwreck Act (43 United States Code [U.S.C.] §§ 2101–2106) asserts the federal government's title to any abandoned shipwreck that meets criteria for inclusion in the National Register of Historic Places. Abandoned shipwreck means any shipwreck to which title has voluntarily been given up by the owner with the intent of never claiming a right or interest in the vessel in the future and without vesting ownership in any other person. Such shipwrecks ordinarily are treated as being abandoned after the expiration of 30 days from the sinking. States have the responsibility to manage the wrecks and to allow access to the sites by the general public while preserving the historical and environmental integrity of the site for scientific investigation.

Clean Air Act

The purpose of the Clean Air Act (42 U.S.C. §§ 7401-7671q) is to protect and enhance the quality of the nation's air resources to promote the public health and welfare and the productive capacity of its

population. To fulfill the act's purpose, federal agencies classify air basins according to their attainment status under the National Ambient Air Quality Standards (40 Code of Federal Regulations [C.F.R.] Part 50) and regulate emissions of criteria pollutants and air toxins to protect the public health and welfare. Noncriteria air pollutants that can affect human health are categorized as hazardous air pollutants under Section 112 of the Clean Air Act. The U.S. Environmental Protection Agency (USEPA) identified 188 hazardous air pollutants such as benzene, perchloroethylene, and methylene chloride. Section 176 (c) (1) of the Clean Air Act, commonly known as the General Conformity Rule, requires federal agencies to ensure that their actions conform to applicable implementation plans for achieving and maintaining the National Ambient Air Quality Standards for criteria pollutants.

Clean Water Act

The Clean Water Act (33 U.S.C. §§ 1251-1376) regulates discharges of pollutants in surface waters of the United States. Section 403 of the Clean Water Act provides for the protection of ocean waters (waters of the territorial seas, the contiguous zone, and the high seas beyond the contiguous zone) from point-source discharges. Under Section 403(a), USEPA or an authorized state agency may issue a permit for an ocean discharge only if the discharge complies with Clean Water Act guidelines for protection of marine waters. For the AFTT EIS/OEIS, the Proposed Action does not include the analysis of discharges incidental to the normal operation of Navy ships.

Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531-1544) established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. An "endangered" species is a species in danger of extinction throughout all or a significant portion of its range. A "threatened" species is one that is likely to become endangered within the near future throughout all or in a significant portion of its range. The U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) jointly administer the ESA and are also responsible for the listing of species (designating a species as either threatened or endangered). The ESA allows the designation of geographic areas as critical habitat for threatened or endangered species. Section 7(a)(2) requires each federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" a listed species, that agency is required to consult with the Service (NMFS or U.S. Fish and Wildlife Service) which has jurisdiction over the species (50 C.F.R. § 402.14(a)).

Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801-1882), enacted in 1976 and amended by the Sustainable Fisheries Act in 1996, mandates identification and conservation of essential fish habitat. Essential fish habitat is defined as those waters and substrates necessary (required to support a sustainable fishery and the federally managed species) to fish for spawning, breeding, feeding, or growth to maturity (i.e., full life cycle). These waters include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include areas historically used by fish. Substrate types include sediment, hard bottom, structures underlying the waters, and associated biological communities. Federal agencies are required to consult with NMFS and to prepare an essential fish habitat assessment if potential adverse effects on essential fish habitat are anticipated from their activities. Any federal agency action that is authorized, funded, or undertaken or proposed to be undertaken that may affect fisheries is subject to the Magnuson-Stevens Fishery Conservation and Management Act. In addition, federal agencies shall consult with the Secretary of

Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this act.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. §§ 1361-1407) established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The act further regulates "takes" of marine mammals in the global commons (that is, the high seas) by vessels or persons under U.S. jurisdiction. The term "take," as defined in Section 3 (16 U.S.C. § 1362 (13)) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of harassment: Level A (potential injury) and Level B (potential behavioral disturbance).

The Marine Mammal Protection Act directs the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if NMFS finds that the taking will have a negligible impact on the species or stock(s), and will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant). The authorization must set forth the permissible methods of taking; other means of effecting the least practicable adverse impact on the species or stock and its habitat; and requirements pertaining to the mitigation, monitoring, and reporting of such taking.

The National Defense Authorization Act of Fiscal Year 2004 (Public Law 108-136) amended the definition of harassment, removed the "specified geographic area" requirement, and removed the small numbers provision as applied to military readiness activities or scientific research activities conducted by or on behalf of the federal government consistent with Section 104(c)(3) (16 U.S.C. § 1374(c)(3)). The Fiscal Year 2004 National Defense Authorization Act adopted the definition of "military readiness activity" as set forth in the Fiscal Year 2003 National Defense Authorization Act (Public Law 107-314). A "military readiness activity" is defined as "all training and operations of the Armed Forces that relate to combat" and "the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." For military readiness activities, the relevant definition of harassment is any act that

- injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment") or
- disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") [16 U.S.C. §§ 1362 (18)(B)(i) and (ii)].

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712) and the Migratory Bird Conservation Act (16 U.S.C. §§ 715–715d, 715e, 715f–715r) of 18 February 1929, are the primary laws in the United States established to conserve migratory birds. The Migratory Bird Treaty Act prohibits the taking, killing, or possessing of migratory birds or the parts, nests, or eggs of such birds, unless permitted by regulation.

The 2003 National Defense Authorization Act provides that the Armed Forces may take migratory birds incidental to military readiness activities provided that, for those ongoing or proposed activities that the Armed Forces determine may result in a significant adverse effect on a population of a migratory bird species, the Armed Forces must confer and cooperate with the U.S. Fish and Wildlife Service to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.

National Environmental Policy Act

The Navy prepared this EIS/OEIS in accordance with the President's Council on Environmental Quality regulations implementing NEPA (40 C.F.R. Parts 1500–1508). NEPA (42 U.S.C. §§ 4321–4347) requires federal agencies to prepare an EIS for a proposed action with the potential to significantly affect the quality of the human environment, disclose significant environmental impacts, and inform decision makers and the public of the reasonable alternatives to the proposed action. Based on Presidential Proclamation 5928, issued 27 December 1988, impacts on ocean areas that lie within 12 nautical miles (nm) of land (U.S. territory) are subject to analysis under NEPA.

Rivers and Harbors Act

The Rivers and Harbors Acts of 1890 and 1899 (33 U.S.C. §§ 401-467) are the legislative origin of the U.S. Army Corps of Engineers regulatory program. Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, and transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States. The geographic jurisdiction of the Rivers and Harbors Act includes all navigable waters of the United States, which are defined as waters subject to the ebb and flow of the tide shoreward to the mean high water mark that may be used to transport interstate or foreign commerce (33 C.F.R. Part 329). This jurisdiction extends seaward to include all ocean waters within 3 nm from the coastline. Department of the Army permits are required to authorize certain structures or work in, or affecting, navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act. Certain activities may fall under an authorized nationwide general permit or a regional general permit. If this is not the case, an individual Section 10 permit is required.

3.0.1.2 Executive Orders

Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*

This OEIS has been prepared in accordance with Executive Order (EO) 12114 (44 Federal Register [FR] 1957) and Navy implementing regulations in 32 C.F.R. Part 187. An OEIS is required because the Proposed Action and the alternatives have the potential to significantly harm the environment of the global commons. The global commons are defined as geographical areas outside the jurisdiction of any nation and include the oceans outside of the territorial limits (more than 12 nm from the coast) and Antarctica but do not include contiguous zones and fisheries zones of foreign nations (32 C.F.R. § 187.3). The EIS and OEIS have been combined into one document, as permitted under NEPA and EO 12114, to reduce duplication.

Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*

EO 13514 (74 FR 52117) was signed in October 2009 to establish an integrated strategy toward sustainability in the federal government and to make reduction of greenhouse gas emissions a priority for federal agencies. The Department of Defense (DoD) developed a Strategic Sustainability Performance Plan that identifies performance-based goals and subgoals, provides a method to meet the goals (including investment strategies), and outlines a plan for reporting on performance. The Strategic Sustainability Performance Plan is included in the analyses in this EIS/OEIS.

Executive Order 13158, *Marine Protected Areas*

EO 13158 (65 FR 34909) was authorized in May 2000 to protect special natural and cultural resources by strengthening and expanding the nation's system of marine protected areas. The purpose of the order is to (1) strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded marine protected areas; (2) develop a scientifically based, comprehensive national system of marine protected areas representing diverse U.S. marine ecosystems, and the nation's natural and cultural resources; and (3) avoid causing harm to marine protected areas through federally conducted, approved, or funded activities.

Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*

EO 13547 (75 FR 43023) was issued in 2010. It is a comprehensive national policy for the stewardship of the ocean, our coasts, and the Great Lakes. This order adopts the recommendations of the Interagency Ocean Policy Task Force and directs executive agencies to implement the recommendations under the guidance of a National Ocean Council. The National Ocean Policy better coordinates and aligns coastal and ocean-related actions of federal agencies to bolster the ocean economy, improve ocean health, support local economies, and strengthen security. It also emphasizes providing better science to improve decision-making to ensure ocean resources are being sustainably used to the benefit of all Americans. The National Ocean Policy is not regulatory, nor does it direct any particular outcome on specific activities. This order establishes a national policy to

- ensure the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources,
- enhance the sustainability of ocean and coastal economies, preserve our maritime heritage,
- support sustainable uses and access,
- provide for adaptive management to enhance our understanding of and capacity to respond to climate change and ocean acidification, and
- coordinate with our national security and foreign policy interests.

3.0.1.3 Guidance

Department of Defense and Navy Directives and Instructions

Several military communications are included in this EIS/OEIS that establish policy or a plan to govern an action, conduct, or procedure. For example, DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings over the High Seas*, and Chief of Naval Operations Instruction 3770.4A, *Use of Airspace by U.S. Military Aircraft and Firing over the High Seas*, specify procedures for conducting aircraft maneuvers and for firing missiles and projectiles. Other directives and instructions referred to in the EIS/OEIS are specific for a range complex or test range such as the Fleet Area Control and Surveillance Facility Virginia Capes Instruction 3120.1L, which is the manual for the *Utilization of Fleet Area Control and Surveillance Facility, Virginia Capes Operating Areas*. Each range complex and test range has its own manual; however, many of the components are similar.

3.0.2 DATA SOURCES AND BEST AVAILABLE DATA

The Navy used the best available data and information to compile the environmental baseline and environmental consequences included in Chapter 3 (Affected Environment and Environmental Consequences). In accordance with NEPA, the Administrative Procedure Act (5 U.S.C. §§ 551-59, 701-06, 1305, 3105, 3344, 4301, 5362, 7521), and EO 12114, best available data accepted by the appropriate regulatory and scientific communities were used in the analyses of resources.

Literature searches of journals, books, periodicals, bulletins, and other technical reports were conducted in preparation of this EIS/OEIS. Searches included general queries in the resource areas evaluated to document the environmental baseline and specific queries for analysis of environmental consequences. A wide range of primary literature was used in preparing this EIS/OEIS from federal agencies such as the U.S. Environmental Protection Act, international organizations, state and federal agencies, and nonprofit and nongovernment organizations. Internet searches were conducted, and websites were evaluated for credibility of the source, quality of the information, and relevance of the content to ensure use of the best available information in this document.

3.0.2.1 Geographical Information Systems Data

Table 3.0-1 is a list of sources of non-Navy Geographical Information System data used in Chapter 3 figures.

Table 3.0-1: Sources of Non-Navy Geographic Information System Data Used to Generate Figures in Chapter 3

Feature/Layer	Applicable Figures	Data Source References
Large Marine Ecosystems	All Chapter 3 Figures	National Oceanic and Atmospheric Administration 2002a
Bathymetry and Ocean Basemap	3.0-6, 3.0-7, 3.0-8, 3.0-9	General Bathymetric Chart of the Oceans 2010; Intergovernmental Oceanographic Commission 2009
Sea Surface Temperature	3.0-11	University of Miami Rosenstiel School of Marine and Atmospheric Science and National Oceanographic and Atmospheric Administration 2007
Critical Habitat	All Critical Habitat Figures	National Oceanic and Atmospheric Administration 2009; U.S. Department of the Navy 2008b, 2011; U.S. Fish and Wildlife Service 2005, 2008, 2010
Florida Seagrass, Invertebrate Habitat Areas of Particular Concern	3.7-2, 3.8-2, 3.8-3	Florida Fish and Wildlife Conservation Commission 2005, 2011
PM2.5, 8-hour Ozone	3.2-1	U.S. Environmental Protection Agency 2009
NRHP Eligible or Listed Resources/Sovereign Immunity, Shipwrecks	3.10-4, 3.10-5, 3.10-6	Google Inc. 2010; National Oceanic and Atmospheric Administration 2002b
Oil-Gas Structures	3.11-1	Minerals Management Service 2006b
Active and Proposed Oil and Gas Pipelines	3.11-2	Minerals Management Service 2006a
State Seaward Extent, 12 nm Territorial Limit	3.11-1, 3.11-2	National Oceanic and Atmospheric Administration 2011
Commercially Used Waterways	3.11-3	Vanderbilt Engineering Center for Transportation Operations and Research 2004
Danger Zones and Restricted Areas	3.11-4, 3.11-5, 3.11-6, 3.11-7	33 C.F.R. Part 334

3.0.2.2 Navy Integrated Comprehensive Monitoring Program

Navy and non-Navy marine mammal scientists and research institutions have, since 2006, conducted scientific monitoring and research in and around ocean areas in the Atlantic and Pacific where the Navy has been training and testing and proposes to continue these activities. Data collected from Navy monitoring, scientific research findings, and annual reports provided to NMFS may inform the analysis of impacts on marine mammals for a variety of reasons, including species distribution, habitat use, and evaluation of potential responses to Navy activities. Monitoring is performed using various methods, including visual surveys from surface vessels and aircraft and passive acoustics. Navy monitoring can generally be divided into two types of efforts: (1) collecting long-term data on distribution, abundance, and habitat use patterns within Navy activity areas, and (2) collecting data during individual training or testing activities. Monitoring efforts during anti-submarine warfare and explosive events focus on observing individual animals in the vicinity of the event and documenting behavior and any observable responses. Although these monitoring events are very localized and short-term, over time they will provide valuable information to support the impact analysis.

Most of the training and testing activities the Navy is proposing for the next five years are similar if not identical to activities that have been occurring in the same locations for decades. For example, the mid-frequency anti-submarine warfare sonar system on the cruisers, destroyers, and frigates has the same sonar system components in the water as those first deployed in the 1970s. While the signal analysis and computing processes onboard these ships have been upgraded with modern technology, the power and output of the sonar transducer, which puts signals into the water, have not changed. Therefore, the history of past marine mammal observations, research, and monitoring reports remain applicable to the analysis of effects from the proposed future training and testing activities.

3.0.2.2.1 Distribution, Abundance, and Habitat Use

The Navy initiated a protected marine species monitoring project in June 2007 in Onslow Bay (Navy Cherry Point Range Complex) to support the planned Undersea Warfare Training Range and later expanded to a parallel monitoring site off the coast of Jacksonville, Florida (JAX Range Complex) in 2009. Beginning in 2011, the Onslow Bay project began to expand north toward Cape Hatteras (VACAPES Range Complex) and will continue to collect survey data in this region. Although the initial intent of the Onslow Bay and Jacksonville monitoring projects was to support development of the Undersea Warfare Training Range, the program has evolved to allow the gathering of robust baseline data within locations where Navy anti-submarine warfare activities regularly occur. Although these locations include regular Navy activity, the baseline data are collected during periods when training and testing is not occurring. Visual surveys have been conducted year-round (weather permitting) since the inception of the project.

From June 2007 through December 2012, as part of this baseline monitoring offshore Cape Hatteras, Onslow Bay, and Jacksonville, the Navy covered over 120,000 km of aerial visual survey and over 10,000 km of vessel visual survey. This monitoring resulted in over 28,000 individual marine mammals and over 4,500 sea turtles being sighted. In addition to visual surveys, passive acoustic monitoring has been ongoing at these sites through use of High-Frequency Acoustic Recording Packages. Tremendous amounts of acoustic data are continuously being generated and analyzed providing information of marine mammal species occurrence and complimenting the visual surveys. Although these sites are small in comparison to the overall Study Area, they represent important areas for Navy training and testing and provide a robust baseline of species occurrence and in some cases have helped to expand the overall scientific knowledge for some species.

3.0.2.2.2 Monitoring During Training and Testing Events

Monitoring during activities involving the use of sonar and other active acoustic sources and explosives is regularly conducted with a combination of visual and passive acoustic methods. These monitoring events are focused on observing individual animals in the vicinity of the event and documenting behavior and any observable responses. Although these monitoring events are very localized and short-term, over time they will provide valuable information to support the impact analysis.

3.0.2.2.2.1 Observations in Association with Activities Involving the Use of Active Acoustic Sources

Training

Monitoring efforts were conducted during training events as part of the Atlantic Fleet Active Sonar Training Letter of Authorization. From January 2009 through December 2012, nine anti-submarine warfare events (two in VACAPES and seven in JAX) were monitored before, during, or after with aerial, vessel, or passive acoustic surveys conducted by third-party or Navy-trained marine mammal observers. A total of 41.4 hours of aerial, 266.5 hours of vessel, and 26.5 hours of towed-hydrophone-array passive acoustic effort were spent collecting data before, during, or after the exercises. Over 1,200 marine mammals and over 100 sea turtles were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

In addition, the Navy has recorded approximately 19,500 hours of passive acoustic monitoring data during anti-submarine training events. These data were collected during one event in Onslow Bay, North Carolina, and three events in the proposed JAX Undersea Warfare Training Range location using an array of Cornell's Marine Acoustic Recording Units and JASCO's Autonomous Multi-Channel Acoustic Recorders. The goal of these recordings was to test the feasibility of using passive acoustic monitoring during Navy training and testing events to assess any behavioral acoustic response to the activities. The data are currently being analyzed for the occurrence of marine mammal vocalizations during sonar activity.

Testing

Monitoring efforts were conducted during anti-submarine warfare testing events from March 2009 to May 2013 within the AFTT Study Area. Fifteen events were monitored with aerial, vessel, and passive acoustic surveys by trained marine mammal observers. A total of 255 hours of aerial and 621 hours of vessel effort were spent collecting data before, during, and after the exercises. Dolphins, large whales, manatees, and sea turtles were observed. Due to different reporting requirements, the total numbers of animals observed is unavailable. For example, the number of individual dolphins within a pod is not recorded; the after action reports only identify a single dolphin pod. Where numbers of animals were recorded, a range of 155 to 214 marine mammals (based on minimum and maximum group size) were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

Sightings data within Narragansett Bay at the Naval Undersea Warfare Center Division, Newport Testing Range have been recorded between April 2009 and July 2012. These sightings, however, are not recorded in response to specific testing activities; all sightings data are recorded regardless of whether a test event is being conducted. A total of 45–66 dolphins or porpoises and 66–71 seals have been observed (based on minimum and maximum group size estimates).

Between June 2011 and June 2012, four mine warfare events involving sonar were monitored with vessel surveys by trained marine mammal observers off Riviera Beach, Florida. A total of 232.3 hours of vessel effort was spent collecting data before, during, and after the exercises. Seventy-three marine

mammals and sea turtles were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

Monitoring efforts were conducted during testing events as part of the Naval Surface Warfare Center, Panama City Division Letter of Authorization. From January 2010 through December 2012, four sonar test events were monitored before, during, or after with aerial surveys conducted by third-party trained marine mammal observers. A total of 43.1 hours of aerial survey effort was conducted. As a result, 454 marine mammals and 312 sea turtles were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

From January 2010 through December 2012, sonar test events were monitored by Navy trained marine mammal observers on vessels in the Naval Surface Warfare Center, Panama City Division Testing Range. A total of 52 days of vessel effort was spent collecting data during the events. Approximately 182 marine mammals and 11 sea turtles were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

3.0.2.2.2.2 Observations in Association with Activities Involving the Use of Explosives

Training

Monitoring efforts were conducted during training events from June 2009 to June 2012, as part of the East Coast Range Complexes Letters of Authorization. Twelve events involving the use of explosives were monitored with aerial, vessel, and passive acoustic surveys. A total of 39 hours of third-party aerial, 34.5 hours of vessel, and 53.8 hours of passive-acoustic-recording effort was spent collecting data before, during, and after the exercises. In addition, trained marine mammal observers conducted 14 hours of survey effort from the firing Navy vessel during a firing exercise event. A total of 304 marine mammals and 161 sea turtles were observed before, during, or after these events, and no observable behavioral disturbance, injury, or mortality was noted. The passive acoustic data are currently being analyzed for the occurrence of marine mammal vocalizations during the explosive events.

Testing

Monitoring efforts were conducted during testing events as part of the Naval Surface Warfare Center, Panama City Division Letter of Authorization. From January 2010 through December 2012, two detonation test events were monitored before, during, or after with aerial, vessel, or passive acoustic surveys conducted by third-party or Navy trained marine mammal observers. A total of 41.3 hours of aerial, 25.8 hours of vessel, and 29.5 hours of towed-hydrophone-array passive acoustic effort was spent collecting data before, during, or after the events. A total of 275 marine mammals, 54 sea turtles, and three acoustic detections of dolphins were observed before, during or after these events, and no observable behavioral disturbance, injury, or mortality was noted.

From January 2010 through December 2012, four detonation testing events were monitored by Navy trained marine mammal observers on vessels in the Naval Surface Warfare Center, Panama City Division Testing Range. A total of 4 days of vessel effort was spent collecting data during the events. A total of 10 marine mammals and 6 sea turtles were observed during these events, and no observable behavioral disturbance, injury, or mortality was noted.

Monitoring of the shock trials of the USS *Winston S. Churchill* (DDG 81) and USS *Mesa Verde* (LPD 19) involved pre- and post-detonation surveys by shipboard and aerial observers (U.S. Department of the Navy 2001, 2008a). Post-detonation monitoring commenced immediately after each detonation and occurred for at least two hours, with additional surveys conducted on the following two days after each

of the first two detonations, and for at least five days following the third detonation. Ninety-two marine mammal and sea turtle sightings were recorded during post-detonation monitoring of the USS *Winston S. Churchill* (DDG 81) ship shock trial, and 64 marine mammals and sea turtles were observed during post-detonation monitoring of the USS *Mesa Verde* (LPD 19) ship shock trial. No observable behavioral disturbance, injury, or mortality was noted.

3.0.2.2.2.3 Relevant Data From the Hawaii-Southern California Training and Testing Study Area

In the Hawaii Range Complex portion of the Hawaii-Southern California Training and Testing (HSTT) Study Area between 2006 and 2012, 21 scientific marine mammal surveys were conducted before, during, or after major exercises. In the Southern California and Hawaii Range Complex portions of HSTT from 2009 to 2012, Navy-funded marine mammal monitoring research completed over 5,000 hours of visual survey effort covering more than 65,000 nautical miles, sighted more than 256,000 individual marine mammals, took more than 45,600 digital photos and 36 hours of digital video, attached 70 satellite tracking tags to individual marine mammals, and collected more than 40,000 hours of passive acoustic recordings. The Navy also cofunded additional visual surveys conducted by the NMFS Pacific Island Fisheries Science Center and Southwest Fisheries Science Center. Finally, an additional 1,532 sightings of an estimated 16,224 marine mammals were made and reported by Navy Lookouts aboard Navy ships within the HSTT Study Area from 2009 to 2012. No observable behavioral disturbance, injury, or mortality was noted during the surveys.

3.0.3 Ecological Characterization of the Study Area

For the purposes of this document, the Study Area includes the intertidal and subtidal marine waters within the boundaries shown in Figure 2.1-1 but does not extend above the mean high tide line. Navy activities in the marine environment predominately occur within established operating areas (OPAREAs), range complexes, test ranges, ports, and pierside locations, although some occur outside these designated areas. These locations were defined by training and testing requirements and regulated maritime and airspace boundaries. However, the Navy-defined boundaries are not consistent with ecological boundaries that may be more appropriate when assessing potential impacts on marine resources. Therefore, for the purposes of this document, the Navy analyzed the marine resources in an ecological context to more comprehensively assess the potential impacts. The Navy used biogeographic classification systems to frame this ecological context.

Biogeographic classifications organize and describe the patterns and distributions of organisms and the biological and physical processes that influence this distribution. These biogeographic classification systems and areas are described in Section 3.0.3.1 (Biogeographic Classifications). Additional ecosystem-related concepts, as well as a discussion of how Navy activities and potential stressors of the Proposed Action fit into the ecosystem, are presented in a separate detailed report titled the *Ecosystem Technical Report for the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement* (U.S. Department of the Navy 2012).

3.0.3.1 Biogeographic Classifications

For the purposes of this document, the Navy organized and described the resources in coastal waters by large marine ecosystems, where primary productivity is higher than open ocean areas; the Navy organized and described the resources in open ocean areas by main oceanographic features (currents, gyres). Primary productivity is the rate of the formation of organic material from inorganic carbon via photosynthesis (e.g., by marine vegetation) or chemical reactions.

The development of the large marine ecosystem classification system began in the mid-1980s as a spatial planning tool to address transboundary management issues such as fisheries and pollution (Duda and Sherman 2002). Large marine ecosystems are "relatively large regions on the order of 58,310 nm^2 (200,000 km^2) or greater, characterized by distinct water depths and bottom features; water features such as tides, currents, and waves; nutrient and food availability; and levels that different organisms occupy in the food chain" (National Oceanic and Atmospheric Administration 2010). The large marine ecosystem concept for ecosystem-based management includes a five-module approach: (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socioeconomics, and (5) governance. This approach is being applied to 16 international projects in Africa, Asia, Latin America, and Eastern Europe (Duda and Sherman 2002).

The large marine ecosystem classification system was advocated by the Council on Environmental Quality's Interagency Ocean Policy Task Force (The White House Council on Environmental Quality 2010) as a marine spatial framework for regional coordination and planning in the United States. However, this task force did not endorse any particular classification system for open ocean areas. Therefore, for this EIS/OEIS, three main oceanographic features are used: the Labrador Current, the Gulf Stream, and the North Atlantic Gyre. The Study Area contains seven coastal water large marine ecosystems: the West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea. The seven large marine ecosystems and three open ocean areas are shown in Figures 3.0-1 through 3.0-4 and outlined in Sections 3.0.3.1.1 (West Greenland Shelf Large Marine Ecosystem) through 3.0.3.1.10 (North Atlantic Gyre Open Ocean Area). Designated training and testing areas in relation to each of the large marine ecosystems and open ocean areas are presented in Table 3.0-2.

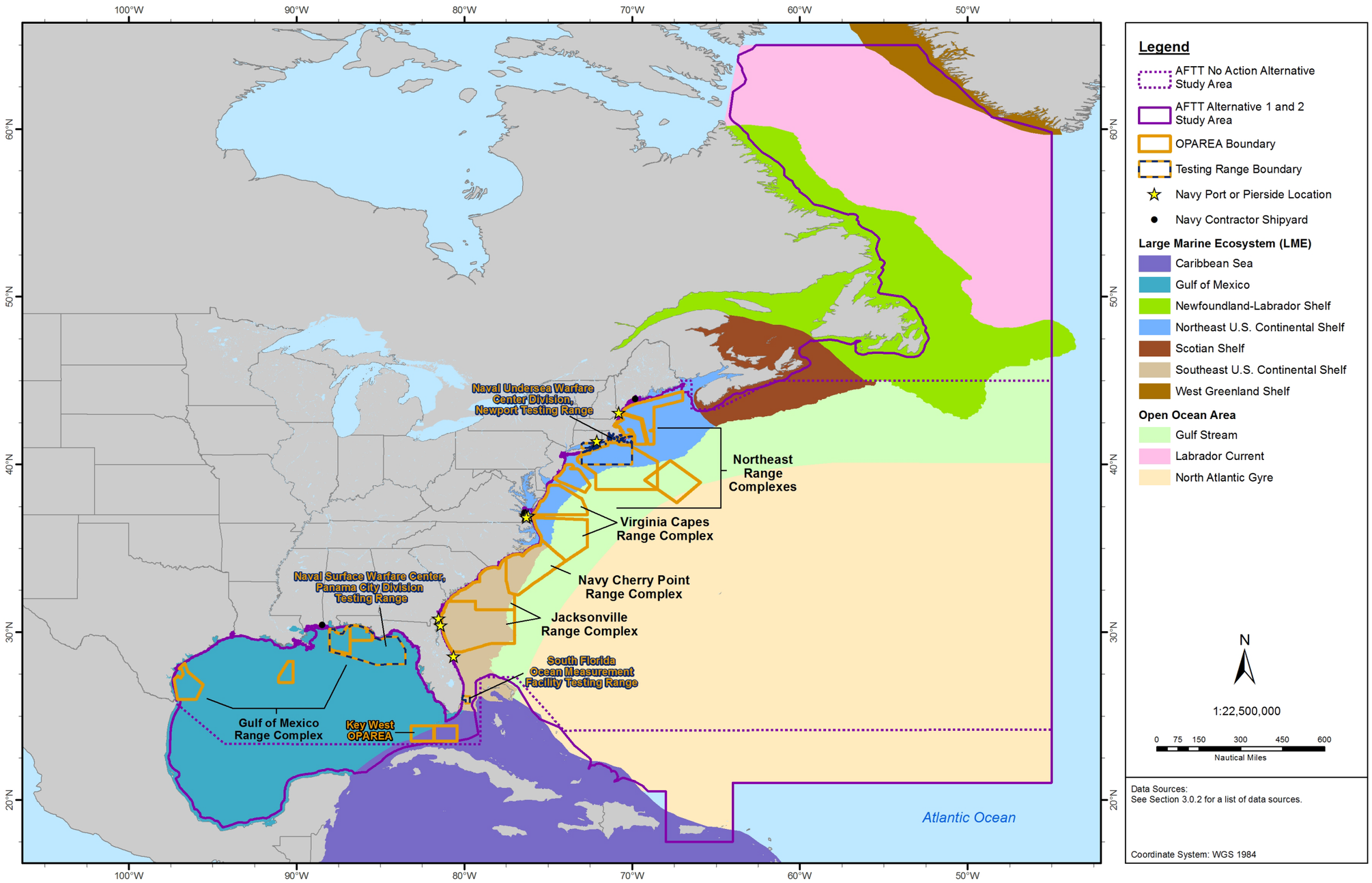

Figure 3.0-1: The Study Area with Large Marine Ecosystems and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

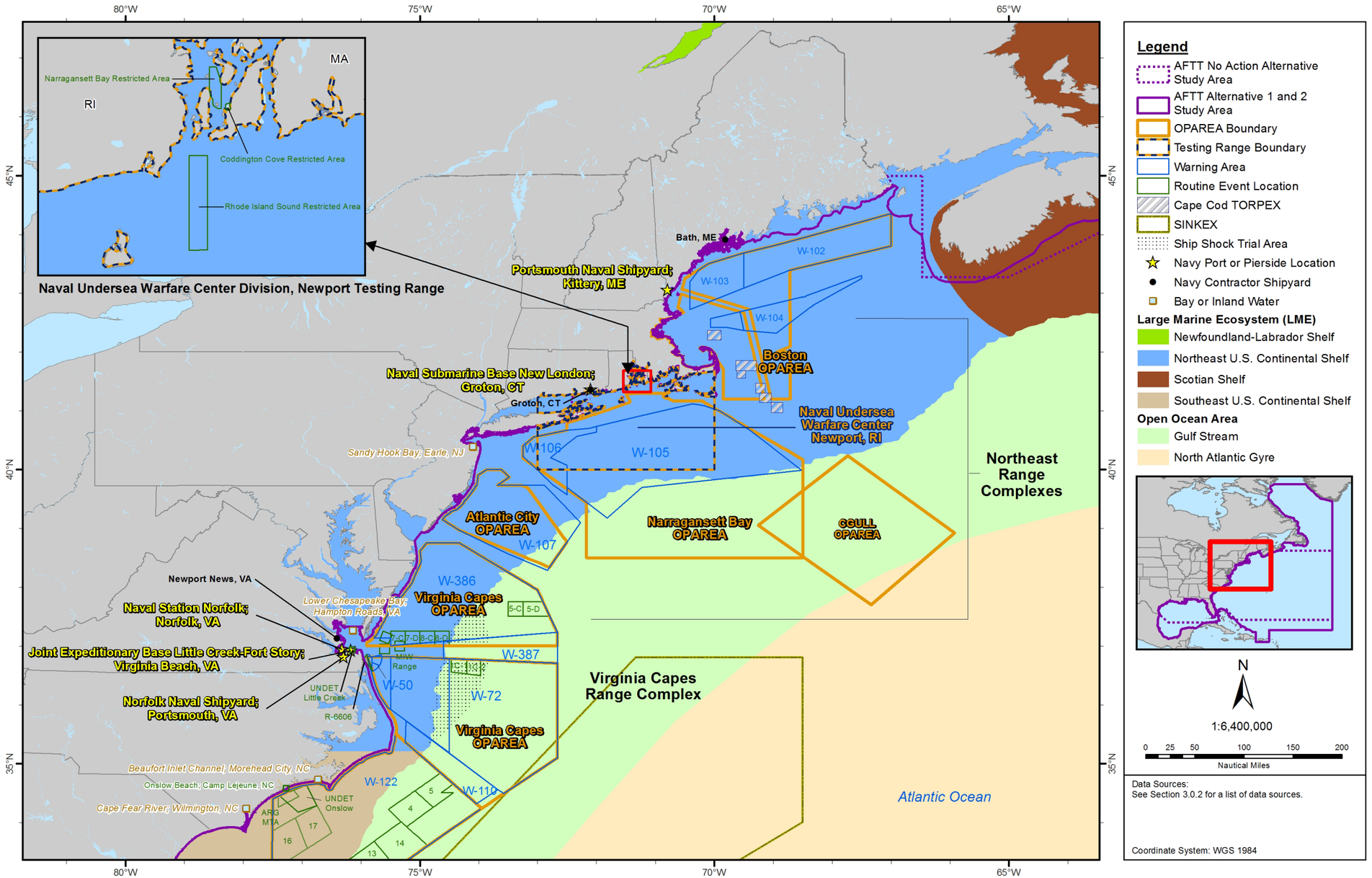

Figure 3.0-2: Navy Training and Testing Locations in the Northeast United States Continental Shelf Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; ME: Maine; NC: North Carolina; NJ: New Jersey; OPAREA: Operating Area; RI: Rhode Island; SINKEX: Sinking Exercise; TORPEX: Torpedo Exercise; VA: Virginia

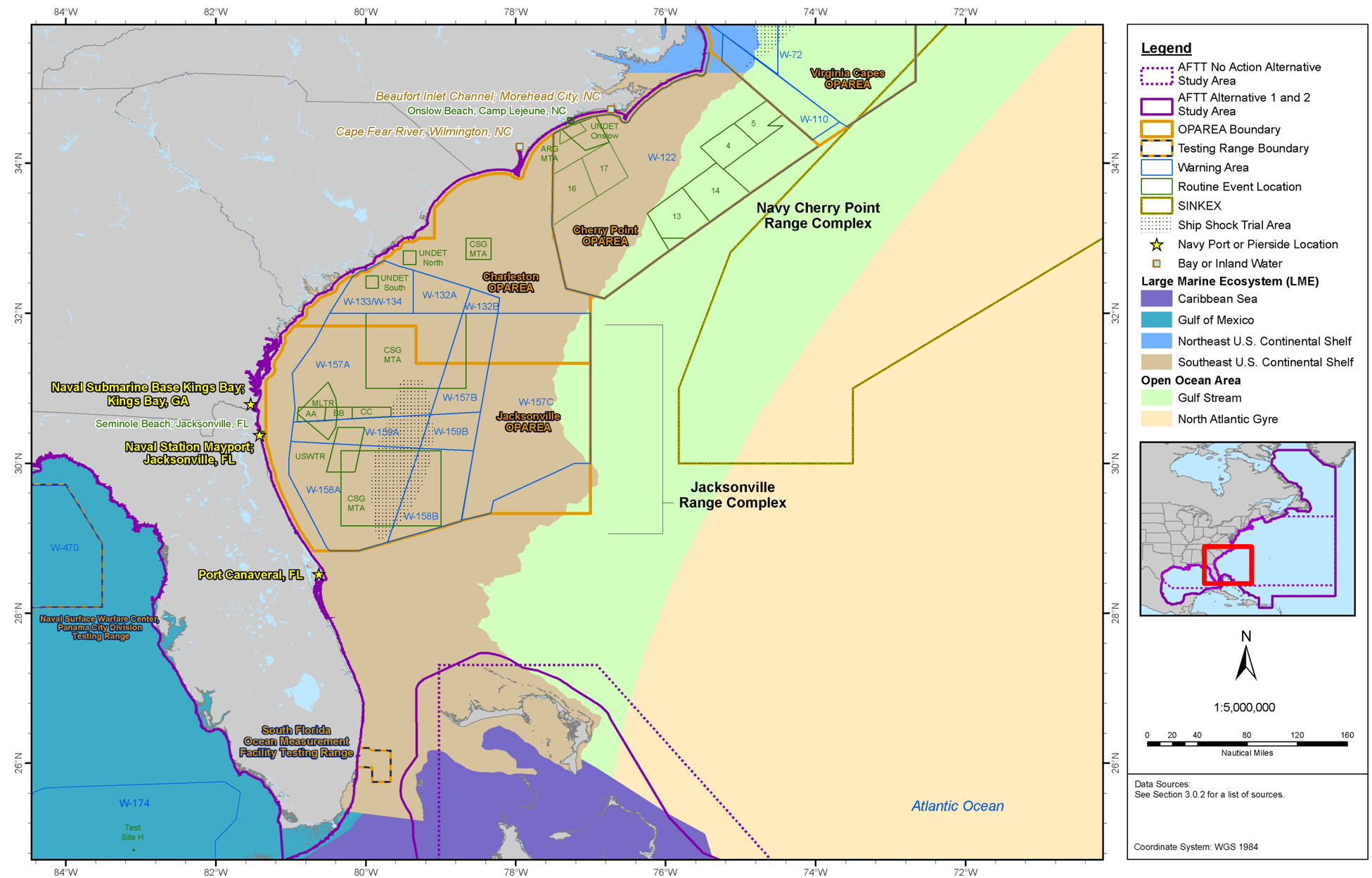

Figure 3.0-3: Navy Training and Testing Locations in the Southeast United States Continental Shelf and Caribbean Sea Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; ARG: Amphibious Readiness Group; CSG: Carrier Strike Group; GA: Georgia FL: Florida; MLTR: Missile Laser Training Range; MTA: Mine Training Area; NC: North Carolina; OPAREA: Operating Area; SINKEX: Sinking Exercise; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Area

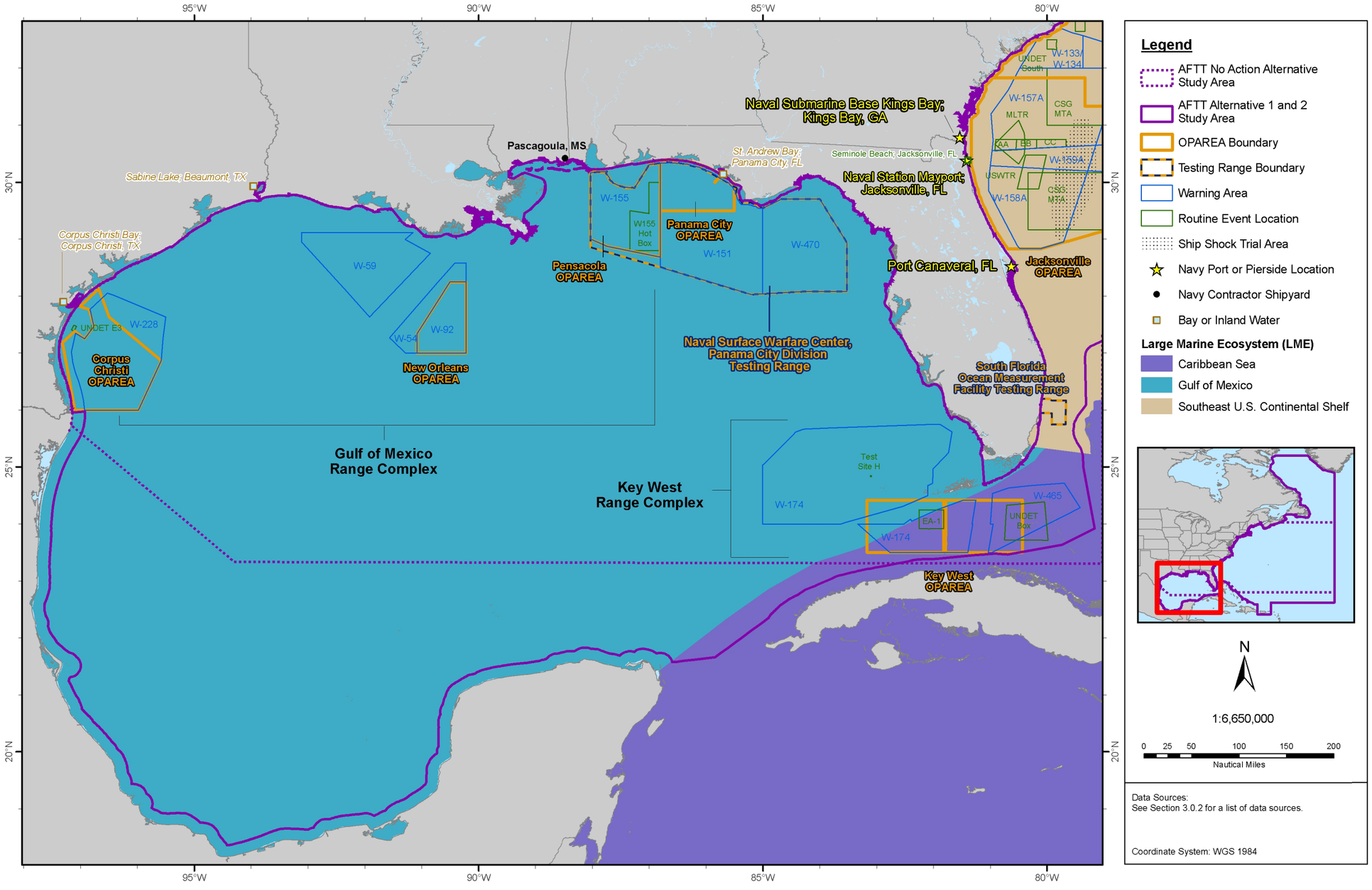

Figure 3.0-4: Navy Training and Testing Locations in the Gulf of Mexico and Caribbean Sea Large Marine Ecosystems

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; GA: Georgia; FL: Florida; OPAREA: Operating Area; MLTR: Missile Laser Training Range; MS: Mississippi; TX: Texas; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

Table 3.0-2: Designated Training and Testing Areas in Relation to Large Marine Ecosystems and Open Ocean Areas

Training/Testing Location[1]	Northeast U.S. Continental Shelf Large Marine Ecosystem	Southeast U.S. Continental Shelf Large Marine Ecosystem	Gulf of Mexico Large Marine Ecosystem	Caribbean Sea Large Marine Ecosystem	Gulf Stream Open Ocean Area	North Atlantic Gyre Open Ocean Area
OPAREAs						
Boston (part of Northeast Range Complexes)	X					
Narragansett Bay (part of Northeast Range Complexes)	X				X	
Atlantic City (part of Northeast Range Complexes)	X				X	
CGULL (part of Northeast Range Complexes)					X	X
Virginia Capes (part of VACAPES)	X				X	
Cherry Point (part of Navy Cherry Point Range Complex)		X			X	
Charleston (part of JAX)		X				
Jacksonville (part of JAX)		X			X	
Corpus Christi (part of GOMEX)			X			
New Orleans (part of GOMEX)			X			
Pensacola (part of GOMEX)			X			
Panama City (part of GOMEX)			X			
Key West (part of Key West Range Complex)			X	X		
Testing Ranges						
Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT)	X					
South Florida Ocean Measurement Facility (SFOMF)		X				
Naval Surface Warfare Center, Panama City Division (NSWC PCD)			X			

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; NSWC PCD: Naval Surface Warfare Center, Panama City Division; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport; OPAREA: Operating Area; SFOMF: South Florida Ocean Measurement Facility; VACAPES: Virginia Capes Range Complex

[1] No specifically designated training or testing areas fall within the West Greenland Shelf Large Marine Ecosystem, Newfoundland-Labrador Shelf Large Marine Ecosystem, Scotian Shelf Large Marine Ecosystem, and Labrador Current Open Ocean Area; however, training or testing may occasionally occur in these areas during transit.

Table 3.0-2: Designated Training and Testing Areas in Relation to Large Marine Ecosystems and Open Ocean Areas (Continued)

Training/Testing Location[1]	Northeast U.S. Continental Shelf Large Marine Ecosystem	Southeast U.S. Continental Shelf Large Marine Ecosystem	Gulf of Mexico Large Marine Ecosystem	Caribbean Sea Large Marine Ecosystem	Gulf Stream Open Ocean Area	North Atlantic Gyre Open Ocean Area
Naval Ports and Naval Shipyards						
Portsmouth Naval Shipyard; Kittery, ME	X					
Naval Submarine Base New London; Groton, CT	X					
Naval Station Norfolk; Norfolk, VA	X					
Norfolk Naval Shipyard; Portsmouth, VA	X					
Joint Expeditionary Base Little Creek—Fort Story; Virginia Beach, VA	X					
Naval Submarine Base Kings Bay; Kings Bay, GA		X				
Naval Station Mayport; Jacksonville, FL		X				
Port Canaveral, FL		X				
Navy Contractor Shipyards						
Bath, ME	X					
Groton, CT	X					
Newport News, VA	X					
Pascagoula, MS			X			
Bays and Inland Waters						
Sandy Hook Bay; Earle, NJ	X					
Lower Chesapeake Bay; Hampton Roads, VA	X					
Beaufort Inlet Channel; Morehead City, NC		X				
Cape Fear River; Wilmington, NC		X				
St. Andrew Bay; Panama City, FL			X			
Sabine Lake; Beaumont, TX			X			
Corpus Christi Bay; Corpus Christi, TX			X			

CT: Connecticut; FL: Florida; ME: Maine; MS: Mississippi; NC: North Carolina; NJ: New Jersey; TX: Texas; VA: Virginia

[1] No specifically designated training or testing areas fall within the West Greenland Shelf Large Marine Ecosystem, Newfoundland-Labrador Shelf Large Marine Ecosystem, Scotian Shelf Large Marine Ecosystem, and Labrador Current Open Ocean Area; however, training or testing may occasionally occur in these areas during transit.

Table 3.0-2: Designated Training and Testing Areas in Relation to Large Marine Ecosystems and Open Ocean Areas (Continued)

Training/Testing Location[1]	Northeast U.S. Continental Shelf Large Marine Ecosystem	Southeast U.S. Continental Shelf Large Marine Ecosystem	Gulf of Mexico Large Marine Ecosystem	Caribbean Sea Large Marine Ecosystem	Gulf Stream Open Ocean Area	North Atlantic Gyre Open Ocean Area
Event Locations						
Narragansett Bay Restricted Area	X					
Rhode Island Sound Restricted Area	X					
Coddington Cove Restricted Area	X					
Cape Cod TORPEX Boxes	X					
MIW Range	X					
1C-1 and 1C-2	X					
7-C, 7-D, 8-C, and 8-D	X					
5-C and 5-D						
W-50	X					
Restricted Area 6606 (R-6606)	X					
Onslow Beach; Camp Lejeune, NC		X				
Onslow Bay UNDET Area		X				
ARG MTA		X				
W-122 (16,17)		X				
W-122 (13,14)					X	
W-122 (4,5)					X	
Charleston UNDET Areas (North and South)		X				
Seminole Beach; Naval Station Mayport, Jacksonville, FL		X				
Carrier Strike Group (CSG) Mine Training Areas (MTA)		X				

ARG: Amphibious Readiness Group; CSG: Carrier Strike Group; FL: Florida; MIW: mine warfare; MTA: mine training area; NC: North Carolina; TORPEX: torpedo exercise; UNDET: underwater detonation; W: warning area

[1] No specifically designated training or testing areas fall within the West Greenland Shelf Large Marine Ecosystem, Newfoundland-Labrador Shelf Large Marine Ecosystem, Scotian Shelf Large Marine Ecosystem, and Labrador Current Open Ocean Area; however, training or testing may occasionally occur in these areas during transit.

Table 3.0-2: Designated Training and Testing Areas in Relation to Large Marine Ecosystems and Open Ocean Areas (Continued)

Training/Testing Location[1]	Northeast U.S. Continental Shelf Large Marine Ecosystem	Southeast U.S. Continental Shelf Large Marine Ecosystem	Gulf of Mexico Large Marine Ecosystem	Caribbean Sea Large Marine Ecosystem	Gulf Stream Open Ocean Area	North Atlantic Gyre Open Ocean Area
Event Locations (Continued)						
Surface Gunnery Areas AA, BB, CC		X				
Missile Laser Training Range (MLTR)		X				
Undersea Warfare Training Range (USWTR)		X				
SINKEX Box					X	X
Ship Shock Trial Locations	X	X			X	
W-155 Hotbox			X			
Corpus Christi UNDET Box E3			X			
Gulf of Mexico			X			
EA-1			X	X		
Test Site H			X			
UNDET Box (part of Key West Range Complex)				X		

MLTR: Missile Laser Training Range; SINKEX: sinking exercise; UNDET: underwater detonation; W: warning area

[1] No specifically designated training or testing areas fall within the West Greenland Shelf Large Marine Ecosystem, Newfoundland-Labrador Shelf Large Marine Ecosystem, Scotian Shelf Large Marine Ecosystem, and Labrador Current Open Ocean Area; however, training or testing may occasionally occur in these areas during transit.

3.0.3.1.1 West Greenland Shelf Large Marine Ecosystem

The West Greenland Shelf Large Marine Ecosystem (Figure 3.0-1) encompasses an area of 109,000 nm^2 (374,000 km^2) (Aquarone et al. 2009). No specifically designated training or testing areas fall within the West Greenland Shelf Large Marine Ecosystem; however, training or testing may occasionally occur in this area during transit (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges). This large marine ecosystem extends off the west coast of Greenland adjacent to Baffin Bay and the Davis Strait. Most of this ecosystem extends outside the Study Area; only the southwestern portion occurs within the Study Area (Figure 3.0-1). Other oceanic influences on this area are the West Greenland Current Front and the East Greenland Current. Significant structural features of this ecosystem include the Fylass Bank and the Tasersuaq Estuary. Most of this large marine ecosystem is covered with ice during parts of the year (Sherman and Hempel 2009).

The West Greenland Shelf Large Marine Ecosystem provides resources for commercial fisheries (e.g., northern shrimp and flounder), and is an important feeding and migration area for the ESA-endangered Gulf of Maine Atlantic salmon (Fay et al. 2006). The average primary productivity within this large marine ecosystem is low: less than 410 milligrams (mg) of carbon per square meter per day (m^2/day) (Aquarone et al. 2009). Low primary productivity is a result of low numbers of primary producers (e.g., algae) which are responsible for most of the primary production in the ocean and form the base of the marine food web. Refer to U.S. Department of the Navy (2012) or Section 2.3.2 (Ecosystem Function) for more information. The productivity ranges for some typical global ecosystems are included in Table 3.0-3 for comparison with the values provided for large marine ecosystems. Less than 1 percent of the Study Area is in the West Greenland Shelf Large Marine Ecosystem.

Table 3.0-3: Net Primary Production for Several Ecosystem Types, for Comparison with the Primary Productivity Values Provided for Each Large Marine Ecosystem

Ecosystems (in descending order of productivity)	Net Primary Productivity g carbon/m^2/year (g carbon/m^2/day)	Large Marine Ecosystems with Equivalent Average Primary Productivity
Salt Marsh Wetland	4,100–23,000 (11.2–63.0)	None
Mangrove Wetland	3,000–14,800 (8.22–40.5)	None
Coral Reef	1,370–11,000 (3.75–30.14)	Scotian Shelf, Northeast U.S. Continental Shelf
Rain Forest	2,750–9,600 (7.53–26.3)	None
Open Ocean	5–1,100 (0.014–3.01)	West Greenland Shelf, Newfoundland-Labrador Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea

Source: Mitsch and Gosselink 1993
g: grams; m^2: square meters

3.0.3.1.2 Newfoundland-Labrador Shelf Large Marine Ecosystem

The Newfoundland-Labrador Shelf Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 261,000 nm^2 (895,000 km^2) (Aquarone and Adams 2009a).

This large marine ecosystem extends off the east coast of Canada within the Labrador Current (Aquarone and Adams 2009a). Other oceanic influences on this area are the Gulf Stream, Labrador Shelf-Slope Front, and Labrador Mid-Shelf Front. Important structural features of this ecosystem include a structurally complex seabed, 14 estuaries, and the Grand Banks, which is a rich fishing ground (Sherman and Hempel 2009). The Newfoundland-Labrador Shelf Large Marine Ecosystem supplies an important ecosystem service by providing resources for commercial fisheries (e.g., cod, haddock, and pollock). The average primary productivity within this large marine ecosystem is moderate: 809 mg of carbon per m^2/day (Aquarone and Adams 2009a). This is comparable to productivity levels associated with the open ocean (Table 3.0-3).

No specifically designated training or testing areas fall within the Newfoundland-Labrador Shelf Large Marine Ecosystem; however, training or testing may occasionally occur in this area during transit (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges). Approximately 5 percent of the Study Area is located in the Newfoundland-Labrador Shelf Large Marine Ecosystem.

3.0.3.1.3 Scotian Shelf Large Marine Ecosystem

The Scotian Shelf Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 82,500 nm^2 (283,000 km^2) (Aquarone and Adams 2009a). This large marine ecosystem is located off the coast of the Canadian province of Nova Scotia and extends to the shelf break (Aquarone and Adams 2009a). The Laurentian Channel in the north separates this large marine ecosystem from the Newfoundland-Labrador Shelf Large Marine Ecosystem. Oceanic influences in this area are the Gulf Stream, Nova Scotia Current, Cape North Front, Cabot Strait Front, Gully Front, and Shelf-Slope Front. Important structural features of this ecosystem include the St. Lawrence Estuary and the complex topography of the area, which includes deep, mid-shelf basins, and many off-shore shallow banks (Sherman and Hempel 2009). The Scotian Shelf Large Marine Ecosystem supplies an important ecosystem service by providing resources for commercial fisheries (e.g., cod, haddock, pollock, snow crab, northern shrimp, and short-finned squid). The average primary productivity within this large marine ecosystem is high: 1,395 mg of carbon per m^2/day (Aquarone and Adams 2009a). This is comparable to productivity levels associated with coral reef ecosystems (Table 3.0-3).

No specifically designated training or testing areas fall within the Scotian Shelf Large Marine Ecosystem; however, training or testing may occasionally occur in this area during transit (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges). Approximately 1 percent of the Study Area is located in the Scotian Shelf Large Marine Ecosystem.

3.0.3.1.4 Northeast United States Continental Shelf Large Marine Ecosystem

The Northeast U.S. Continental Shelf Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 90,300 nm^2 (309,700 km^2) (Aquarone and Adams 2009b). This large marine ecosystem extends from the Gulf of Maine to Cape Hatteras, North Carolina. This area includes the Gerry E. Studds Stellwagen Bank National Marine Sanctuary. For additional details on marine protected areas and national marine sanctuaries, see Section 6.1.2 (Marine Protected Areas).

Oceanic influences in this large marine ecosystem are the Gulf Stream, Cape North Front, Georges Bank Front, Maine Coastal Front, Mid-Shelf Front, Nantucket Shoals Front, and Shelf-Slope Front (Aquarone and Adams 2009b). Important structural features of this ecosystem include 28 estuaries and river systems such as Penobscot Bay/River, Hudson River, Delaware Bay/River, and Chesapeake Bay (Sherman

and Hempel 2009). This large marine ecosystem also supplies an important ecosystem service by providing resources for commercial fisheries (e.g., cod, flounder, mackerel, lobster, sea scallops, and red crab). The Northeast U.S. Continental Shelf Large Marine Ecosystem is one of the most productive large marine ecosystems in the world, with a high average primary productivity of 1,536 mg of carbon per m^2/day (Aquarone and Adams 2009b). While this is comparable to productivity levels associated with coral reef ecosystems (Table 3.0-3), a lower value of 760 mg of carbon per m^2/day was recently reported (National Marine Fisheries Service 2012).

A large proportion of Navy training and testing activities occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem. To determine which designated training and testing areas (or portions of these areas) occur within this large marine ecosystem, refer to Table 3.0-2 and Figure 3.0-2, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Approximately 2 percent of the Study Area is located in the Northeast U.S. Continental Shelf Large Marine Ecosystem.

3.0.3.1.5 Southeast United States Continental Shelf Large Marine Ecosystem

The Southeast U.S. Continental Shelf Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 87,000 nm^2 (298,000 km^2) (Aquarone 2009). This large marine ecosystem extends from Cape Hatteras, North Carolina to the Straits of Florida (Aquarone 2009). This area includes the Monitor and Gray's Reef National Marine Sanctuaries. For additional details on marine protected areas and national marine sanctuaries, see Section 6.1.2 (Marine Protected Areas).

Oceanic influences in this large marine ecosystem are the Gulf Stream, Inshore Gulf Stream Front, Mid-Shelf Front, and Offshore Gulf Stream Front. Important structural features of this ecosystem include many types of habitat such as coral reefs, estuaries, barrier islands, and coastal marshes (Sherman and Hempel 2009). The calving grounds for the North Atlantic right whale are located in this large marine ecosystem, as discussed in Section 3.4 (Marine Mammals). The Southeast U.S. Continental Shelf Large Marine Ecosystem supplies important ecosystem services by providing resources for commercial fisheries (e.g., mackerel, swordfish, tuna, white shrimp, brown shrimp) and by supporting these fisheries with estuarine nurseries for these species. The Southeast U.S. Continental Shelf Large Marine Ecosystem includes important breeding areas for sea turtles. This large marine ecosystem is a moderately productive ecosystem, with an average primary productivity of 721 mg of carbon per m^2/day (Aquarone 2009). This is comparable to productivity levels associated with the open ocean (Table 3.0-3).

A large proportion of Navy training and testing activities occur in the Southeast U.S. Continental Shelf Large Marine Ecosystem. To determine which designated training and testing areas (or portions of these areas) occur within this large marine ecosystem, refer to Table 3.0-2 and Figure 3.0-3, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Approximately 2 percent of the Study Area is located in the Southeast U.S. Continental Shelf Large Marine Ecosystem.

3.0.3.1.6 Gulf of Mexico Large Marine Ecosystem

The Gulf of Mexico Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 430,000 nm^2 (1,475,000 km^2) (Heileman and Rabalais 2009). This large marine ecosystem is a semi-enclosed sea that borders the United States, Mexico, and Cuba. This area includes the Florida Keys and Flower Garden Banks National Marine Sanctuaries. For additional details on marine protected areas and national marine sanctuaries, see Section 6.1.2 (Marine Protected Areas).

Oceanic influences in this large marine ecosystem are the Loop Current, Campeche Bank Coastal Front, Campeche Bank Shelf-Slope Front, Inner Shelf Front, Louisiana-Texas Shelf Front, and West Florida Shelf Front. Important structural features of this ecosystem include the extensive continental shelf, numerous estuaries, and a large amount of freshwater input from the Mississippi River (Sherman and Hempel 2009). The Gulf of Mexico Large Marine Ecosystem supplies an important ecosystem service by providing resources for commercial fisheries (e.g., Gulf menhaden, king mackerel, red grouper, brown shrimp, white shrimp, and pink shrimp). This large marine ecosystem has a low average primary productivity of 201 mg of carbon per m^2/day (Heileman and Rabalais 2009). This is comparable to productivity levels associated with the open ocean (Table 3.0-3). Other human uses in this large marine ecosystem include off-shore oil and gas exploration. The oil spill from BP's *Deepwater Horizon* occurred in the Gulf of Mexico between April and August 2010.

A large proportion of Navy training and testing activities occur in the Gulf of Mexico Large Marine Ecosystem. To determine which designated training and testing areas (or portions of these areas) occur within this large marine ecosystem, refer to Table 3.0-2 and Figure 3.0-4, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Approximately 13 percent of the Study Area is located in the Gulf of Mexico Large Marine Ecosystem.

3.0.3.1.7 Caribbean Sea Large Marine Ecosystem

The Caribbean Sea Large Marine Ecosystem (Figure 3.0-1) encompasses an area of approximately 960,000 nm^2 (3,290,000 km^2). This large marine ecosystem is bordered by the southern part of Florida, Central and South America, and the Antilles (Heileman and Mahon 2009). Oceanic influences in this area are the Loop Current, North Equatorial Current, and Windward Passage Front. Important structural features of this ecosystem include coral reefs, sea mounts, and major input of freshwater from large rivers (Sherman and Hempel 2009). The Caribbean Sea Large Marine Ecosystem supplies an important ecosystem service by providing resources for commercial fisheries (e.g., king mackerel, Spanish mackerel, dolphinfish, spiny lobster, queen conch, and shrimp). The Caribbean Sea Large Marine Ecosystem includes important breeding areas for sea turtles, as discussed in Section 3.5 (Sea Turtles). This region has a low average primary productivity of 478 mg of carbon per m^2/day (Heileman and Mahon 2009). This is comparable to productivity levels associated with the open ocean (Table 3.0-3).

To determine which designated training and testing areas (or portions of these areas) occur within the portion of the Caribbean Sea Large Marine Ecosystem that falls within the Study Area, refer to Table 3.0-2 and Figures 3.0-3 and 3.0-4, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Approximately 1 percent of the Study Area is located in the Caribbean Sea Large Marine Ecosystem.

3.0.3.1.8 Labrador Current Open Ocean Area

The Labrador Current Open Ocean Area (Figure 3.0-1) lies between Labrador (Canada) and Greenland, and is characterized by the cold water of the Labrador Current that flows north to south from the Arctic Ocean, down along the eastern coast of Canada (Reverdin et al. 2003). The Labrador Current then joins the Gulf Stream Current to form the North Atlantic Current (Gould 1985; Reverdin et al. 2003). The Labrador Current has an average width of 26 to 50 nm, with typical velocities of 1.0 to 1.6 feet per second (ft./s) (0.3 to 0.5 meters per second [m/s]), and flows to a maximum depth of 500 ft. (150 m) (Halkin and Rossby 1985; Reverdin et al. 2003; Tomczak and Godfrey 2003).

The Arctic influence, combined with the southward-flowing current, results in an abundance of icebergs in this open ocean area, particularly during the spring and early summer months (Reverdin et al. 2003;

Schmitz and McCartney 1993; Tomczak and Godfrey 2003). The cold-water Labrador Current influences the species assemblages found within this open ocean area (Valiela 1995). However, farther south where this cold water current combines with the warm waters of the Gulf Stream (offshore of the Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems), the species assemblage reflects both warm- and cold-water organisms (Aquarone 2009; Aquarone and Adams 2009a; Valiela 1995). The Labrador Current Open Ocean Area is an important feeding and migration area for the Gulf of Maine Atlantic salmon (Fay et al. 2006).

No specifically designated training or testing areas fall within the Labrador Current Open Ocean Area; however, training or testing may occasionally occur in this area during transit (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges). Approximately 10 percent of the Study Area is located in the Labrador Current Open Ocean Area.

3.0.3.1.9 Gulf Stream Open Ocean Area

The major western boundary current of the North Atlantic, the Gulf Stream, characterizes the Gulf Stream Open Ocean Area (Figure 3.0-1). The Gulf Stream forms where the Loop Current in the Gulf of Mexico (Reverdin et al. 2003) and the Florida Current (Atkinson et al. 1984) combine in the Atlantic Ocean. The Gulf Stream begins where the Florida Current ceases to follow the continental shelf, flowing northeast along the southeastern United States from Cape Canaveral, Florida, to Cape Hatteras, North Carolina (Atkinson and Targett 1983). As the Gulf Stream moves away from Cape Hatteras it flows northeast toward Europe (Garrison 1998).

The Gulf Stream has a maximum width of 108 miles (mi.) (200 kilometers [km]), with typical velocities exceeding 3.3 ft./s (1.0 m/s), and flows to a maximum depth of 660 ft. (200 m) (Halkin and Rossby 1985; Reverdin et al. 2003; Tomczak and Godfrey 2003). The Gulf Stream flows over the shelf break south of 32° N at water depths less than 2,950 ft. (800 m) (Atkinson et al. 1984; Halkin and Rossby 1985). North of 32° N, the Gulf Stream is displaced 54 nm offshore, at which point it abruptly turns east near the Charleston Bump (a deep-water outcropping) (Reverdin et al. 2003). From there, the Gulf Stream continues northeast, joining the Labrador Current to form the Slope Jet Current at 41° N–42° N. This branch of the Gulf Stream, along with the Labrador and Slope Jet Current, continues northeast as the North Atlantic Current (Gould 1985; Reverdin et al. 2003).

The Gulf Stream is an important migratory corridor for many different marine species, including marine mammals, sea turtles, and fishes. The influence of the warm waters of the Gulf Stream also provides passive dispersal of tropical species from southern portions of the Study Area into the northern portions of the Study Area.

A large proportion of Navy training and testing activities occur in this open ocean area. To determine which designated training and testing areas (or portions of these areas) occur within the Gulf Stream Open Ocean Area, refer to Table 3.0-2 and Figures 3.0-2 and 3.0-3, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Approximately 11 percent of the Study Area is located in the Gulf Stream Open Ocean Area.

3.0.3.1.10 North Atlantic Gyre Open Ocean Area

North Atlantic Ocean circulation is driven by the anticyclonic (clockwise) motion of the North Atlantic Subtropical Gyre (Figures 3.0-1, 3.0-2, and 3.0-3). The North Atlantic Gyre Open Ocean Area occurs from 10° N to 40° N and is delimited by the westward-flowing Canary Current, North Equatorial Current, the

Caribbean Current, Loop Current in the Gulf of Mexico, Florida Current, Gulf Stream (Talwani et al. 1971), and the eastward-flowing North Atlantic Current (Schmitz and McCartney 1993). The North Atlantic Subtropical Gyre is transected by the eastward-flowing Azores Current (Juliano and Alves 2007). Only the northwestern portion of the North Atlantic Gyre is located in the Study Area. The North Atlantic Gyre, like all large subtropical gyres in the ocean, has extremely low rates of primary productivity (Valiela 1995). The observed low productivity is caused by a persistent thermocline (a layer of water that separates warm water from cold deep water) that prevents the vertical mixing of water. This thermocline results in dilute (nutrient-poor) surface waters in the gyre, which limits the growth of phytoplankton throughout the year (Valiela 1995). The Sargasso Sea is a unique feature contained within this gyre, and despite the nutrient limitations of the area, is characterized by dense mats of floating *Sargassum*, a type of marine vegetation (seaweed) that provides important cover habitat for a variety of marine organisms (see Section 3.7 [Marine Vegetation] for more details).

To determine which designated training and testing areas (or portions of these areas) occur within the North Atlantic Gyre Open Ocean Area, refer to Table 3.0-2 and Figures 3.0-2 and 3.0-3, and for more information on the types of activities that will occur in an ecosystem, refer to Tables 2.8-1 through 2.8-3. Although approximately 50 percent of the Study Area is located in the North Atlantic Gyre Open Ocean Area, the majority of Navy training and testing activities do not occur here.

3.0.3.2 Bathymetry

This section provides a description of the bathymetry (water depth) of the Study Area. Given that the bathymetry of an area reflects the topography (surface features) of the seafloor, it is an important factor in understanding the potential impacts of Navy training and testing activities on the seafloor, the propagation of underwater sound (Section 3.0.4.4.1, Sound Attenuation and Transmission Loss), and species diversity (see Sections 3.3, Marine Habitats–3.9, Fish). The discussion of bathymetry includes a general overview of the Study Area followed by more detailed sections organized by biogeographic classification area. Table 3.0-4 provides a description of the bathymetry of Navy training and testing areas within each large marine ecosystem and open ocean area.

Table 3.0-4: Summary of Bathymetry within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas

Range/Component	Description	General Bathymetry
West Greenland Shelf Large Marine Ecosystem		
No Navy designated training or testing areas fall within this large marine ecosystem.[1]	Located off the southwest coast of Greenland	Depth ranges from 25 to 2,000 m
Newfoundland-Labrador Shelf Large Marine Ecosystem		
No Navy designated training or testing areas fall within this large marine ecosystem.[1]	Located off the coast of Newfoundland and Labrador, Canada in part of the Labrador current	Depth ranges from 25 to 2,000 m
Scotian Shelf Large Marine Ecosystem		
No Navy designated training or testing areas fall within this large marine ecosystem.[1]	Located off the coast of Nova Scotia	Depth ranges from 25 to 2,000 m

m: meters

[1] This Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) would provide the flexibility for Navy to conduct specific training and testing activities, or vessel transits, within the entire Study Area (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges).

Table 3.0-4: Summary of Bathymetry Features within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas (Continued)

Range/Component	Description	General Bathymetry
Northeast U.S. Continental Shelf Large Marine Ecosystem		
OPAREAs		
Boston (part of Northeast Range Complexes)	Located largely in the Gulf of Maine, but also in Cape Cod and Massachusetts Bays	Average depth of the Gulf of Maine is 150 m. Depth ranges from 1 to 292 m
Narragansett Bay (part of Northeast Range Complexes)	Located east of Narragansett Bay	Depth ranges from 1 to 1,596 m
Atlantic City (part of Northeast Range Complexes)	Located mostly over the continental shelf	Depth ranges from 8 to 1,728 m
Virginia Capes (part of VACAPES)	Located along the coast from Delaware to North Carolina; ranges in width from 24 nm off Cape Hatteras to about 87 nm off Delaware Bay	Depth ranges from 5 to 2,100 m
Testing Ranges		
Naval Undersea Warfare Center Division, Newport	Includes shallow estuarine waters of Buzzards Bay, Vineyard Sound, Narragansett Bay, Rhode Island Sound, Block Island Sound, and Long Island Sound	Depths range from 18 to 55 m
Naval Ports and Naval Shipyards		
Portsmouth Naval Shipyard; Kittery, ME	Located on Seavey's Island in an estuary 2.1 nm up the Piscataqua River from the open ocean	Depth ranges from 6 to 16 m in the immediate vicinity of the facility
Naval Submarine Base New London; Groton, CT	Located on Thames River 2.1 nm up river from Long Island Sound	Depth ranges from 5 to 12 m in the immediate vicinity of the facility
Naval Station Norfolk; Norfolk, VA	Located near the mouth of the Chesapeake Bay	Depth ranges from 2 to 13 m in the immediate vicinity of the facility
Joint Expeditionary Base Little Creek—Fort Story; Virginia Beach, VA	Located near the mouth of the Chesapeake Bay	Depth ranges from 3 to 7 m in the immediate vicinity of the facility
Norfolk Naval Shipyard; Portsmouth, VA	Located on the Elizabeth River near the mouth of the Chesapeake Bay	Depth ranges from 1 to 15 m in the immediate vicinity of the facility
Navy Contractor Shipyards		
Bath, ME	Located on Kennebec River estuary 10 nm up river from the ocean; shallow system of estuarine channels	Depth ranges from 5 to 14 m in the immediate vicinity of the facility
Groton, CT	Located on Thames River 2.1 nm up river from Long Island Sound	Depth ranges from 5 to 12 m in the immediate vicinity of the facility
Newport News, VA	Located 9.7 nm from an open-ocean inlet within the Chesapeake Bay	Depth ranges from 6 to 15 m in the immediate vicinity of the facility
Bays and Inland Waters		
Sandy Hook Bay; Earle, NJ	Located in Sandy Hook Bay, NJ	Depth ranges from 1 to 13 m in the immediate vicinity of the facility
Lower Chesapeake Bay; Hampton Roads, VA	Estuarine waters located in the southern portion of Chesapeake Bay	The average depth is 6.4 m, depth range is from 1 to 30 m

CT: Connecticut; m: meter(s); ME: Maine; NJ: New Jersey; VA: Virginia; VACAPES: Virginia Capes Range Complex

Table 3.0-4: Summary of Bathymetry Features within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas (Continued)

Range/Component	Description	General Bathymetry
Event Locations		
Narragansett Bay Restricted Area	Located in Narragansett Bay between Conanicut and Prudence Islands	Depth ranges from 6 to 15 m
Rhode Island Sound Restricted Area	Located 3 nm east of Point Judith	Depth ranges from 30 to 36 m
Coddington Cove Restricted Area	Located in a cove on the west coast of Aquidneck Island, RI	Depth ranges from 8 to 9 m
Cape Cod TORPEX Boxes	Located east of Cape Cod within and adjacent to the Boston OPAREA	Depth ranges from 30 to 150 m
MIW Range	Located 25 nm east of the mouth of Chesapeake Bay	Depth ranges from 25 to 50 m
1C-1 and 1C-2	Located 75 nm east of the mouth of Chesapeake Bay	Depth ranges from 100 to 130 m
7-C, 7-D, 8-C, and 8-D	Located 25 nm east of the mouth of Chesapeake Bay	Depth ranges from 25 to 50 m
Warning Area 50 (W-50)	Located 7 nm from the mouth of the Chesapeake Bay	Depth ranges from 10 to 20 m
Restricted Area 6606 (R-6606)	Located 7 nm from the mouth of the Chesapeake Bay; borders the western limit of W-50	Depth is less than 10 m
Ship Shock Trial Locations	Located 75 nm east of the mouth of Chesapeake Bay	Depth ranges from 182 to 2,700 m
Southeast U.S. Continental Shelf Large Marine Ecosystem		
OPAREAs		
Cherry Point (part of Navy Cherry Point Range Complex)	Located off the coast of North Carolina	Depth ranges from 2 to 2,194 m
Charleston (part of JAX)	Located off the coast of North and South Carolina	Depth ranges from 2 to 1,050 m
Jacksonville (JAX)	Located off the coasts of Georgia and northern Florida	Depth ranges from 2 to 2,613 m
Testing Ranges		
South Florida Ocean Measurement Facility	Located off the coast of Port Everglades, FL	Depth ranges from 1 to 762 m
Naval Ports and Naval Shipyards		
Naval Submarine Base Kings Bay; Kings Bay, GA	Located 7 nm from an open-ocean inlet on the St. Mary's River and King's Bay	Depth ranges from 0.6 to 14 m in the vicinity of the facility. Shallow estuarine channel located close to the open ocean
Naval Station Mayport; Jacksonville, FL	Located 0.86 nm from an open-ocean inlet on the St. John's River	Depth ranges from 5 to 12 m in the vicinity of the facility
Port Canaveral, FL	Shallow dredged port located on the Banana River and connected to the open ocean 3 nm to the east	Depth ranges from 9 to 12 m in the dredged channels of the facility

FL: Florida; GA: Georgia; JAX: Jacksonville Range Complex; m: meter(s); MIW: mine warfare; RI: Rhode Island; TORPEX: torpedo exercise; W: warning area

Table 3.0-4: Summary of Bathymetry Features within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas (Continued)

Range/Component	Description	General Bathymetry
Bays and Inland Waters		
Beaufort Inlet Channel; Morehead City, NC	Located in estuarine waters adjacent to Bogue Sound	Depth ranges from 5 to 10 m
Cape Fear River; Wilmington, NC	This area includes the Cape Fear River and Cape Fear Estuary	Shallow with channel depths of up to 13 m
Event Locations		
Onslow Beach; Camp Lejeune, NC	Located in Onslow Bay area; 4 nm long	Shallow, sandy beach area
UNDET Onslow	Located off the coast of Onslow Beach; Camp Lejeune, NC	Depth ranges from 10 to 30 m
ARG MTA	Located off the coast of Onslow Beach; Camp Lejeune, NC	Depth ranges from 10 to 20 m
W-122 (16, 17)	Located off the coast of Onslow Beach; Camp Lejeune, NC	Depth ranges from 25 to 30 m
Charleston UNDET North and South	Located 12 nm off the coast of South Carolina	Depth ranges from 10 to 20 m
Seminole Beach; Naval Station Mayport, Jacksonville, FL	Located at the mouth of St. John's River, which flows into the Atlantic; the length is less than 2 nm	Shallow, sandy beach
CSG MTA	Located 60 nm east of Charleston, SC	Depth ranges from 25 to 165 m
Surface Gunnery Areas AA, BB, CC	Located east of the border between Georgia and Florida, 25 nm off the coast	Depth ranges from 20 to 680 m
MLTR	Located east of the border between Georgia and Florida, approximately 25 nm off the coast	Depth ranges from 20 to 680 m
Undersea Warfare Training Range	Located approximately 50 nm east of Jacksonville, FL	Depth ranges from 20 to 680 m
Ship Shock Trial Locations	Located approximately 90 nm east of the southern part of Georgia and northern part of Florida	Depth ranges from 182 to 800 m
Gulf of Mexico Large Marine Ecosystem		
OPAREAs		
Key West (part of Key West Range Complex)	Located approximately 50 nm southwest of the southern tip of Florida	Depth ranges from 15 to 1,651 m
Panama City (part of GOMEX)	Located off the coast of the Florida panhandle	Depth ranges from 2 to 328 m
Pensacola (part of GOMEX)	Located off the coast of Alabama and Florida panhandle	Depth ranges from 9 to 2,152 m

ARG MTA: amphibious readiness group mine training area; CSG MTA: carrier strike group mine training area; FL: Florida; GOMEX: Gulf of Mexico Range Complex; m: meters; MLTR: missile laser training range; NC: North Carolina; SC: South Carolina; UNDET: underwater detonation; W: warning area

Table 3.0-4: Summary of Bathymetry Features within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas (Continued)

Range/Component	Description	General Bathymetry
OPAREAs		
New Orleans (Part of GOMEX)	Most of the OPAREA is located beyond the shelf break	Depth ranges from 72 to 2,365 m
Corpus Christi (Part of GOMEX)	The shelf break runs through the middle of the area	Depth ranges from 11 to 1,433 m
Testing Ranges		
Naval Surface Warfare Center, Panama City Division	Located offshore of the Florida panhandle and Alabama. Most of the area is located on the continental shelf in waters less than 200 m.	Average depth is more than 1,000 m, and the maximum depth is 3,000 m
Navy Contractor Shipyards		
Pascagoula, MS	Deep water port located at Pascagoula Bay	Depth ranges from 3 to 17 m in the dredged channels of the facility
Bays and Inland Waters		
St. Andrew Bay, FL	Estuarine bay near Panama City, Florida	Depth ranges from 2 to 12 m in the dredged channels of the bay. Average depth is 4 m
Sabine Lake; Beaumont, TX	Estuary on the Texas and Louisiana border	Depth ranges from 1 to 3 m
Corpus Christi Bay; Corpus Christi, TX	Estuary separated from the Gulf of Mexico by Padre Island	Depth ranges from 0.3 to 4.5 m
Routine Event Locations		
Gulf of Mexico	Ocean basin bound by U.S. Gulf coast states and Mexico	Depth ranges from 0 to 4,000 m
W-155 Hotbox	Located in the eastern half of the OPAREA 22 nm from the coast	Depth ranges from 30 to 304 m
Corpus Christi UNDET E3	Located 9 nm from the coast on the continental shelf	Depth ranges from 10 to 90 m
Caribbean Sea Large Marine Ecosystem		
OPAREA		
Key West (part of Key West Range Complex)	Located approximately 50 nm southwest of the southern tip of Florida	Depth ranges from 2 to 2,010 m
Labrador Current Open Ocean Area		
No Navy-designated training or testing areas fall within this open ocean area.[1]	Located between south Greenland and Labrador, Canada	Depth ranges from 150 to 4,000 m
Gulf Stream Open Ocean Area		
OPAREAs		
Narragansett Bay (part of Northeast Range Complexes)	Located east of Narragansett Bay	Depth ranges from 142 to 3,915 m

EIS/OEIS: Environmental Impact Statement/Overseas Environmental Impact Statement; FL: Florida; m: meter(s); OPAREA: operating area; TX: Texas; UNDET: underwater detonation

[1] This EIS/OEIS would provide the flexibility for Navy to conduct specific training and testing activities, or vessel transits, within the entire Study Area (see Chapter 2 [Description of Proposed Action and Alternatives] for locations of activities within and outside of designated training and testing ranges).

Table 3.0-4: Summary of Bathymetry Features within Large Marine Ecosystems and Open Ocean Areas in Navy Training and Testing Areas (Continued)

Range/Component	Description	General Bathymetry
OPAREAs		
Atlantic City (Part of Northeast Range Complexes)	Located mostly over the continental shelf	Depth ranges from 753 to 2,627 m
CGULL OPAREA (Part of Northeast Range Complexes)	Located off the southern side of Georges Bank, a shallow underwater plateau	Depth is approximately 1,088 to 4,670 m
Virginia Capes (Part of VACAPES)	Located off the coast from Delaware to North Carolina	Depth ranges from 170 to 4,362 m
Cherry Point (Part of Navy Cherry Point Range Complex)	Located off the coast of North Carolina	Depth ranges from 300 to 4,124 m
Charleston (Part of JAX)	Located off the coasts of North and South Carolina	Depth ranges from 951 to 2,403 m
Jacksonville (Part of JAX)	Located off the coasts of South Carolina, Georgia, and Florida	Depth ranges from 912 to 2,786 m
Event Locations		
W-122 (13, 14)	Located less than 80 nm off the coast of North Carolina	Depth ranges from 20 to 30 m
W-122 (4, 5)	Located less than 80 nm off the coast of North Carolina	Depth ranges from 25 to 35 m
SINKEX Box	Northwest edge located 200 nm east of the border between Virginia and North Carolina; southwest edge located 200 nm southeast of Cape Fear, NC	Depth ranges from 3,100 to 5,000 m
Ship Shock Trial Locations	Located approximately 75 nm east of the mouth of Chesapeake Bay	Depth ranges from 100 to 130 m
North Atlantic Gyre Open Ocean Area		
OPAREA		
CGULL (Part of Northeast Range Complexes)	Located off the southern side of Georges Bank, a shallow underwater plateau	Depth is approximately 4,598 to 4,863 m
Routine Event Locations		
SINKEX Box	Northwest edge located 200 nm east of the border between Virginia and North Carolina; southwest edge located 200 nm southeast of Cape Fear, NC	Depth ranges from 3,800 to 5,400 m

Sources: (National Oceanic and Atmospheric Administration 2001; Navy Research Laboratory 2011). National Oceanic and Atmospheric Administration nautical charts were also reviewed to determine depth ranges at specific locations. Some "pierside activities" listed as taking place at these locations actually take place away from the coastal areas and are located inside ranges.

JAX: Jacksonville Range Complex; m: meters; NC: North Carolina; OPAREA: operating area; SINKEX: sinking exercise; VACAPES: Virginia Capes Range Complex; W: warning area

The contour of the ocean floor as it descends from the shoreline has an important influence on the distribution of organisms, as well as the structure and function of marine ecosystems (Madden et al. 2009). The continental shelf and slope make up the continental margin of oceans. The typical zonation of oceans is shown in Figure 3.0-5. The continental shelf gently slopes seaward hundreds of miles from shore from the low tide line to a maximum depth of 200 m (Tomczak and Godfrey 2003; United Nations Educational Scientific and Cultural Organization 2009). The continental slope is steep; it begins seaward of the shelf break and extends to a depth of approximately 3,000 m. The continental rise extends from the continental slope to a depth of approximately 4,000 m. The abyssal zone, a relatively flat or gently sloping ocean floor, continues from the continental rise to depths of up to approximately 6,500 m. The abyssal zones of the Atlantic Ocean reach depths greater than 6,000 m. Bathymetry of the entire Study Area is shown in Figures 3.0-6 through 3.0-9.

Bathymetric features associated with the continental margin and the deep seafloor of the Study Area include canyons, seamounts (underwater mountains), trenches, ridges, and plateaus. The continental shelf of the northwest Atlantic ranges in width from 5 to 17 nm at its narrowest point off the coast of North Carolina to 215 nm at its widest point off the coast of Newfoundland (Blanton et al. 2003; Slatt 1984).

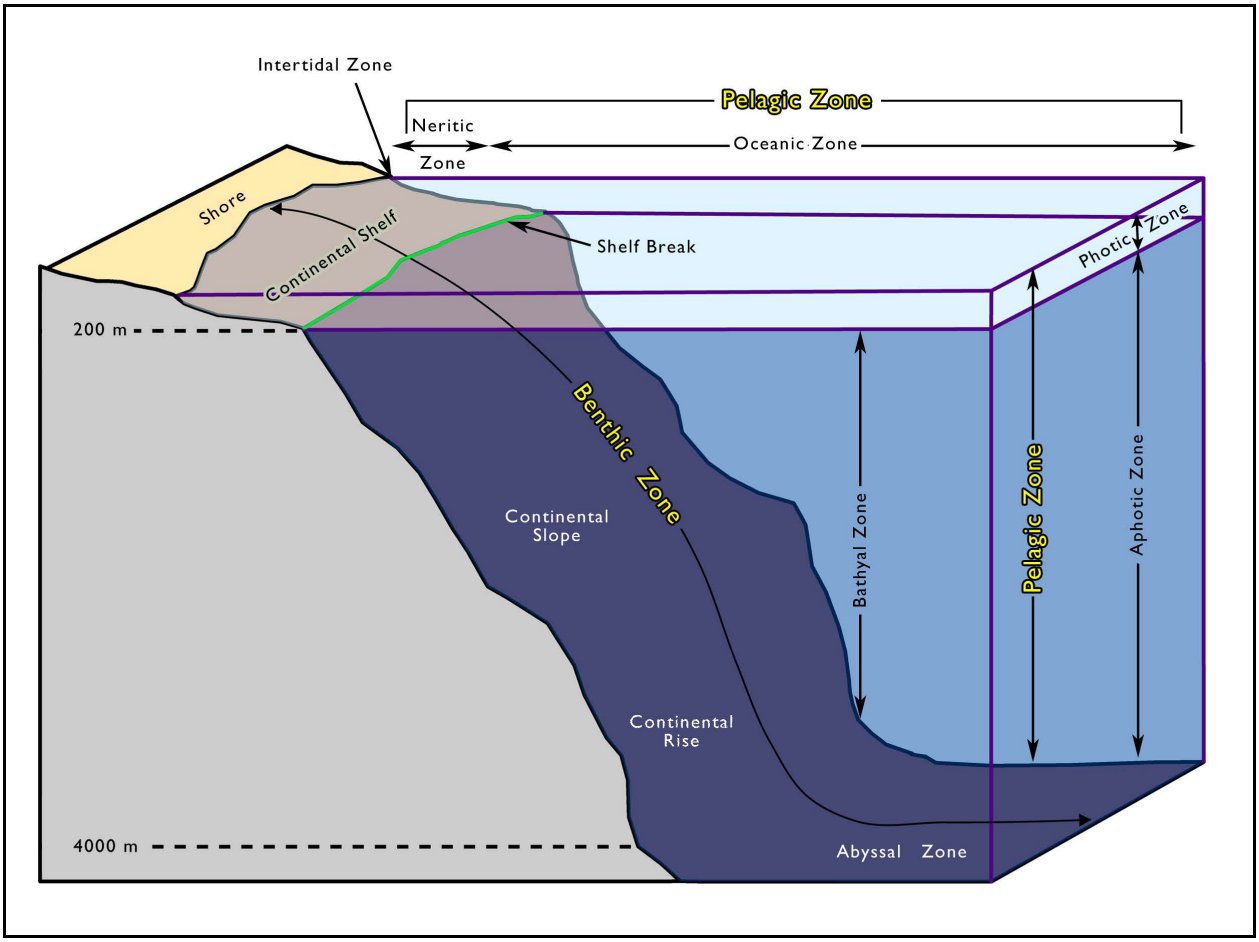

Figure 3.0-5: Three-Dimensional Representation of the Intertidal Zone (shoreline), Continental Margin, Abyssal Zone, and Water Column Zones
(U.S. Department of the Navy 2007)

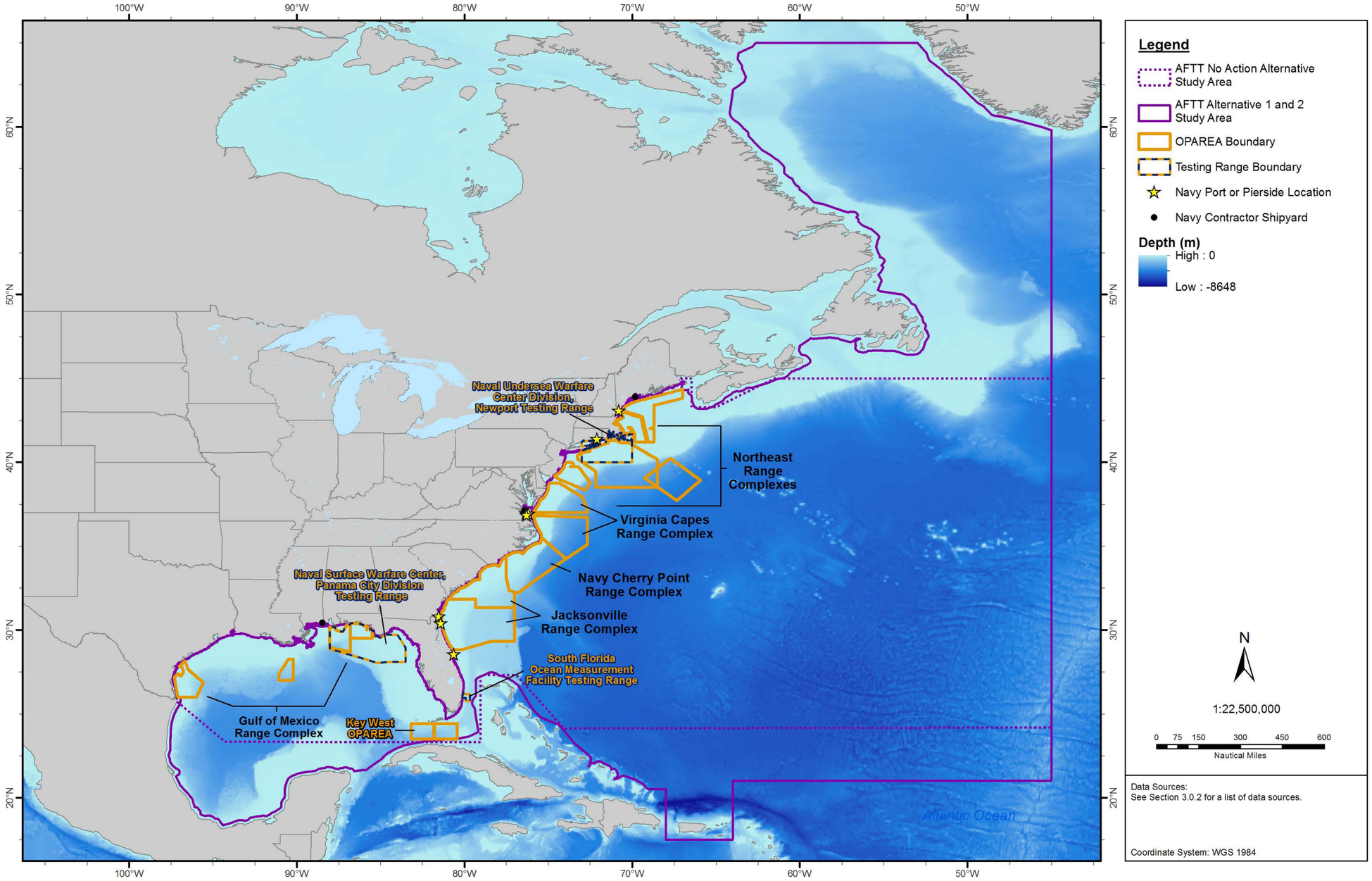

Figure 3.0-6: Bathymetry of the Entire Study Area
AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

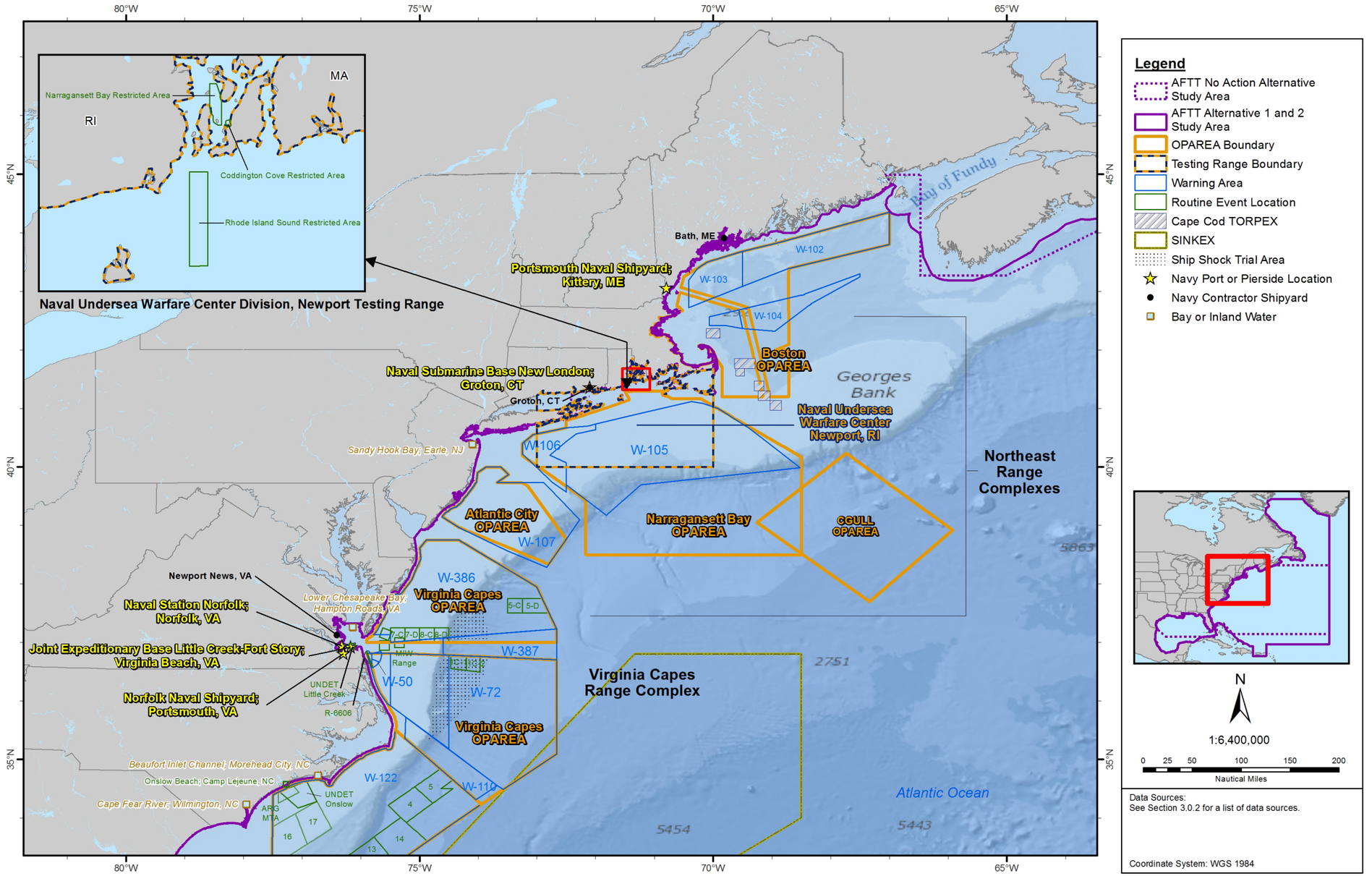

Figure 3.0-7: Bathymetry of the Northeast Portion of the Study Area

AFTT: Atlantic Fleet Training and Testing; ARG: Amphibious Readiness Group; CT: Connecticut; MA: Massachusetts; ME: Maine; MIW: Mine Warfare; MTA: Mine Training Area; NC: North Carolina; NJ: New Jersey; OPAREA: Operating Area; RI: Rhode Island; SINKEX: Sinking Exercise; TORPEX: Torpedo Exercise; UNDET: Underwater Detonation; VA: Virginia

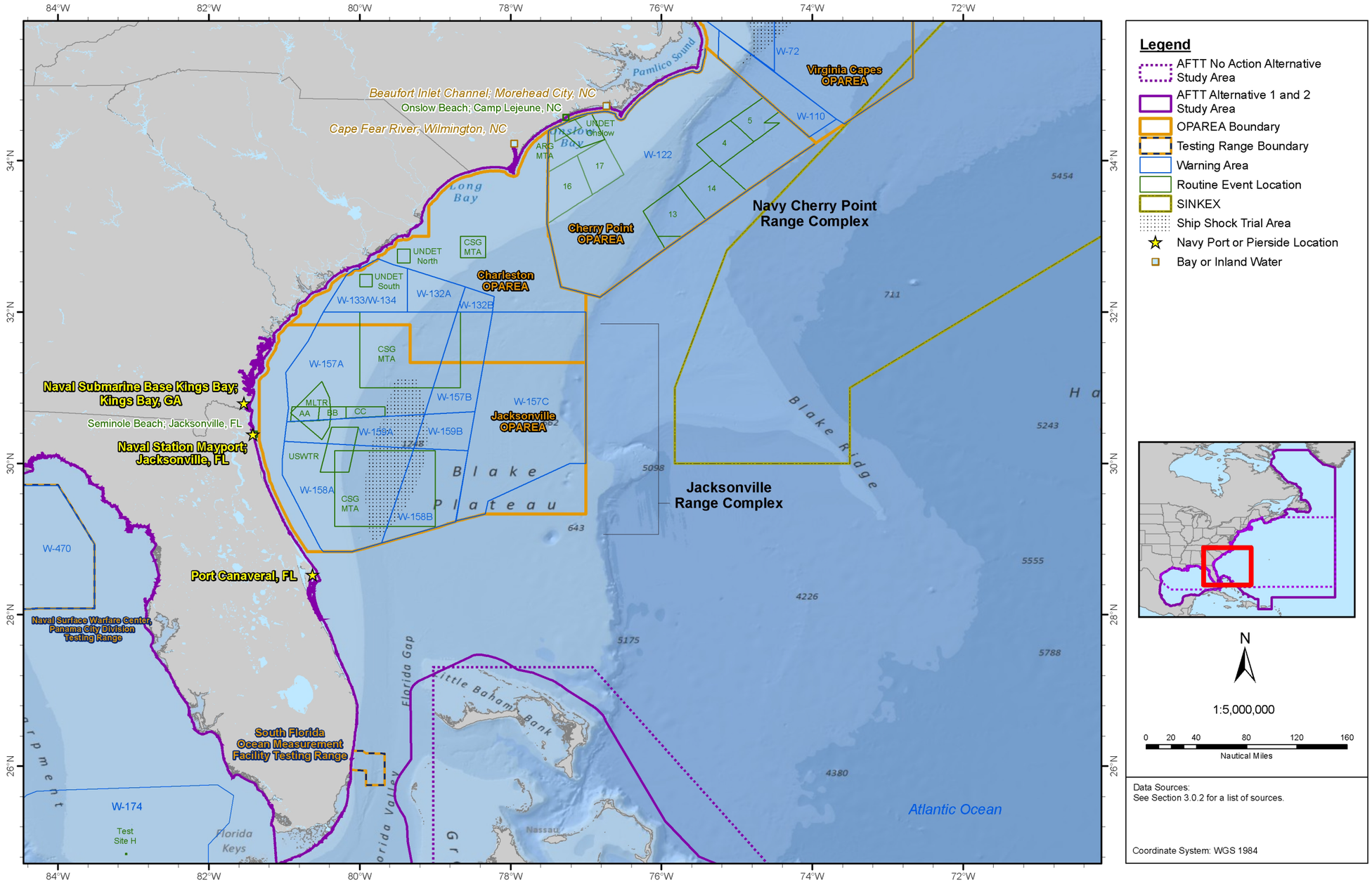

Figure 3.0-8: Bathymetry of the Southeast and Caribbean Portions of the Study Area

AFTT: Atlantic Fleet Training and Testing; ARG: Amphibious Readiness Group; CSG: Carrier Strike Group; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MTA: Mine Training Area; OPAREA: Operating Area; RI: Rhode Island; SINKEX: Sinking Exercise; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range; VACAPES: Virginia Capes

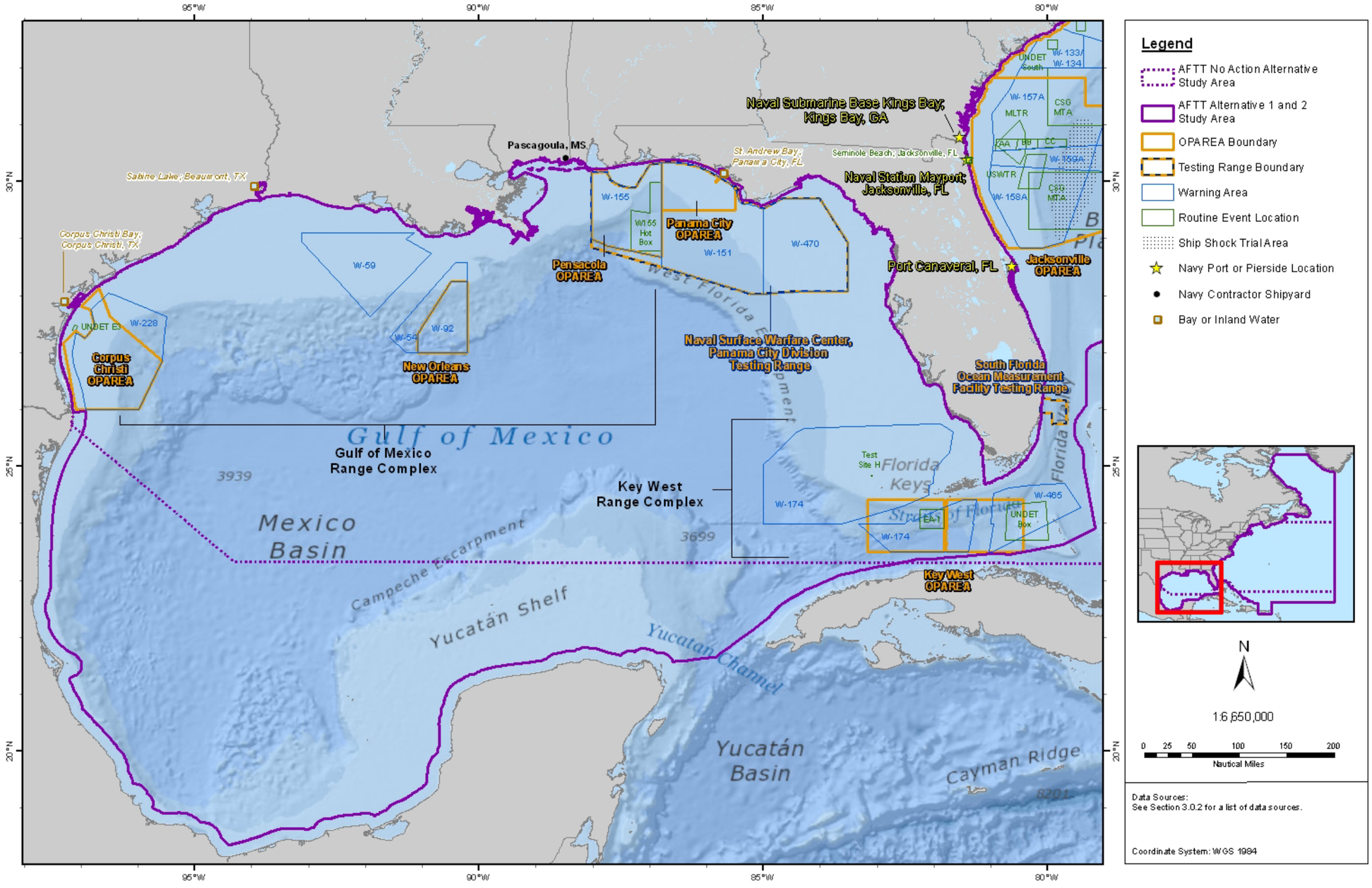

Figure 3.0-9: Bathymetry of the Gulf of Mexico and Caribbean Sea Portions of the Study Area

AFTT: Atlantic Fleet Training and Testing; CSG:Carrier Strike Grou ; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MS: Mississippi; MTA: Mine Training Area; OPAREA: Operating Area; TX: Texas; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

Several bathymetric features are located in the Northeast U.S. Continental Shelf, the Scotian Shelf, and the Newfoundland-Labrador Shelf Large Marine Ecosystems. The Grand Banks are a group of shallow underwater plateaus on the eastern extent of the continental shelf in 25 to 100 m of water. South of the Grand Banks is the Newfoundland Rise, at 41° N, 50° W and the northernmost extent of the New England Seamount Chain (Reverdin et al. 2003). This chain includes more than 30 volcanic seamounts that extend south to Bermuda.

The Scotian Shelf extends 60 to 117 nm off the east coast of Nova Scotia (Slatt 1984). The continental shelf is relatively shallow, with an average depth of 90 m. However, in some areas it rapidly drops to depths greater than 3,000 m (Parks Canada - National Marine Conservation Areas of Canada 2010). Sable Island, located 160 nm southeast of Halifax, is surrounded by shallow banks (25 to 100 m).

The Gulf of Maine is a semi-enclosed continental sea with an area of 26,000 nm^2 (89,000 km^2) and average depth of 150 m (Ballard and Uchupi 1974). It is characterized by rocky shorelines of exposed bedrock from previous glacial scouring. Inland of the Gulf of Maine is the Bay of Fundy. It covers 4,810 nm^2 (16,500 km^2) with an average depth of 50 m (Wade et al. 1996). The Bay of Fundy and Gulf of Maine are known for having extreme tidal ranges as great as 15 m (Wade et al. 1996).

The Southeast U.S. Continental Shelf Large Marine Ecosystem includes the coastal area from southern Florida to Cape Hatteras, North Carolina (Shepard 2005). It includes the topographic feature known as the Blake Plateau, which covers 66,400 nm^2 (227,750 km^2) in water depths of 500 to 1,100 m (Popenoe and Manheim 2001). The Blake Plateau is bounded by the continental shelf on the west, Cape Hatteras on the north, the Bahama Banks on the south, and the abyssal plain on the east (Gorsline 1963; Popenoe and Manheim 2001). The Charleston Bump, a rocky, high-relief outcrop, occurs on the Blake Plateau between latitude 31° N and 32° N, and between longitude 77.5° W and 79.5° W (Popenoe and Manheim 2001). The continental shelf in this area gently slopes to 55 m (Atkinson et al. 1984), while the continental slope reaches depths of 1,400 m (Knebel 1984). Portions of the continental slope in this area are associated with deep-water coral communities at depths of 70 to 1,000 m (Reed and Ross 2005). At the boundary between the Northeast U.S. Continental Shelf and the Southeast U.S. Continental Shelf, the continental slope is divided by Hatteras Canyon, the most southerly canyon along the continental margin of the U.S. east coast. Offshore of Hatteras Canyon, the continental slope is steep and reaches 5,000 m (Rowe 1971). Other notable features are large sand shoals that extend from the barrier islands off North Carolina (Hunt et al. 1977; Oertel 1985).

The average depth of the Gulf of Mexico is 1,615 m, with a maximum depth of 3,850 m (Pequegnat et al. 1990). Dominant features of the Gulf of Mexico include the Sigsbee Escarpment (steep slope) and the Alaminos and Keathley Canyons, which divide the escarpment into western and eastern portions (Roberts et al. 2005). The eastern Gulf of Mexico is dominated by the Florida Escarpment, which is divided by a series of submarine canyons and contains more than 90 basins (Rowe and Kennicutt 2002). The western portion is underlain by the Louann Salt Formation, which creates faults and diapirs (salt domes) often associated with hydrocarbon seeps along the faults. Dominant features in the southern portion of the Gulf of Mexico are the Campeche Escarpment and the Mexican Ridge, which consists of a series of valleys and ridges (Escobar-Briones et al. 2008).

3.0.3.3 Currents, Circulation Patterns, and Water Masses

To analyze the impact of Navy training and testing activities on marine resources (e.g., vegetation and animals) it is important to know where they occur in the Study Area. Some of the major factors that influence the distribution of marine resources are currents, circulation patterns, and water masses.

Prevailing winds and the Coriolis effect (the deflection of objects caused by the rotation of the earth) cause surface waters to move in a gyre, or circular fashion, in ocean basins. In the North Atlantic Ocean, this gyre system is composed of the Gulf Stream, North Atlantic, Canary, and Equatorial Currents. In the Gulf of Mexico, the Florida Current is a strong, east-northeast-flowing current that connects the Loop Current to the Gulf Stream at the entrance to the Florida Straits (Figure 3.0-10).

Surface currents are horizontal movements of water primarily driven by the drag of the wind over the sea surface. Wind-driven circulation affects the upper 100 m of the water column and therefore drives the circulation over continental shelves (Hunter et al. 2007). Surface currents of the Atlantic Ocean have an annual average mean velocity of 1.64 ft./s (0.5 m/s) and include equatorial currents, circumpolar currents, eastern boundary currents, and western boundary currents (Juliano and Alves 2007). Refer to Figure 3.0-10 and Table 3.0-5 for a depiction and description of the major surface currents in the Study Area. Eastern boundary currents are relatively shallow, broad, and slow-moving and travel toward the equator along the eastern boundaries of ocean basins. Western boundary currents are narrow, deep, and swift and are a result of the trade winds and the westerlies. In general, eastern boundary currents carry cold waters from higher latitudes to lower latitudes, and western boundary currents carry warm waters from lower latitudes to higher latitudes (Reverdin et al. 2003).

In the northern hemisphere, including the Study Area, the influence of the westerlies and the northeasterly trade winds on North Atlantic currents produce the eastward-flowing Subtropical Counter Current (Tomczak and Godfrey 2003). Subpolar gyres are also present in the North Atlantic as a result of the polar easterlies and the westerlies. In the North Atlantic, subpolar gyres rotate counterclockwise (Tomczak and Godfrey 2003).

The western continental margin of any ocean basin is the location of intense boundary currents; the Gulf Stream Current is the western boundary current found in the North Atlantic Ocean (Figure 3.0-10). The Gulf Stream Current is part of a larger current system called the Gulf Stream System that also includes the Loop Current in the Gulf of Mexico, the Florida Current in the Florida Straits, and the North Atlantic Current in the central North Atlantic Ocean. The Gulf Stream Current is a powerful surface current, carrying warm water into the cooler North Atlantic just south of the Northeast Range Complexes (Pickard and Emery 1990; Verity et al. 1993). In general, the Gulf Stream flows roughly parallel to the coastline from the Florida Straits to Cape Hatteras, where it is deflected away from the North American continent and flows northeastward.

The temperature and salinity of water determines its density; density differences cause water masses to move both vertically and horizontally in relation to one another. Cold, salty, dense water at the surface will sink, and warm, less saline water will rise. Density differences also drive the horizontal circulation of deep-water masses throughout ocean basins.

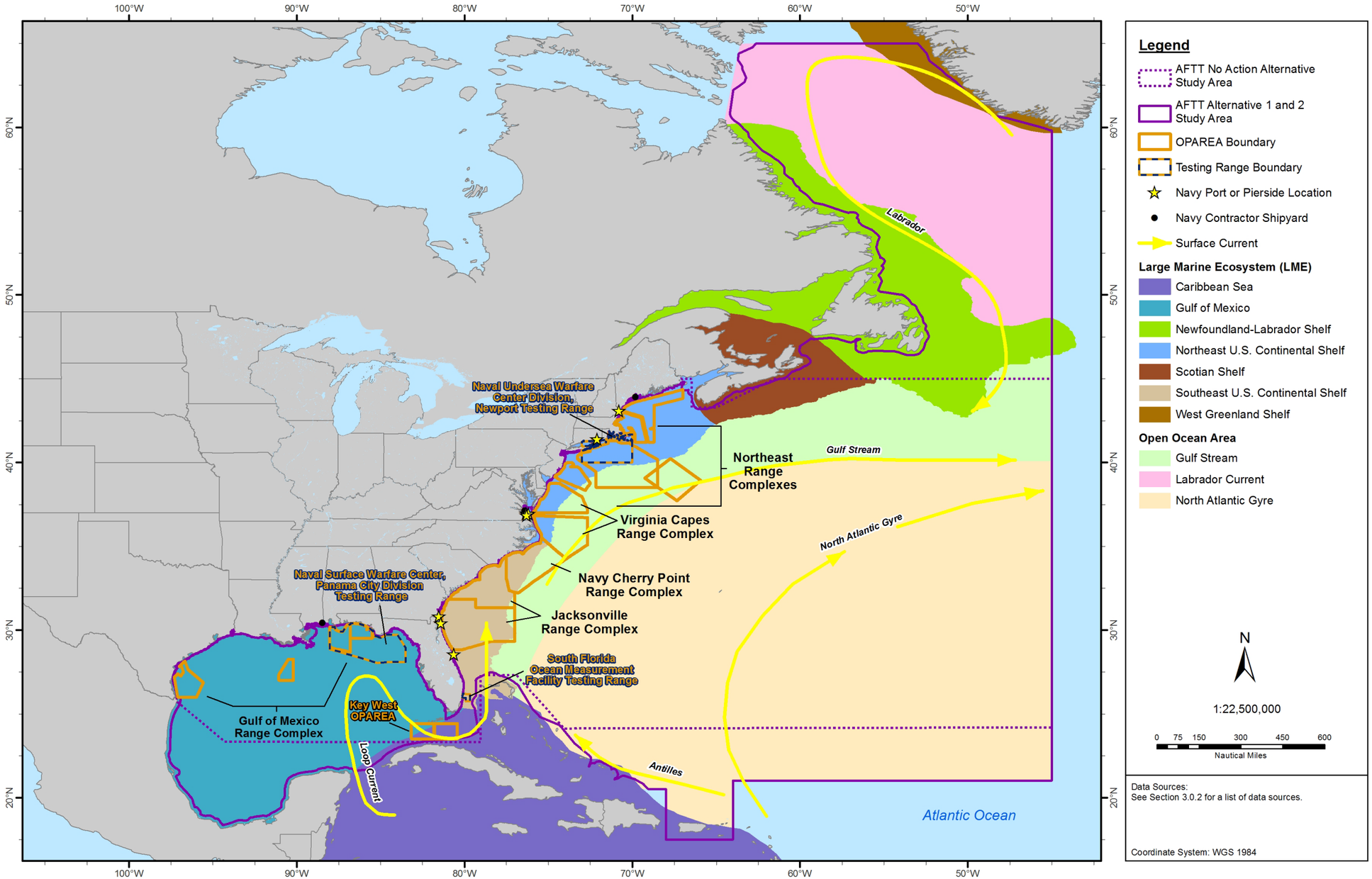

Figure 3.0-10: Major Currents in the Study Area

AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

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Table 3.0-5: Summary of Current Patterns in Areas Located Outside the Range Complexes

Component	Currents
Northeast U.S. Continental Shelf Large Marine Ecosystem	
Bath, ME	Riverine and tidal circulation patterns.
Portsmouth Naval Shipyard; Kittery, ME	
Naval Undersea Warfare Center Division, Newport Testing Range	Shallow water coastal currents generated by tidal action and wind. Currents are affected by open-ocean conditions as well as by tidal exchange and wind-generated currents in the estuaries.
Naval Submarine Base New London; Groton, CT	Riverine and tidal circulation patterns near mouth of estuary. Subject to the influence of larger open oceanic currents and circulation systems.
Newport News, VA	
Naval Station Norfolk; Norfolk, VA	
Joint Expeditionary Base Little Creek—Fort Story; Virginia Beach, VA	
Norfolk Naval Shipyard; Portsmouth, VA	
Southeast U.S. Continental Shelf Large Marine Ecosystem	
Naval Submarine Base Kings Bay; Kings Bay, GA	Riverine and tidal circulation patterns in middle part of estuary.
Naval Station Mayport, Jacksonville, FL	Riverine and tidal circulation patterns in the mouth of estuary inlet. Subject to the influence of larger open oceanic currents and circulation systems.
Port Canaveral, FL	Tidal mixing within shallow dredged channel, plus wind driven circulation.
Gulf of Mexico Large Marine Ecosystem	
Pascagoula, MS	Riverine and tidal circulation patterns in mouth of estuary/inlet. Offshore, near coastal areas subject to influence of larger open oceanic current/circulation.
Gulf of Mexico	The Louisiana coast current flows along the coast of the United States from the mouth of the Mississippi River to the western Gulf of Mexico. The Yucatan Current flows north, east, and west as it enters the Gulf of Mexico from the Caribbean Sea. The Loop Current originates as part of the Yucatan Current and spins in a clockwise direction and connects with the Florida Current from west to east through the Florida Straits. Warm and cold core eddy rings develop in the western half of the Gulf of Mexico between the Loop Current and the Texas/Mexico coast. Cold-core eddy rings develop off the Florida Current in the eastern Gulf.
Caribbean Sea Large Marine Ecosystem	
Other AFTT Areas (Outside the Range Complexes)	The Antilles Current flows southeast to northwest along the northern edge of the Turks and Caicos Islands and Bahama Islands. The Labrador Current flows south from Labrador Bay.
Labrador Current Open Ocean Area	
Other AFTT Areas (Outside the Range Complexes)	Labrador surface current and West Greenland surface current move water in a counter clockwise direction around the outer edges of the Labrador Sea. West Labrador surface current also moves water farther to the north. Portions of the deep North Atlantic Current return cold, more dense water back to the south, away from the Labrador Sea.

Source: (Stewart 2008)
CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; MS: Mississippi; VA: Virginia.

Thermohaline circulation—also called the ocean conveyor belt or meridional overturning—is the continuous horizontal circulation of water masses throughout the ocean. This cycle begins when dense waters sink and deep-water masses form. Deep-water masses form in the North Atlantic and Southern Oceans (Dickson and Brown 1994). North Atlantic Deep Water is formed in the Norwegian Sea between Iceland and Greenland. North Atlantic Deep Water is carried by the Deep Western Boundary Current along the western continental slope to join Antarctic Bottom Water (Dengler et al. 2004; Pickart 1992). At the surface, waters are heated and freshwater inputs result in lower salinity. As a result of density differences and higher sea levels in the Pacific Ocean and Indian Ocean, these surface water masses return to the Antarctic Ocean and North Atlantic Ocean. In the North Atlantic, these surface waters undergo evaporative cooling, which increases their densities, resulting in the sinking and formation of the North Atlantic Deep Water (Huang and Tiedemann 1998).

3.0.3.4 Ocean Fronts

The impacts of Navy training and testing activities are dependent on the intersection between where the marine resources and those activities occur. Ocean fronts are relevant to the analysis because they are characterized by increased productivity and biomass (e.g., marine vegetation and animals) (Bost et al. 2009). Fronts are the boundaries between two water masses with distinct temperatures or densities and are characterized by rapid changes in specific water properties over short distances. The Study Area is influenced by the Mid-Atlantic Bight (a curve in the coastline) shelf break front, the Gulf Stream front, and the Loop Current and Florida Current. As the Gulf Stream Current moves east from Cape Hatteras, North Carolina it carries warm equatorial waters into the cooler Atlantic Ocean. Cold water flowing north to south from coastal areas of the northeastern United States (as shown in Figure 3.0-10) converges with the warmer waters of the Gulf Stream off Cape Hatteras, creating a frontal system. These fronts can be depicted on maps that show the drastic changes in sea surface temperatures between water masses. Figure 3.0-11 shows the influence of ocean fronts on the sea surface temperatures of the Study Area.

A persistent feature that extends from the Mid-Atlantic Bight into New England waters is the front formed at the intersection of the continental shelf and slope. This front is biologically important and persists year-round. Phytoplankton (microscopic drifting plants) production is enhanced at this frontal boundary, often with twice the concentration of phytoplankton found in adjacent waters (Ryan et al. 1999).

North of Cape Hatteras, the Gulf Stream meanders in a wave-like fashion and becomes unstable. These instabilities in current flow lead to the pinching off of relatively warm or cool waters as either warm- or cold-core mesoscale eddies (Mann and Lazier 1996). Mesoscale eddies are large (54 to 108 nm wide) rotating water currents that separate from the main current. They cause cold, deep waters to rise to the surface (upwelling) or conversely, warm, surface waters to sink (downwelling), and consequently influence primary production (Sangrà et al. 2009) and facilitate the transfer of energy to higher trophic levels (Godø et al. 2012; Thompson et al. 2012). Warm-core eddies rotate clockwise (anticyclonic) and bring warm water and associated plankton (drifting organisms), including ichthyoplankton (fish eggs and larvae), to the colder areas of the northeast shelf. Cold-core eddies rotate counterclockwise (cyclonic) and deliver cold, nutrient-rich waters and plankton to the surface of the ocean. These types of mesoscale eddies form around the Gulf Stream and influence the sea surface temperature.

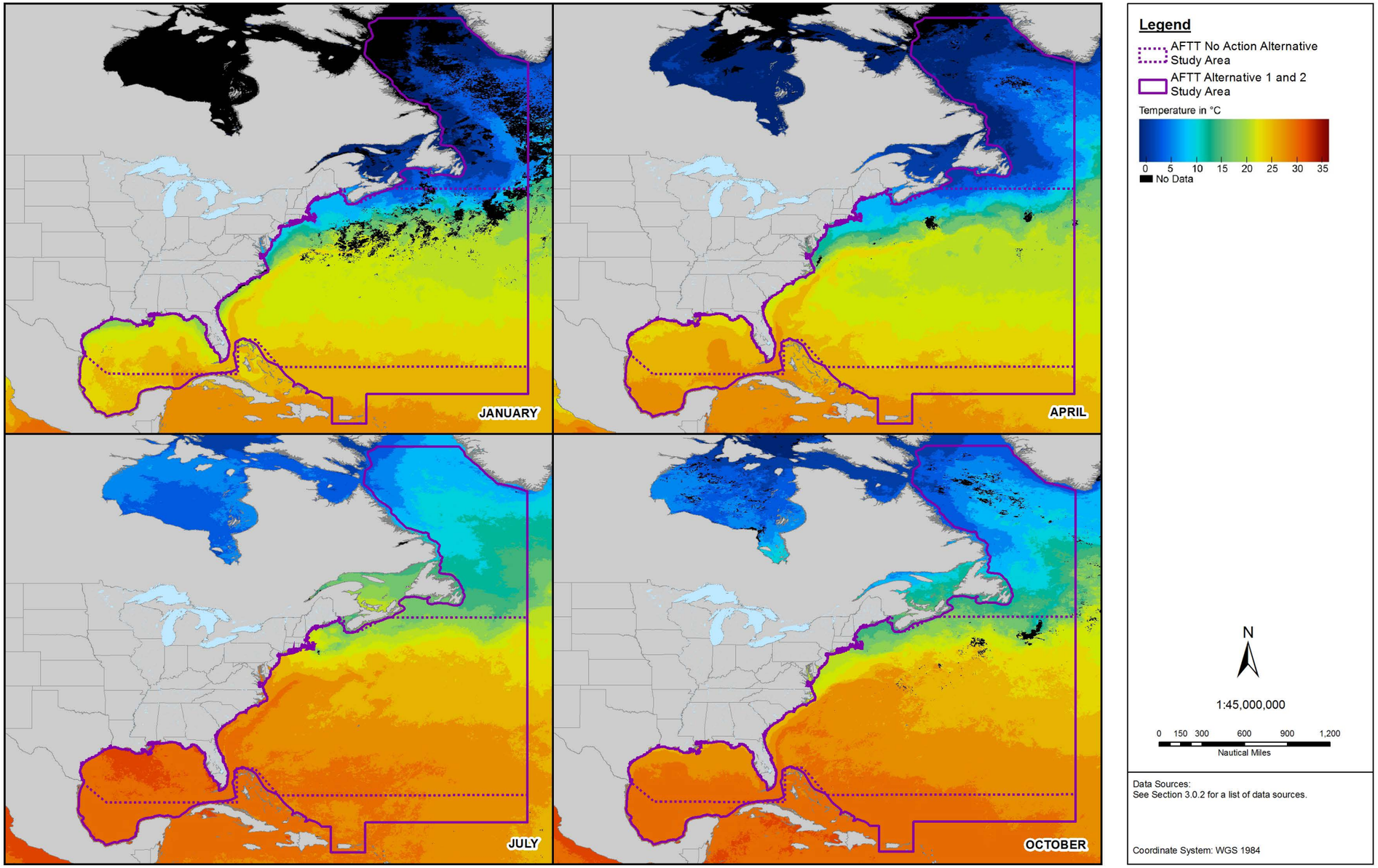

Figure 3.0-11: Sea Surface Temperature in the Study Area
AFTT: Atlantic Fleet Training and Testing

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Warm- and cold-core eddy rings develop in the western half of the Gulf of Mexico between the Loop Current and the Texas and Mexico coast. These eddies travel westward and southward in the Gulf (Elliot 1982; Gallaway et al. 2001; Hamilton 1990). The Loop Current and associated eddies are responsible for circulation in the deepest portions of the Gulf of Mexico (Hamilton 1990). Frontal eddies occur along the East Florida Shelf (Fiechter and Mooers 2003; Lee et al. 1992) when warm Florida Current front waters meander seaward beyond the shelf break, allowing colder slope waters to upwell onto the East Florida Shelf.

3.0.4 ACOUSTIC AND EXPLOSIVES PRIMER

This section introduces basic acoustic principles and terminology describing how sound travels or "propagates" in air and water. These terms and concepts are used when analyzing potential impacts due to acoustic sources and explosives used during naval testing and training. This section briefly explains the transmission of sound; introduces some of the basic mathematical formulas used to describe the transmission of sound; and defines acoustical terms, abbreviations, and units of measurement. Because seawater is a very efficient medium for the transmission of sound, the differences between transmission of sound in water and in air are discussed. Finally, it discusses the various sources of underwater sound, including physical, biological, and anthropogenic sounds.

3.0.4.1 Terminology/Glossary

Sound is an oscillation in pressure, particle displacement, or particle velocity, as well as the auditory sensation evoked by these oscillations, although not all sound waves evoke an auditory sensation (i.e., they are outside of an animal's hearing range) (American National Standards Institute 1994). Sound may be described in terms of both physical and subjective attributes. Physical attributes may be directly measured. Subjective (or sensory) attributes cannot be directly measured and require a listener to make a judgment about the sound. Physical attributes of a sound at a particular point are obtained by measuring pressure changes as sound waves pass. The following material provides a short description of some of the basic parameters of sound.

3.0.4.1.1 Particle Motion and Sound Pressure

Sound is produced when a medium (air or water in this analysis) is set into motion, often by a vibrating object within the medium. As the object vibrates, its motion is transmitted to adjacent particles of the medium. The motion of these particles is transmitted to adjacent particles, and so on. As the sound wave travels through the medium, the individual particles of the medium oscillate about their original positions but do not actually move with the sound wave. The result is a mechanical disturbance (the "sound wave") that propagates away from the source. The measurable properties of a sound are the pressure oscillations of the sound wave and the velocity, displacement amplitude, and direction of particle movements. The basic unit of sound pressure is the pascal (Pa) (1 Pa = 1.45×10^{-4} pounds per square inch), although the most commonly encountered unit is the micro Pa (µPa) (1 µPa = 1×10^{-6} Pa).

Animals with an eardrum or similar structure directly detect the pressure component of sound. Some marine fish also have specializations to detect pressure changes. Certain animals (e.g., most invertebrates and some marine fish) likely cannot detect sound pressure, only the particle motion component of sound. Because particle motion is most detectable near a sound source and at lower frequencies, this difference in acoustic energy sensing mechanisms limits the range at which these animals can detect most sound sources analyzed in this document.

3.0.4.1.2 Frequency

The number of oscillations or waves per second is called the frequency of the sound, and the metric is Hertz (Hz). One Hz is equal to one oscillation per second, and 1 kilohertz (kHz) is equal to 1,000 oscillations per second. The inverse of the frequency is the period or duration of one acoustic wave.

Frequency is the physical attribute most closely associated with the subjective attribute "pitch"; the higher the frequency, the higher the pitch. Human hearing generally spans the frequency range from 20 Hz to 20 kHz. The pitch based on these frequencies is subjectively "low" (at 20 Hz) or "high" (at 20 kHz).

Pure tones have a constant, single frequency. Complex tones contain multiple, discrete frequencies, rather than a single frequency. Broadband sounds are spread across many frequencies. The frequency range of a sound is called its bandwidth. A harmonic of a sound at a particular frequency is a multiple of that frequency (e.g., harmonic frequencies of a 2 kHz tone 4 kHz, 6 kHz, 8 kHz, etc.). A source operating at a nominal frequency may emit several harmonic frequencies at much lower sound pressure levels.

In this document, sounds are generally described as either low- (less than 1 kHz), mid- (1 kHz to 10 kHz), high- (greater than 10 kHz to 100 kHz), or very high- (greater than 100 kHz) frequency. Hearing ranges of marine animals (e.g., fish, birds, and marine mammals) are quite varied and are species-dependent. For example, some fish can hear sounds below 100 Hz and some species of marine mammals have hearing capabilities that extend above 100 kHz. Discussions of sound and potential impacts must therefore focus not only on the sound pressure, but the composite frequency of the sound and the species considered.

3.0.4.1.3 Duty Cycle

Duty cycle describes the portion of time that a sound source actually generates sound. It is defined as the percentage of the time during which a sound is generated over a total operational period. For example, if a sound navigation and ranging (sonar) source produces a one-second ping once every 10 seconds, the duty cycle is 10 percent. Duty cycles vary among different acoustic sources; in general, a low duty cycle is 20 percent or less and a high duty cycle is 80 percent or higher.

3.0.4.1.4 Categories of Sound

3.0.4.1.4.1 Signal versus Noise

When sound is purposely created to convey information, communicate, or obtain information about the environment, it is often referred to as a signal. Examples of sounds that could be considered signals are sonar pings, marine mammal vocalizations and echolocations, tones used in hearing experiments, and small sonobuoy explosions used for submarine detection.

Noise is undesired sound (American National Standards Institute 1994). Sounds produced by naval aircraft and vessel propulsion are considered noise because they represent possible inefficiencies and increased detectability, which are undesirable. Whether a sound is noise often depends on the receiver (i.e., the animal or system that detects the sound). For example, small explosives and sonar used to generate sounds that can locate an enemy submarine produce signals that are useful to sailors engaged in anti-submarine warfare but are assumed to be noise when detected by marine mammals.

Noise also refers to all sound sources that may interfere with detection of a signal (background noise) and the combination of all sounds at a particular location (ambient noise) (American National Standards Institute 1994).

3.0.4.1.4.2 Impulsive versus Non-Impulsive Sounds

Although no standard definitions exist, sounds may be broadly categorized as impulsive or non-impulsive. Impulsive sounds feature a very rapid increase to high pressures, followed by a rapid return to the static pressure. Impulsive sounds are often produced by processes involving a rapid release of energy or mechanical impacts (Hamernik and Hsueh 1991). Explosions, airgun detonations, and impact pile driving are examples of impulsive sound sources analyzed in this document. Non-impulsive sounds lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sound can be continuous or intermittent. Sonar pings, vessel noise, and underwater transponders are all examples of non-impulsive sound sources analyzed in this document.

3.0.4.1.4.3 Explosive Detonations

An explosive detonation generates a high-speed shock wave that rises almost instantaneously to a maximum pressure, then rapidly decays. At the instant of explosion, gas is instantaneously generated at high pressure and temperature, creating a bubble. In addition, the heat causes a certain amount of water to vaporize, adding to the volume of the bubble. This action immediately begins to force the water in contact with the blast front in an outward direction creating an intense pressure wave. This shock wave passes into the surrounding medium and travels faster than the speed of sound. The near-instantaneous rise from ambient to high pressures is what makes the shock wave potentially damaging. As the high pressure wave travels away from the source, it begins to slow and act like an acoustic wave similar to other impulsive sources that lack the strong shock wave (e.g., airguns). Noise associated with the blast is also transmitted into the surrounding medium as acoustic waves.

The peak pressure experienced by a receptor (i.e., an animal) is a function of the explosive material, the net explosive weight (the equivalent explosive energy expressed in weight of TNT), and the distance from the charge. The peak pressure is higher for larger charge weights at a given distance and decreases for increasing distances from a given charge. In general, shock wave effects near an explosive charge increase in proportion to the cube root of the explosive weight (Young 1991). For example, shock wave impacts will double when the explosive charge weight is increased by a factor of eight (i.e., cube root of eight equals two).

If the detonation occurs underwater and is not near the surface, gases released during the explosive chemical reaction form a bubble that pulsates as the gases expand and contract. These bubble pulsations create pressure waves that are weaker than the original shock wave but can still be damaging. If the detonation occurs at or just below the surface, a portion of the explosive power is released into the air and a pulsating gas bubble is not formed.

The detonation depth of an explosive is important because of the propagation effect known as surface-image interference. For underwater explosions near the sea surface, a distinct interference pattern arises from reflection from the water's surface. As the source depth or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface reflection scattering loss). This effect can significantly reduce the peak pressures experienced near the water surface.

3.0.4.2 Sound Metrics

3.0.4.2.1 Pressure

Various sound pressure metrics are illustrated in Figure 3.0-12 for a hypothetical (a) pure tone (non-impulsive), and (b) an impulsive sound. Sound pressure varies differently with time for non-impulsive and impulsive sounds. As shown in the figure, the non-impulsive sound has a relatively gradual rise in pressure from static pressure (the ambient pressure without the added sound), while the impulsive sound has a near-instantaneous rise to a higher peak pressure. The peak pressure shown on both illustrations is the maximum absolute value of the instantaneous sound pressure during a specified time interval, which accounts for the values of peak pressures below the static pressure (American National Standards Institute 1994). Peak-to-peak pressure is the difference between the maximum and minimum sound pressures. The root mean square sound pressure is often used to describe the average pressure level of sounds. As the name suggests, this method takes the square root of the average squared sound pressure values over a time interval. The duration of this time interval can have a strong effect on the measured root mean square sound pressure for a given sound, especially where pressure levels vary significantly, as during an impulse. If the analysis duration includes a significant portion of the waveform after the impulse has ended and the pressure has returned to near static, the root mean square level would be relatively low. If the analysis duration includes the highest pressures of the impulse and excludes the portion of the waveform after the impulse has terminated, the root mean square level would be comparatively high. For this reason, it is important to specify the duration used to calculate the root mean square pressure for impulsive sounds.

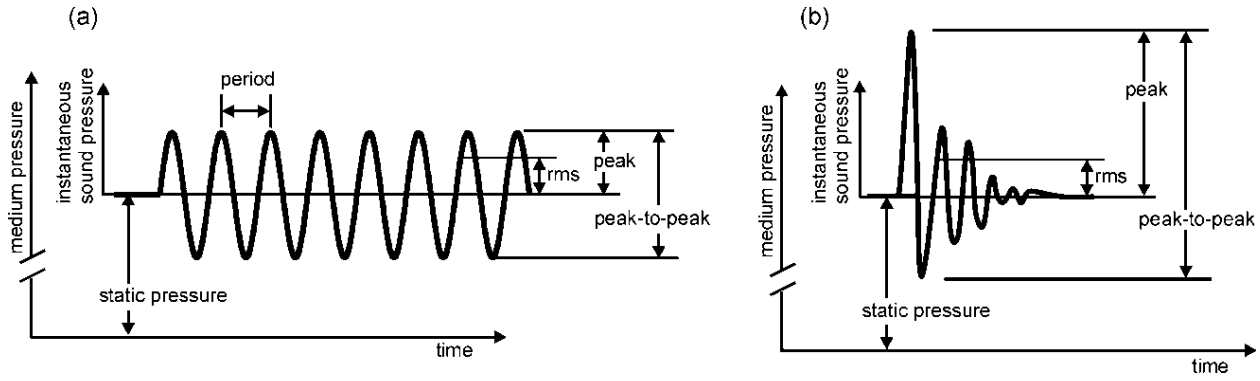

Figure 3.0-12: Various Sound Pressure Metrics for a Hypothetical (a) Pure Tone (Non-Impulsive) and (b) Impulsive Sound

3.0.4.2.1.1 Sound Pressure Level

Because mammalian ears can detect large pressure ranges and humans judge the relative loudness of sounds by the ratio of the sound pressures (a logarithmic behavior), sound pressure level is described by taking the logarithm of the ratio of the sound pressure to a reference pressure (American National Standards Institute 1994). Use of a logarithmic scale compresses the wide range of pressure values into a more usable numerical scale.

Sound levels are normally expressed in decibels (dB). To express a pressure X in decibels using a reference pressure X_{ref}, the equation is:

$$20\log_{10}\left(\frac{X}{X_{ref}}\right)$$

The pressure *X* is the root-mean-square value of the pressure. When a value is presented in decibels, it is important to specify the value and units of the reference pressure. Normally the decibel value is given, followed by the text "re," meaning "with reference to," and the value and unit of the reference pressure. The standard reference pressures are 1 µPa for water and 20 µPa for air (American National Standards Institute 1994). It is important to note that, because of the difference in reference units between air and water, the same absolute pressures would result in different decibel values for each medium.

3.0.4.2.1.2 Sound Exposure Level

When analyzing effects on marine animals from multiple moderate-level sounds, it is necessary to have a metric that quantifies cumulative exposures (American National Standards Institute 1994). The sound exposure level can be thought of as a composite metric that represents both the intensity of a sound and its duration. Individual time-varying noise events (e.g., a series of sonar pings) have two main characteristics: (1) a sound level that changes throughout the event and (2) a period of time during which the event is heard. Cumulative sound exposure level provides a measure of the net impact of the entire acoustic event, but it does not directly represent the sound level heard at any given time. Sound exposure level is determined by calculating the decibel level of the cumulative sum-of-squared pressures over the duration of a sound, with units of dB re 1 micro pascal-squared seconds (μPa^2-s) for sounds in water.

Some rules of thumb for sound exposure level are as follows:

- The numeric value of sound exposure level is equal to the sound pressure level of a one-second sound that has the same total energy as the exposure event. If the sound duration is one second, sound pressure level and sound exposure level have the same numeric value (but not the same reference quantities). For example, a one-second sound with a sound pressure level of 100 dB re 1 µPa has a sound exposure level of 100 dB re 1 squared micro pascal-second (μPa^2-s).
- If the sound duration is constant but the sound pressure level changes, sound exposure level will change by the same number of decibels as the sound pressure level.
- If the sound pressure level is held constant and the duration (*T*) changes, sound exposure level will change as a function of $10\log_{10}(T)$:
    - $10\log_{10}(10) = 10$, so increasing duration by a factor of 10 raises sound exposure level by 10 dB.
    - $10\log_{10}(0.1) = -10$, so decreasing duration by a factor of 10 lowers sound exposure level by 10 dB.
    - Since $10\log_{10}(2) \approx 3$, doubling the duration increases sound exposure level by 3 dB.
    - $10\log_{10}(1/2) \approx -3$, so halving the duration lowers sound exposure level by 3 dB.

Figure 3.0-13 illustrates the summation of energy for a succession of sonar pings. In this hypothetical case, each ping has the same duration and sound pressure level. The sound exposure level at a particular location from each individual ping is 100 dB re 1 μPa^2-s (red circles). The upper, blue curve shows the running total or cumulative sound exposure level.

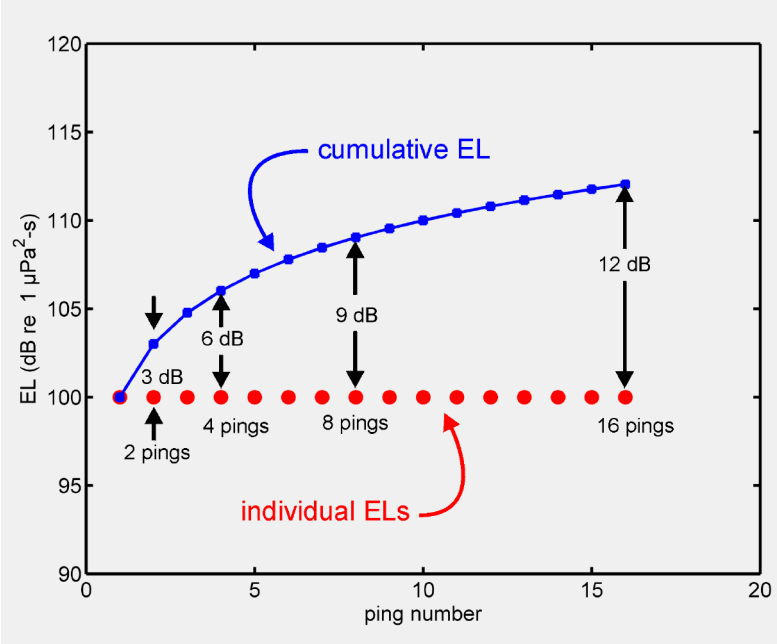

Figure 3.0-13: Summation of Acoustic Energy (Cumulative Exposure Level, or Sound Exposure Level) from a Hypothetical, Intermittently Pinging, Stationary Sound Source (EL = Exposure Level)

After the first ping, the cumulative sound exposure level is 100 dB re 1 μPa^2-s. Since each ping has the same duration and sound pressure level, receiving two pings is the same as receiving a single ping with twice the duration. The cumulative sound exposure level from two pings is therefore 103 dB re 1 μPa^2-s. The cumulative sound exposure level from four pings is 3 dB higher than the cumulative sound exposure level from two pings, or 106 dB re 1 μPa^2-s. Each doubling of the number of pings increases the cumulative sound exposure level by 3 dB.

Figure 3.0-14 shows a more realistic example where the individual pings do not have the same sound pressure level or sound exposure level. These data were recorded from a stationary hydrophone as a sound source approached, passed, and moved away from the hydrophone. As the source approached the hydrophone, the received sound pressure level from each ping increased, causing the sound exposure level of each ping to increase. After the source passed the hydrophone, the received sound pressure level and sound exposure level from each ping decreased as the source moved farther away (downward trend of red line), although the cumulative sound exposure level increased with each additional ping received (slight upward trend of blue line). The main contributions are from those pings with the highest individual sound exposure levels. Individual pings with sound exposure levels 10 dB or more below the ping with the highest level contribute little (less than 0.5 dB) to the total cumulative sound exposure level. This is shown in Figure 3.0-14 where only a small error is introduced by summing the energy from the eight individual pings with sound exposure level greater than 185 dB re 1 μPa^2-s (black line), as opposed to including all pings (blue line).

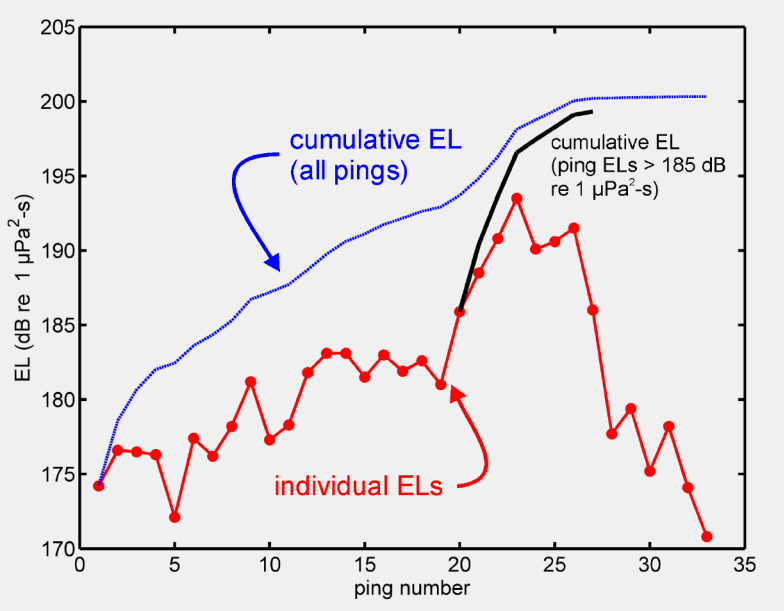

Figure 3.0-14: Cumulative Sound Exposure Level under Realistic Conditions with a Moving, Intermittently Pinging Sound Source (Cumulative Exposure Level = Sound Exposure Level)

3.0.4.2.1.3 Impulse (Pa-s)

Impulse is a metric used to describe the pressure and time component of an intense shock wave from an explosive source. The impulse calculation takes into account the magnitude and duration of the initial peak positive pressure, which is the portion of an impulsive sound most likely to be associated with damage. Specifically, impulse is the time integral of the initial peak positive pressure with units pascal-seconds (Pa-s). The peak positive pressure for an impulsive sound is shown in Figure 3.0-12b as the first and largest pressure peak above static pressure. This metric is used to assess potential injurious effects from explosives.

3.0.4.3 Loudness and Auditory Weighting Functions

Animals, including humans, are not equally sensitive to sounds across their entire hearing range. The subjective judgment of a sound level by a receiver such as an animal is known as loudness. Two sounds received at the same sound pressure level (an objective measurement), but at two different frequencies, may be perceived by an animal at two different loudness levels depending on its hearing sensitivity (lowest sound pressure level at which a sound is first audible) at the two different frequencies. Furthermore, two different species may judge the relative loudness of the two sounds differently.

Auditory weighting functions are a method common in human hearing risk analysis to account for differences in hearing sensitivity at various frequencies. This concept can be applied to other species as well. When used in analyzing the impacts of sound on an animal, auditory weighting functions adjust received sound levels to emphasize ranges of best hearing and de-emphasize ranges of less or no sensitivity. A-weighted sound levels, often seen in units of "dBA," (A-weighted decibels) are frequency-weighted to account for the sensitivity of the human ear to a barely audible sound. Many measurements of sound in air appear as A-weighted decibels in the literature because the intent of the authors is often to assess noise impacts on humans.

3.0.4.4 Predicting How Sound Travels

Sounds are produced throughout a wide range of frequencies, including frequencies beyond the audible range of a given receptor. Most sounds heard in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate perceptible sound.

The speed of sound is not affected by its intensity, amplitude, or frequency, but rather depends wholly on characteristics of the medium through which it is passing. Sound generally travels faster as the density of the medium increases. Speeds of sound through air are primarily influenced by air temperature, relative humidity, and pressure, averaging about 1,115 ft./s (340 m/s) at standard barometric pressure. Sound speeds in air increase as air temperature increases. Sound travels differently in the water than in air because seawater is a very efficient medium for the transmission of sound. Sound moves at a faster speed in water, about 4,921 ft./s (1,500 m/s). The speed of sound through water is influenced by temperature, pressure, and salinity because sound travels faster as any of these parameters increase.

In the simple case of sound propagating from a point source without obstruction or reflection, the sound waves take on the shape of an expanding sphere. As spherical propagation continues, the sound energy is distributed over an ever-larger area following the inverse square law: the intensity of a sound wave decreases inversely with the square of the distance between the source and the receptor. For example, doubling the distance between the receptor and a sound source results in a reduction in the intensity of the sound of one-fourth of its initial value; tripling the distance results in one-ninth of the original intensity, and so on (Figure 3.0-15). As expected, sound intensity drops at increasing distance from the point source. In spherical propagation, sound pressure levels drop an average of 6 dB for every doubling of distance from the source.

While the concept of a sound wave traveling from its source to a receptor is relatively simple, sound propagation is quite complex because of the simultaneous presence of numerous sound waves of different frequencies and other phenomena such as reflections of sound waves and subsequent constructive (additive) or destructive (cancelling) interferences between reflected and incident waves. Other factors such as refraction, diffraction, bottom types, and surface conditions also affect sound propagation. While simple examples are provided here for illustration, the Navy Acoustic Effects Model used to quantify acoustic exposures to marine mammals and sea turtles takes into account the influence of multiple factors to predict acoustic propagation (Marine Species Modeling Team 2013).

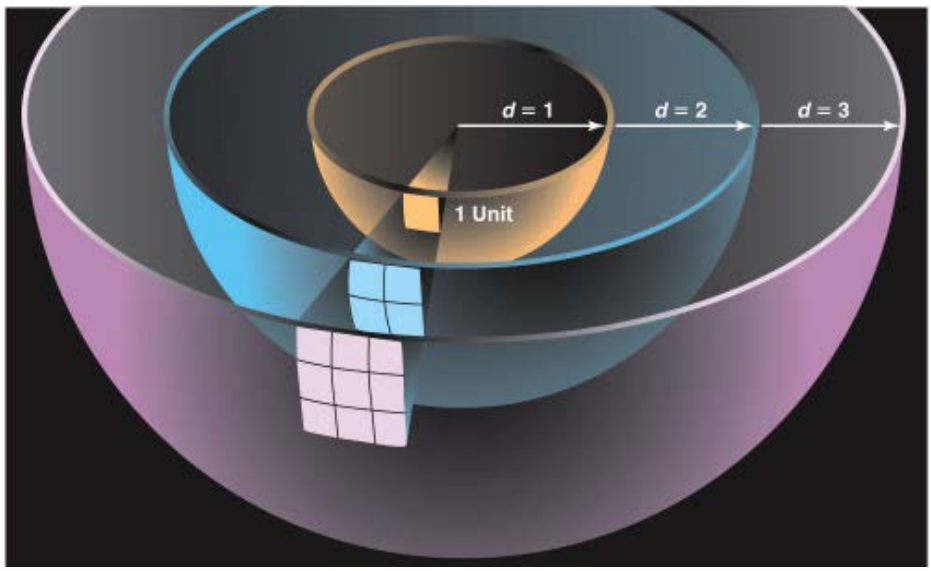

Figure 3.0-15: Graphical Representation of the Inverse-Square Relationship in Spherical Spreading

3.0.4.4.1 Sound Attenuation and Transmission Loss

As a sound wave passes through a medium, the intensity decreases with distance from the sound source. This phenomenon is known as attenuation or propagation loss. Sound attenuation may be described in terms of transmission loss (TL). The units of transmission loss are dB. The transmission loss is used to relate the source level (SL), defined as the sound pressure level produced by a sound source at a distance of 1 m, and the received level (RL) at a particular location, as follows:

$$RL = SL - TL.$$

The main contributors to sound attenuation are as follows:

- Geometrical spreading of the sound wave as it propagates away from the source
- Sound absorption (conversion of sound energy into heat)
- Scattering, diffraction, multipath interference, boundary effects
- Other nongeometrical effects (Urick 1983).

3.0.4.4.1.1 Spreading Loss

Spreading loss or divergence loss is a geometrical effect representing regular weakening of a sound wave as it spreads out from a source (Campbell et al. 1988). Spreading describes the reduction in sound pressure caused by the increase in surface area as the distance from a sound source increases. Spherical and cylindrical spreading are common types of spreading loss.

As described before, a point sound source in a homogeneous medium without boundaries will radiate spherical waves—the acoustic energy spreads out from the source in the form of a spherical shell. As the distance from the source increases, the shell surface area increases. If the sound power is fixed, the sound intensity must decrease with distance from the source (intensity is power per unit area). The surface area of a sphere is $4\pi r^2$, where r is the sphere radius, so the change in intensity is proportional to the radius squared. This relationship is known as the spherical spreading law. The transmission loss for spherical spreading is:

$$TL = 20\log_{10} r$$

where r is the distance from the source. This is equivalent to a 6 dB reduction in sound pressure level for each doubling of distance from the sound source. For example, calculated transmission loss for spherical spreading is 40 dB at 100 m and 46 dB at 200 m.

In cylindrical spreading, spherical waves expanding from the source are constrained by the water surface and the seafloor and take on a cylindrical shape. In this case the sound wave expands in the shape of a cylinder rather than a sphere and the transmission loss is:

$$TL = 10\log_{10} r$$

Cylindrical spreading is an approximation to wave propagation in a water-filled channel with horizontal dimensions much larger than the depth. Cylindrical spreading predicts a 3 dB reduction in sound pressure level for each doubling of distance from the source. For example, calculated transmission loss for cylindrical spreading is 20 dB at 100 m and 23 dB at 200 m.

3.0.4.4.1.2 Reflection and Refraction

When a sound wave propagating in a medium encounters a second medium with a different density or sound speed (e.g., the air-water boundary) part of the incident sound will be reflected back into the first medium and part will be transmitted into the second medium (Kinsler et al. 1982). If the second medium has a different sound speed than the first, the propagation direction will change as the sound wave enters the second medium; this phenomenon is called refraction. Refraction may also occur within a single medium if the sound speed varies in the medium.

Refraction of sound resulting from spatial variations in the sound speed is one of the most important phenomena that affects sound propagation in water (Urick 1983). The sound speed in the ocean primarily depends on hydrostatic pressure (i.e., depth) and temperature. Sound speed increases with both hydrostatic pressure and temperature. In seawater, temperature has the most important effect on sound speed for depths less than about 300 m. Below 1,500 m, the hydrostatic pressure is the dominant factor because the water temperature is relatively constant. The variation of sound speed with depth in the ocean is called a sound speed profile.

Although the actual variations in sound speed are small, the existence of sound speed gradients in the ocean has an enormous effect on the propagation of sound in the deep ocean. If one pictures sound as rays emanating from an underwater source, the propagation of these rays changes as a function of the sound speed profile in the water column. Specifically, the directions of the rays bend toward regions of slower sound speed. This phenomenon creates ducts in which sound becomes “trapped,” allowing it to propagate with high efficiency for large distances within certain depth boundaries. During winter months, the reduced sound speed at the surface due to cooling can create a surface duct that efficiently propagates sound such as shipping noise. The deep sound channel or Sound Frequency and Ranging channel is another duct that exists where sound speeds are lowest in the water column (600 m–1,200 m depth at the mid-latitudes). Intense low-frequency underwater sounds, such as explosions, can be detected halfway around the world from their source via the Sound Frequency and Ranging channel (Baggeroer and Munk 1992).

3.0.4.4.1.3 Diffraction, Scattering, and Reverberation

Sound waves experience diffraction in much the same manner as light waves. Diffraction may be thought of as the bending of a sound wave around an obstacle. Common examples include sound heard from a source around the corner of a building and sound propagating through a small gap in an otherwise closed door or window. An obstacle or inhomogeneity (e.g., smoke, suspended particles, or gas bubbles) in the path of a sound wave causes scattering if secondary sound spreads out from it in a variety of directions (Pierce 1989). Scattering is similar to diffraction. Normally diffraction is used to describe sound bending or scattering from a single object, and scattering is used when there are multiple objects. Reverberation, or echo, refers to the prolongation of a sound that occurs when sound waves in an enclosed space are repeatedly reflected from the boundaries defining the space, even after the source has stopped emitting.

3.0.4.4.1.4 Multipath Propagation

In multipath propagation, sound may not only travel a direct path from a source to a receiver, but also be reflected from the surface or bottom multiple times before reaching the receiver (Urick 1983). At some distances, the reflected wave will be in phase with the direct wave (their waveforms add together) and at other distances the two waves will be out of phase (their waveforms cancel). The existence of multiple sound paths, or rays, arriving at a single point can result in multipath interference, a condition that permits the addition and cancellation between sound waves resulting in the fluctuation of sound levels over short distances. A special case of multipath propagation loss is called the Lloyd mirror effect, where the sound field near the water's surface reaches a minimum because of the destructive interference (cancellation) between the direct sound wave and the sound wave being reflected from the surface. This can cause the sound level to decrease dramatically within the top few meters of the water column.

3.0.4.4.1.5 Surface and Bottom Effects

Because the sea surface reflects and scatters sound, it has a major effect on the propagation of underwater sound in applications where either the source or receiver is at a shallow depth (Urick 1983). If the sea surface is smooth, the reflected sound pressure is nearly equal to the incident sound pressure; however, if the sea surface is rough, the amplitude of the reflected sound wave will be reduced.

The sea bottom is also a reflecting and scattering surface, similar to the sea surface. Sound interaction with the sea bottom is more complex, however, primarily because the acoustic properties of the sea bottom are more variable and the bottom is often layered into regions of differing density and sound speed. The Lloyd mirror effect may also be observed from sound sources located near the sea bottom. For a hard bottom such as rock, the reflected wave will be approximately in phase with the incident wave. Thus, near the ocean bottom, the incident and reflected sound pressures may add together, resulting in an increased sound pressure near the sea bottom.

3.0.4.4.2 Air-Water Interface

Sound from aerial sources, such as aircraft, muzzle blasts, and projectile sonic booms, can be transmitted into the water. The most studied of these sources are fixed-wing aircraft and helicopters, which create noise with most energy below 500 Hz. Noise levels in water are highest at the surface and are highly dependent on the altitude of the aircraft and the angle at which the aerial sound encounters the ocean surface. Transmission of the sound once it is in the water is identical to any other sound as described in the section above.

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed by Urick (1983), Young (1973), Richardson et al. (1995), Eller and Cavanagh (2000), Laney and Cavanagh (2000), and others. Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) evanescent transmission in which sound travels laterally close to the water surface; and (4) scattering from interface roughness due to wave motion.

Airborne sound is refracted upon transmission into water because sound waves move faster through water than through air (a ratio of about 0.23:1). Based on this difference, the direct sound path is reflected if the sound reaches the surface at an angle more than 13 degrees from vertical. As a result, most of the acoustic energy transmitted into the water from an aircraft arrives through a relatively narrow cone extending vertically downward from the aircraft (Figure 3.0-16). The intersection of this cone with the surface traces a "footprint" directly beneath the flight path, with the width of the footprint being a function of aircraft altitude. Sound may enter the water outside of this cone due to surface scattering and as evanescent waves, which travel laterally near the water surface.

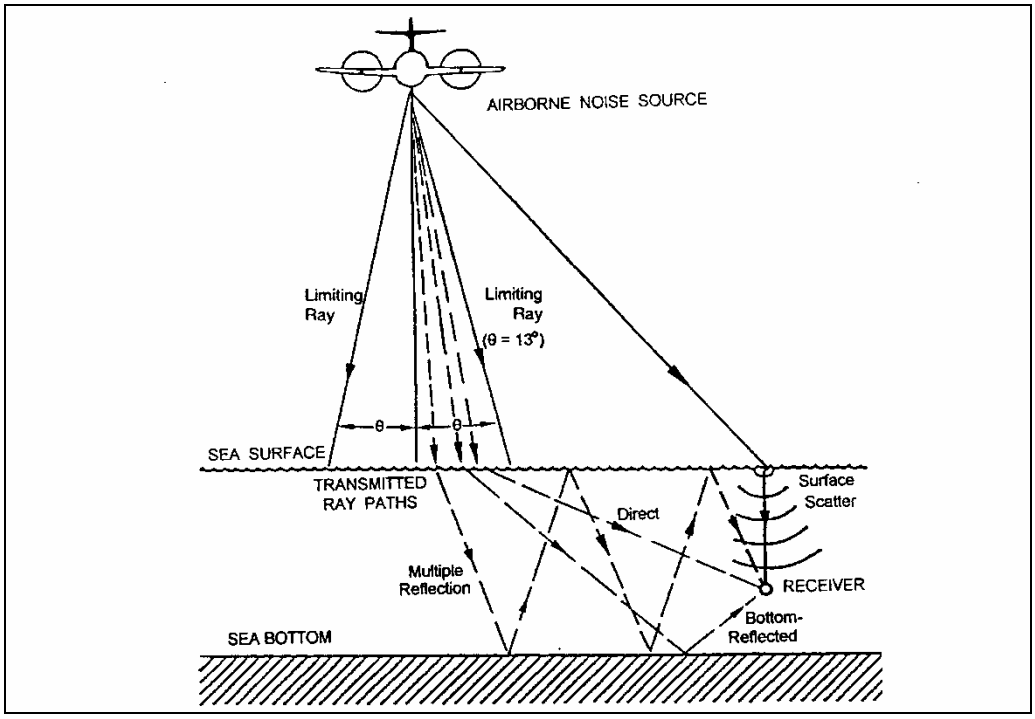

Figure 3.0-16: Characteristics of Sound Transmission through the Air-Water Interface
(Richardson et al. 1995)

The sound pressure field is actually doubled (+6 dB) at the air-to-water interface because of the large difference in the acoustic properties of water and air. For example, an airborne sound with a sound pressure level of 100 dB re 1 µPa at the sea surface becomes 106 dB re 1 µPa just below the surface. The pressure and sound levels then decrease with increasing distance as they would for any other in-water noise.

3.0.4.4.3 Sonic Booms

A sonic boom occurs when an object, such as an aircraft or projectile, exceeds the speed of sound (referred to as supersonic flight). When an object exceeds the speed of sound, air molecules are pushed aside with great force, forming a shock front much like a boat creates a bow wave. Supersonic aircraft can generate two shock fronts. One is immediately in front of the aircraft; the other is immediately behind it. These shock fronts "push" a sharply defined surge in air pressure in front of them, creating a sonic boom consisting of two very closely spaced impulses. The two impulses are usually heard as a single sonic boom.

Sonic booms differ from most other sounds because they are impulsive, there is no warning of their impending occurrence, and the peak levels of a sonic boom are higher than those for most other types of airborne noise. Although objects exceeding the speed of sound always create a sonic boom, not all sonic booms are heard near the water or ground surface. As altitude increases, air temperature normally decreases, and these layers of temperature change cause the shock front to be turned upward as it travels toward the ground. Depending on the altitude of the aircraft and its speed, the shock fronts of many sonic booms are bent upward sufficiently that they never reach the ground. This same phenomenon also acts to limit the width (area covered) of those sonic booms that actually do reach the ground.

3.0.4.5 Ambient Noise

Ambient noise is the collection of ever-present sounds of both natural and man-made origin. Ambient noise in the ocean comprises sound generated by natural physical, natural biological, and anthropogenic (human-generated) sources (Figure 3.0-17). Preindustrial physical and biological noise sources in marine environments were often not high enough to interfere with the hearing of marine animals (Richardson et al. 1995). However, the increase in anthropogenic noise sources in recent times is a concern.

Except for some sounds generated by marine mammals, most natural ocean sound is broadband (composed of a spectrum of numerous frequencies). Virtually the entire frequency spectrum is represented in ambient sound sources as shown in Figure 3.0-17 (National Research Council 2003 adapted from Wenz 1962). Earthquakes and explosions produce sound signals from 1 Hz to 100 Hz; marine species can produce signals from 100 Hz to more than 10,000 Hz; and commercial shipping, industrial activities, and naval ships have signals between 10 Hz and 10,000 Hz (Figure 3.0-17). Spray and bubbles associated with breaking waves are the major contributors to the ambient sound in the 500 Hz to 100,000 Hz range. At frequencies greater than 100,000 Hz, "thermal noise" caused by the random motion of water molecules is the primary source. Ambient sources, especially from wave and tidal action, can cause coastal environments to have particularly high ambient sound levels.

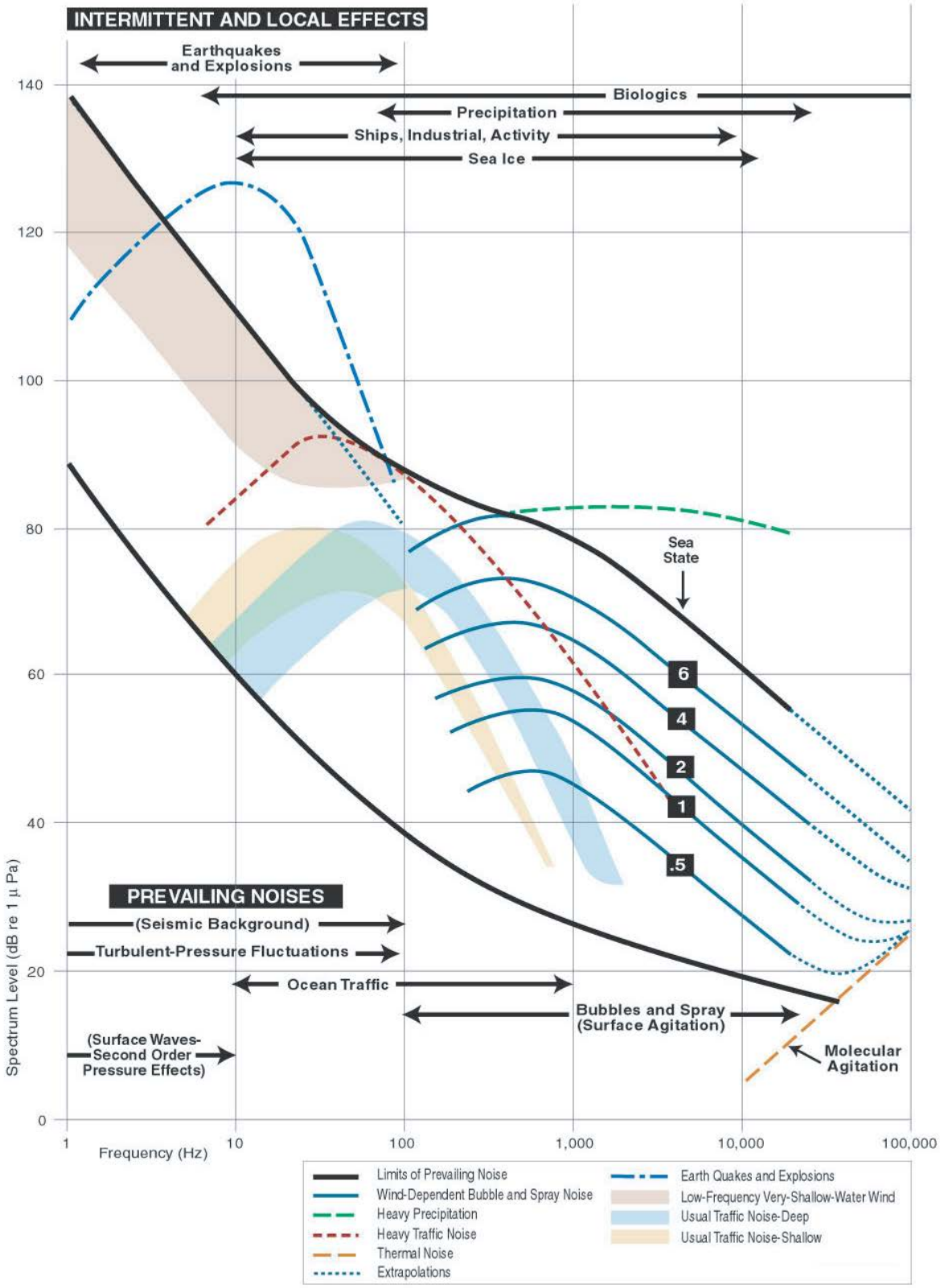

Figure 3.0-17: Oceanic Ambient Noise Levels from 1 Hz to 100,000 Hz, Including Frequency Ranges for Prevalent Noise Sources

From National Research Council (2003), adapted from Wenz (1964)

3.0.4.6 Underwater Sounds

Physical, biological, and anthropogenic sounds all contribute to the ambient underwater noise environment. Example source levels for various underwater sounds are shown in Table 3.0-6. Many naturally occurring sounds have source levels similar to anthropogenic sounds.

Table 3.0-6: Representative Source Levels of Common Underwater Sounds

Source	Source Level (dB re 1 µPa at 1 m)
Icebreaker Ship	193[1]
Large Tanker	186[1]
Seismic Airgun Array (32 guns)	259 (peak)[1]
Dolphin Whistles	125–173[1]
Dolphin Clicks	194–219[2]
Humpback Whale Song	144–174[3]
Snapping Shrimp	183–189[4]
Sperm Whale Click	236[5]
Naval Mid-Frequency Active Sonar (SQS-53)	235
Lightning Strike	260[6]
Seafloor Volcanic Eruption	255[7]

[1] (Richardson et al. 1995), [2] (Rasmussen et al. 2002), [3] (Payne and Payne 1985; Thompson et al. 1979), [4] (Au and Banks 1998), [5] (Levenson 1974; Watkins 1980), [6] (Hill 1985),[7] (Northrop 1974)

3.0.4.6.1 Physical Sources of Underwater Sound

Physical processes that create sound in the ocean include rain, wind, waves, sea ice, lightning strikes at the sea surface, undersea earthquakes, and eruptions from undersea volcanoes. Generally, these sound sources contribute to a rise in the ambient sound levels on an intermittent basis. Underwater sound from rain typically is between 1 and 10 kHz. Wind produces frequencies between 100 Hz and 30 kHz, while wave-generated sound is a significant contributor in the infrasonic range (i.e., 1 to 20 Hz) (Simmonds et al. 2003). Seismic activity results in the production of low-frequency sounds that can be heard for great distances.

3.0.4.6.2 Biological Sources of Underwater Sound

Marine animals use sound both passively and actively to navigate, communicate, locate food, reproduce, and detect predators and other important environmental cues. Sounds produced by marine species can increase ambient sound levels by nearly 20 dB over the range of a few kHz (e.g., crustaceans and fish) or over the range of tens to hundreds of kHz (e.g., dolphin clicks and whistles). For example, reproductive activity, including courtship and spawning, accounts for the majority of sounds produced by fish. During the spawning season, croakers (family Sciaenidae) vocalize for many hours and often dominate the acoustic environment (Ramcharitar et al. 2006). Other species, including baleen whales (Mysticetes) and toothed whales and dolphins (Odontocetes) produce a wide variety of sounds in many different behavioral contexts. These sounds can include tonal calls, clicks, whistles, and pulsed sounds, which cover a wide range of frequencies depending on the species and sound type produced. For instance, bottlenose dolphin clicks and whistles have a dominant frequency range of 110 to 130 kHz and 3.5 to 14.5 kHz, respectively (Au 1993). In addition, sperm whale clicks range in frequency from 0.1 kHz

to 30 kHz, with dominant energy in two bands (2 to 4 kHz and 10 to 16 kHz) (Richardson et al. 1995). Blue and fin whales produce low-frequency moans at frequencies of 10 to 25 Hz. Colonies of snapping shrimp can generate sounds at frequencies of 2 to 15 kHz.

3.0.4.6.3 Anthropogenic Sources of Underwater Sound

In addition to sounds generated during Navy training and testing, anthropogenic (human-generated) sound is introduced into the ocean by a number of sources, including non-military vessel traffic, industrial operations onshore (pile driving), seismic profiling for oil exploration, oil drilling, and underwater explosions. Noise levels resulting from human activities in coastal and offshore areas are increasing; however, there are few historical records of ambient noise data to substantiate the level of increase. Some studies have documented increases in ambient noise off California over the last several decades (Andrew et al. 2002; McDonald et al. 2006; McDonald et al. 2008).

Commercial shipping is the most widespread source of human-made, low-frequency (0 to 1,000 Hz) noise in the oceans and may contribute more than 75 percent of all human-made sound in the sea (International Council for the Exploration of the Sea 2005), particularly in coastal areas and near shipping lanes (see Figure 3.11-3 for commercial shipping lanes in the Study Area). There are approximately 20,000 large commercial vessels at sea worldwide at any given time. Because low-frequency sounds carry for long distances, a large vessel can be detected 75 to 250 nm away (Polefka 2004). The dominant component of low-frequency ambient noise is commercial tankers, which contribute twice as much noise as cargo vessels and at least 100 times as much noise as research vessels (Hatch et al. 2008). Most of these sounds are produced as a result of propeller cavitation (when air spaces created by the motion of propellers collapse) (Southall et al. 2007).

High-intensity, low-frequency impulsive sounds are emitted during seismic surveys to determine the structure and composition of the geological formations below the sea bed to identify potential hydrocarbon reservoirs (i.e., oil and gas exploration) (Simmonds et al. 2003).

3.0.4.7 Aerial Sounds

Aerial sounds may be produced by physical, biological, or anthropogenic sources. These sounds may be transmitted across the air-water interface as well. Of the physical sources of sound, surf noise is one of the most dominant. The highest sound levels from surf are typically low frequency (below 100 Hz). Biological sources of sound can be a significant contribution to the noise level in coastal environments such as areas occupied by highly vocal sea lions. Anthropogenic noise sources like ships, industrial sites, cars, and airplanes are also potential contributors.

3.0.5 Overall Approach to Analysis

The overall approach to analysis in this EIS/OEIS included the following general steps:

- Identification of resources for analysis
- Resource-specific impacts analysis for individual stressors
- Resource-specific impacts analysis for multiple stressors
- Examination of potential population-level impacts
- Cumulative impacts analysis
- Consideration of mitigations to reduce identified potential impacts

Navy training and testing activities in the Proposed Action may create one or more stimuli that cause stress on a resource. Each proposed Navy activity was examined to determine its potential stressors (Table 3.0-7). Not all stressors affect every resource, nor do all proposed Navy activities produce all stressors (Table 3.0-8). The potential direct, indirect, and cumulative impacts of the Proposed Action were analyzed based on these potential stressors being present with the resource. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts result when a direct impact on one resource induces an impact on another resource (referred to as a secondary stressor). Indirect impacts would be reasonably foreseeable because of a functional relationship between the directly impacted resource and the secondarily impacted resource. For example, a significant change in water quality could secondarily impact those resources that rely on water quality such as marine animals and public health and safety.

First, a preliminary analysis was conducted to determine the environmental resources potentially impacted and associated stressors. The term stressor is broadly used in this document to refer to an agent, condition, or other stimulus that causes stress to an organism or alters physical, socioeconomic, or cultural resources. Secondly, each resource was analyzed for potential impacts of individual stressors, followed by an analysis of the combined impacts of all stressors related to the Proposed Action. A cumulative impact analysis was conducted to evaluate the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions (Chapter 4, Cumulative Impacts). Mitigation measures are discussed in detail in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

In this phased approach, the initial analyses were used to develop each subsequent step so the analysis focused on relevant issues (defined during scoping) that warranted the most attention. The systematic nature of this approach allowed the Proposed Action with the associated stressors and potential impacts to be effectively tracked throughout the process. This approach provides a comprehensive analysis of applicable stressors and potential impacts. Each step is described in more detail below.

3.0.5.1 Resources and Issues Evaluated

Physical resources and issues evaluated include marine sediments, marine water quality, and air quality. Biological resources (including threatened and endangered species) evaluated include marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, and fish. Human resources evaluated in this EIS/OEIS include cultural resources, socioeconomics, and public health and safety.

3.0.5.2 Resources and Issues Eliminated from Further Consideration

Resources and issues considered but not carried forward for further consideration include land use, demographics, environmental justice, and children's health and safety. Land use was eliminated from further consideration because the offshore activities in the Proposed Action would not be relevant to land use issues and no new actions are being proposed that would include relevant land use. Demographics were eliminated from further consideration because implementation of the Proposed Action would not result in a change in the demographics within the Study Area of the counties of the coastal states that abut the Study Area. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was eliminated as an issue for further consideration because there were no disproportionately high and adverse human health or environmental impacts from the Proposed Action on minority populations and low-income populations. Similarly, EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was eliminated as an issue for

further consideration because there were no child protection concerns identified from implementation of the Proposed Action.

Table 3.0-7: List of Stressors Analyzed

Components and Stressors for Physical Resources
Sediments and Water Quality • Explosives and explosion byproducts • Metals • Chemicals other than explosives • Other materials
Air Quality • Criteria pollutants • Hazardous air pollutants
Components and Stressors for Biological Resources
Acoustic Stressors • Sonar and other active sources • Explosives • Pile driving • Swimmer defense airguns • Weapons firing noise • Vessel noise • Aircraft noise
Energy Stressors • Electromagnetic devices • High energy lasers
Physical Disturbance and Strike Stressors • Vessels • In-water devices • Aircraft and aerial targets • Military expended materials • Seafloor devices
Entanglement Stressors • Fiber optic cables and guidance wires • Parachutes
Ingestion Stressors • Military expended materials from munitions • Military expended materials other than munitions
Secondary Stressors • Habitat (sediments and water quality; air quality) • Prey
Components and Stressors for Human Resources
Cultural Resources Stressors • Acoustic • Physical disturbance
Socioeconomic Stressors • Accessibility • Airborne acoustics • Physical disturbance and strikes • Secondary impacts from availability of resources
Public Health and Safety Stressors • Underwater energy • In-air energy • Physical interactions • Secondary stressors (sediments and water quality)

Table 3.0-8: Stressors by Warfare and Testing Area

Warfare Area/Testing Area	Acoustic Stressors	Energy Stressors	Physical Disturbance and Strike Stressors	Entanglement Stressors	Ingestion Stressors	Accessibility	Underwater Energy	In-Air Energy	Physical Interactions	Secondary Stressors	
										Sediments and Water Quality	Air Quality
Training Activities											
Anti-Air Warfare	✓		✓	✓	✓	✓		✓	✓	✓	✓
Amphibious Warfare	✓		✓		✓	✓			✓	✓	✓
Strike Warfare	✓		✓		✓	✓		✓	✓	✓	✓
Anti-Surface Warfare	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Anti-Submarine Warfare	✓		✓	✓	✓	✓	✓		✓	✓	✓
Electronic Warfare	✓		✓		✓			✓	✓	✓	✓
Mine Warfare	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Major Exercises	✓		✓	✓	✓	✓	✓		✓	✓	✓
Other Training Activities	✓		✓		✓	✓	✓		✓	✓	✓
Testing Activities											
Anti-Air Warfare	✓		✓	✓	✓	✓		✓	✓	✓	✓
Anti-Surface Warfare	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electronic Warfare	✓		✓		✓				✓	✓	✓
Anti-Submarine Warfare	✓		✓	✓	✓	✓	✓		✓	✓	✓
Mine Warfare	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Ship Construction	✓		✓	✓	✓	✓	✓		✓	✓	✓
Shock Trials	✓		✓		✓	✓	✓		✓	✓	✓
Life Cycle Activities	✓		✓	✓	✓	✓	✓		✓	✓	✓
Naval Surface Warfare Center Panama City Activities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Naval Undersea Warfare Center Division, Newport Testing Range Activities	✓		✓	✓		✓	✓		✓		✓
South Florida Ocean Measurement Facility Activities	✓	✓	✓			✓	✓	✓	✓		✓
Anti-Surface/Anti-Submarine Warfare Testing	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Mine Warfare Testing	✓	✓	✓		✓	✓	✓		✓	✓	✓
Shipboard Protections Systems and Swimmer Defense Testing	✓		✓		✓	✓	✓		✓	✓	✓
Unmanned Vehicle Testing	✓		✓		✓	✓	✓		✓	✓	✓
Other Testing Activities	✓		✓			✓	✓		✓	✓	✓
Martha's Vineyard Coastal Observatory Acoustic Communications Experiment	✓					✓	✓		✓		
Sediment Acoustics	✓					✓	✓		✓		
Northwestlant Tomography Experiment	✓					✓	✓		✓		
East Coast Shallow Water Experiment	✓					✓	✓		✓		

3.0.5.3 Identification of Stressors for Analysis

The proposed training and testing activities were evaluated to identify specific components that could act as stressors (Table 3.0-7) by having direct or indirect impacts on the environment. This analysis included identification of the spatial variation of the identified stressors. The warfare and testing areas along with their associated environmental stressors are identified in Table 3.0-8. Matrices were prepared to identify associations between stressors, resources, training and testing activities, warfare and testing areas, range complexes, and alternatives. The following subsections describe the environmental stressors for biological resources in more detail. Each description contains a list of activities in which the stressor may occur. Refer to Appendix F (Training and Testing Activities Matrices) for more information on stressors associated with each training and testing activity. Resources that may occur or are known to occur within the Study Area and that may be exposed to the identified stressors are also listed in Appendix F (Training and Testing Activities Matrices). Stressors for physical resources (sediments and water quality, air quality) and human resources (cultural resources, socioeconomic resources, and public health and safety) are described in their respective sections of Chapter 3 (Affected Environment and Environmental Consequences).

A preliminary analysis identified the stressor/resource interactions that warrant further analysis in the EIS/OEIS based on scoping, previous NEPA analyses, and opinions of subject matter experts. Stressor/resource interactions that were determined to have negligible or no impacts were not carried forward for analysis in the EIS/OEIS.

3.0.5.3.1 Acoustic Stressors

This section describes the characteristics of sounds produced during naval training and testing and the relative magnitude and location of these sound-producing activities. This provides the basis for analysis of acoustic and explosive impacts on resources in the remainder of Chapter 3 (Affected Environment and Environmental Consequences). For additional details on the properties of sound and explosives, see Section 3.0.4 (Acoustic and Explosives Primer).

3.0.5.3.1.1 Sonar and Other Active Acoustic Sources

Sonar and other non-impulsive sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. Most systems operate within specific frequencies (although some harmonic frequencies may be emitted at lower sound pressure levels). Sonar use associated with anti-submarine warfare would emit the most non-impulsive sound underwater during training and testing activities. Sonar use associated with mine warfare would also contribute a notable portion of overall non-impulsive sound. Other sources of non-impulsive sound include acoustic communications, sonar used in navigation, and other sound sources used in testing. General categories of sonar systems are described in Section 2.3.1 (Sonar Systems and Other Acoustic Sensors). The use of each acoustic source class proposed under each alternative is shown in Table 3.0-9. The proposed use of some acoustic source classes changed after publication of the AFTT Draft EIS/OEIS due to refinement of training and testing model inputs and changes to the tempo or location of certain proposed activities (see Foreword).

Table 3.0-9: Sonar and Other Active Acoustic Source Classes for Each Alternative

For Annual Training and Testing Activities								
Source Class Category	Source Class	Units	Annual Hours					
			No Action Alternative		Alternative 1		Alternative 2	
			Training	Testing	Training	Testing	Training	Testing
Low-Frequency (LF) Sources that produce signals less than 1 kHz	LF3	Hours	0	0	0	0	0	0
	LF4	Hours	0	100	0	218	0	254
	LF5	Hours	0	33	0	325	0	370
Mid-Frequency (MF) Tactical and nontactical sources that produce signals from 1 to 10 kHz	MF1	Hours	4,370	18	9,844	206	9,844	220
	MF1K	Hours	156	5	163	18	163	19
	MF2	Hours	1,498	0	3,150	36	3,150	36
	MF2K	Hours	59	0	61	0	61	0
	MF3	Hours	1,706	32	2,058	371	2,058	434
	MF4	Hours	647	126	927	698	927	776
	MF5	Count	10,112	1,099	14,556	3,802	14,556	4,184
	MF6	Count	0	69	0	255	0	303
	MF8	Hours	0	80	0	72	0	90
	MF9	Hours	0	299	0	11,825	0	13,034
	MF10	Hours	0	12	0	1,066	0	1,067
	MF11	Hours	0	0	800	0	800	0
	MF12	Hours	23	0	687	144	687	144
High-Frequency (HF) Tactical and nontactical sources that produce signals greater than 10kHz but less than 180kHz	HF1	Hours	410	26	1,676	1,104	1,676	1,243
	HF2	Hours	0	0	0	0	0	0
	HF3	Hours	0	26	0	307	0	384
	HF4	Hours	6,680	692	8,464	4,841	8,464	5,572
	HF5	Hours	0	219	0	1,135	0	1,206
	HF6	Hours	0	433	0	1,754	0	1,974
	HF7	Hours	0	30	0	321	0	366
	HF8	Hours	0	0	0	0	0	0
Anti-Submarine Warfare (ASW) Tactical sources used during anti-submarine warfare training and testing activities	ASW1	Hours	0	0	128	96	128	96
	ASW2[1]	Hours	0	0	0	200	0	274
	ASW2[1]	Count	1450	1115	2,620	2,378	2,620	2,743
	ASW3	Hours	5,202	89	13,586	901	13,586	948
	ASW4	Count	1,006	144	1,365	400	1,365	483
Doppler Sonar (DS) Sonar using Doppler effect to aid in navigation/collect oceanographic information	DS1	Hours	0	0	0	0	0	0
Acoustic Modems (M) Transmit data acoustically through the water	M3	Hours	0	46	0	392	0	461

ASW: anti-submarine warfare; DS: Doppler sonar; HF: high-frequency; LF: low-frequency; M: acoustic modem; MF: mid-frequency

[1] The ASW2 bin contains both sources that are analyzed by hours and those that are analyzed by count. There is no overlap of the numbers in the two rows.

Table 3.0-9: Sonar and Other Active Acoustic Source Classes for each Alternative (Continued)

For Annual Training and Testing Activities (Continued)								
Source Class Category	**Source Class**	**Units**	**Annual Hours**					
			No Action Alternative		**Alternative 1**		**Alternative 2**	
			Training	**Testing**	**Training**	**Testing**	**Training**	**Testing**
Synthetic Aperture Sonar (SAS) Post-processed signals form high-resolution images of the seafloor	SAS1	Hours	0	5	0	6	0	6
	SAS2	Hours	0	108	0	3,042	0	3,424
	SAS3	Hours	0	0	0	0	0	0
Swimmer Detection Sonar (SD) Used to detect divers and submerged swimmers	SD1-SD2	Hours	0	80	0	200	0	230
Forward Looking Sonar (FLS) Forward or upward looking object avoidance sonar.	FLS2-FLS3	Hours	0	30	0	320	0	365
Torpedoes (TORP) Source classes associated with active acoustic signals produced by torpedoes	TORP1	Count	42	86	54	540	54	581
	TORP2	Count	93	143	80	464	80	521
For Non-Annual Training and Testing Activities[1]								
Source Class Category	**Source Class**	**Units**	**Hours over a 5-year Period**					
			No Action Alternative		**Alternative 1**		**Alternative 2**	
			Training	**Testing**	**Training**	**Testing**	**Training**	**Testing**
Low-Frequency (LF) Sources that produce low-frequency (less than 1 kHz) signals	LF5	Hours	0	129	0	240	0	240
Mid-Frequency (MF) Tactical and nontactical sources that produce mid-frequency (1 to 10 kHz) signals	MF9	Hours	0	259	0	480	0	480
High-Frequency (HF) Tactical and nontactical sources that produce high-frequency (greater than 10 kHz but less than 180 kHz) signals	HF4	Hours	0	0	192	0	192	0
	HF5	Hours	0	129	0	240	0	240
	HF6	Hours	0	388	0	720	0	720
	HF7	Hours	0	129	0	240	0	240
Forward Looking Sonar (FLS) Forward or upward looking object-avoidance sonar	FLS2 – FLS3	Hours	0	129	0	240	0	240
Synthetic Aperture Sonar (SAS) Sonar in which active acoustic signals are post-processed to form high-resolution images of the seafloor	SAS2	Hours	0	388	0	720	0	720

[1] The portion of this table describing use of sonar and other active acoustic sources during non-annual activities was inadvertently left out of the AFTT Draft EIS/OEIS. The impacts due to the activities, however, were analyzed in the AFTT Draft EIS/OEIS.
FLS: forward looking sonar; SAS: synthetic aperture sonar; SD: swimmer detection sonar; TORP: torpedoes

Underwater sound propagation is highly dependent upon environmental characteristics such as bathymetry, bottom type, water depth, temperature, and salinity. The sound received at a particular location will be different than near the source due to the interaction of many factors, including propagation loss; how the sound is reflected, refracted, or scattered; the potential for reverberation; and interference due to multi-path propagation (Section 3.0.4.4, Predicting How Sound Travels).

A very simple estimate of sonar transmission loss can be calculated using the spherical spreading law, $TL = 20 \log_{10} r$, where r is the distance from the sound source and TL is the transmission loss in decibels (Section 3.0.4.4.1, Sound Attenuation and Transmission Loss). While a simple example is provided here for illustration, the Navy Acoustic Effects Model takes into account the influence of multiple factors to predict acoustic propagation (Marine Species Modeling Team 2013). The simplified estimate of spreading loss for a ping from a hull-mounted tactical sonar with a representative source level of 235 dB re 1 µPa is shown in Figure 3.0-18. The figure shows that sound levels drop off significantly near the source, followed by a more steady reduction with distance. Most non-impulsive sound sources used during training and testing have sound source levels lower than this example.

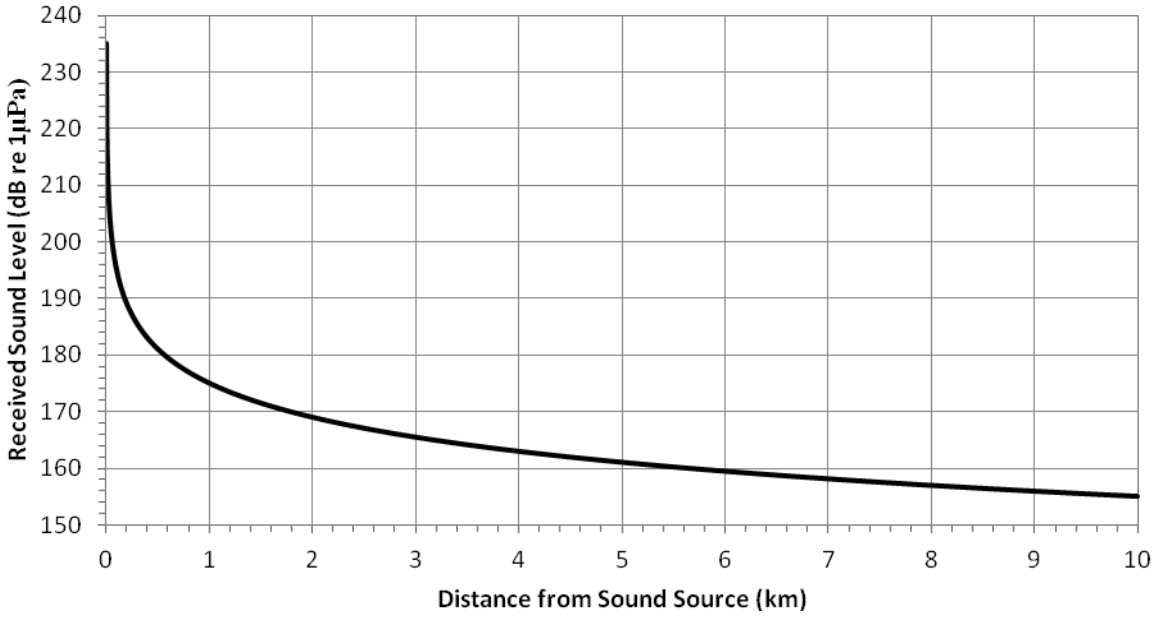

Figure 3.0-18: Estimate of Spreading Loss for a 235 dB re 1 µPa Sound Source Assuming Simple Spherical Spreading Loss

Most use of active acoustic sources involves a single unit or several units (ship, submarine, aircraft, or other platform) employing a single active sonar source in addition to sound sources used for communication, navigation, and measuring oceanographic conditions. Anti-submarine warfare activities may also use an acoustic target or an acoustic decoy.

Anti-Submarine Warfare Sonar

Sonar used in anti-submarine warfare is deployed on many platforms and is operated in various ways. Anti-submarine warfare active sonar is usually mid-frequency (1–10 kHz) because mid-frequency sound balances sufficient resolution to identify targets and distance within which threats can be identified.

- Ship tactical hull-mounted sonar contributes the largest portion of overall non-impulsive sound. Duty cycle can vary from about a ping per minute to continuously active. Sonar can be wide-ranging in a search mode or highly directional in a track mode.
- A submarine's mission revolves around its stealth; therefore, a submarine's mid-frequency sonar is used infrequently because its use would also reveal a submarine's location.
- Aircraft-deployed, mid-frequency, anti-submarine warfare systems include omnidirectional dipping sonar (deployed by helicopters) and omnidirectional sonobuoys (deployed from various aircraft), which have a typical duty cycle of several pings per minute.
- Acoustic decoys that continuously emulate broadband vessel sound or other vessel acoustic signatures may be deployed by ships and submarines.
- Torpedoes use directional high-frequency sonar when approaching and locking onto a target. Practice targets emulate the sound signatures of submarines or repeat received signals.

Anti-submarine warfare activities for all platforms typically would occur within and adjacent to existing east coast OPAREAs beyond 12 nm, with the exception of sonar dipping activities conducted by helicopters closer to shore. In addition, hull-mounted sonar may occasionally be used in port during system maintenance. Most anti-submarine warfare activities involving submarines or submarine targets would occur in waters greater than 183 m (600 ft.) deep due to safety concerns about running aground at shallower depths.

Most events usually occur over a limited area and are completed in less than one day, often within a few hours. Multi-day anti-submarine warfare events requiring coordination of movement and effort between multiple platforms with active sonar over a larger area occur less often, but constitute a large portion of the overall non-impulsive underwater noise that would be imparted by Navy activities. For example, the largest event, a composite training unit exercise, would have periods of concentrated, near-continuous anti-submarine warfare sonar use by several platforms during a several-week period.

Mine Warfare Sonar

Sonar used to locate mines and other small objects is typically high-frequency, which provides higher resolution. Mine detection sonar is deployed at variable depths on moving platforms to sweep a suspected mined area (towed by ships, helicopters, or unmanned underwater vehicles). Mid-frequency hull-mounted sonar can also be used in an object detection mode known as "Kingfisher" mode. Mine detection sonar use would be concentrated in areas where practice mines are deployed, typically in water depths less than 200 ft. (61 m). Most events usually occur over a limited area and are completed in less than one day, often within a few hours.

Other Active Acoustic Sources

Active sound sources used for navigation and obtaining oceanographic information (e.g., depth, bathymetry, and speed) are typically directional, have high duty cycles, and cover a wide range of frequencies, from mid-frequency to very high-frequency. These sources are similar to the navigation systems on standard large commercial and oceanographic vessels. Sound sources used in communications are typically high-frequency or very high-frequency. These sound sources could be used by vessels during most activities and while transiting throughout the Study Area.

Use of Sonar During Training

Anti-submarine Warfare training activities using sonar would be concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area, although these

activities could occur anywhere in the Study Area. These activities would typically occur in the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Tracking exercises/torpedo exercises typically consist of a single unit conducting anti-submarine warfare; however, other events could include multiple units conducting anti-submarine warfare concurrently.

Mine warfare training activities using sonar would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream and North Atlantic Gyre Open Ocean Areas. These activities would typically occur in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

In general, sonar use would increase under Alternatives 1 and 2 compared to the No Action Alternative. Many of these changes would be to increases in the number of similar activities at similar locations as under the No Action Alternative. The most notable changes in activities using sonar that were analyzed under Alternatives 1 and 2 compared to the No Action Alternative include:

- Reduced use of sonar during:
  - Anti-Submarine Warfare Tactical Development Exercise in JAX Range Complex.
  - Tracking exercises/torpedo exercises in Navy Cherry Point and GOMEX Range Complexes.

- Increased use of sonar during:
  - Mine warfare training in VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.
  - Composite training unit exercises in VACAPES, JAX, and GOMEX Range Complexes.
  - Group Sail in VACAPES, Navy Cherry Point, and JAX Range Complexes.
  - Joint task force exercises/sustainment exercises in JAX Range Complex.
  - Tracking exercises/torpedo exercises in VACAPES and JAX Range Complexes.

- New use of sonar during:
  - Composite training unit exercises in Navy Cherry Point Range Complex.
  - Submarine under ice certification in Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes.

The number of training activities using sonar and their proposed locations under each alternative are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).

Use of Sonar During Testing

Anti-submarine warfare testing activities using sonar could occur in multiple locations in the Study Area, typically in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream and North Atlantic Gyre Open Ocean Areas. These activities could occur in all training range complexes; at Naval Undersea Warfare Center Division, Newport Testing Range, Rhode Island; at Naval Surface Warfare Center, Panama City Division Testing Range; and at the South Florida Ocean Measurement Facility Testing Range.

Mine warfare training activities using sonar could occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream and North Atlantic Gyre Open Ocean Areas. These activities would typically occur in the VACAPES, JAX, and GOMEX Range Complexes.

In general, sonar use would increase under Alternatives 1 and 2 compared to the No Action Alternative. Many of these changes would be to amounts of similar activities at similar locations as under the No Action Alternative. Notable changes in activities using sonar that were analyzed under Alternatives 1 and 2 compared to the No Action Alternative include:

- Increased use of sonar during:
  - Anti-submarine warfare tracking test- helicopter at Northeast, VACAPES, JAX, and GOMEX Range Complexes.
  - Anti-submarine warfare torpedo test- helicopter at VACAPES Range Complex.
  - Unmanned underwater vehicle testing at Naval Surface Warfare Center, Panama City Division Testing Range and Naval Undersea Warfare Center Division, Newport Testing Range, Rhode Island.
  - Surface ship and submarine sonar testing and maintenance throughout the Study Area.
  - New ship construction activities while pierside.
  - Non-explosive torpedo testing at Northeast, VACAPES, JAX, and GOMEX Range Complexes.

- New use of sonar during:
  - Mission package testing in VACAPES and JAX Range Complexes.
  - Submarine sea trials at Northeast, VACAPES, JAX, and GOMEX Range Complexes.
  - Surface combatant sea trials at Northeast, VACAPES, JAX, and GOMEX Range Complexes.
  - Testing activities at the South Florida Ocean Measurement Facility Testing Range.
  - Sonobuoy lot acceptance testing in Key West Range Complex.
  - Combat system ship qualification trials in JAX Range Complex.
  - Countermeasure testing at Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes, and at Naval Surface Warfare Center, Panama City Division Testing Range.
  - Special warfare testing and stationary source testing at Naval Surface Warfare Center, Panama City Division Testing Range.
  - Unmanned vehicle development and payload testing at Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

The number of testing activities using sonar and their proposed locations under each alternative are shown in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

3.0.5.3.1.2 Explosives

Explosive detonations during testing and training activities are associated with high-explosive munitions (including bombs, missiles, torpedoes, and naval gun shells), mines, demolition charges, explosive sonobuoys, and ship shock trial charges. Most explosive detonations during training and testing would be in the air or near the water surface, although charges associated with mine neutralization could occur anywhere within the water column or on the sea floor. Most detonations would occur in waters greater than 200 ft. (61 m) in depth and greater than 3 nm from shore, although mine warfare, demolition, and some testing detonations could occur closer to shore. Detonations associated with anti-submarine warfare would typically occur in waters greater than 600 ft. (180 m) depth. The numbers of explosions in each explosive source class proposed under each alternative are shown in Table 3.0-10 through Table 3.0-14. The proposed use of some explosive source classes changed after publication of the AFTT

Draft EIS/OEIS due to refinement of training and testing model inputs and changes to the tempo or location of certain proposed activities.

Table 3.0-10: Explosives for Annual Training and Testing Activities in the Study Area (Annual Usage)

Source Class (Net Explosive Weight)	Number of Explosives (Annual) for Training Activities			Number of Explosives (Annual) for Testing Activities		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
E1 (0.1 – 0.25 lb.)	103	124,552	124,552	7,000	22,802	25,501
E2 (0.26 – 0.5 lb.)	32	856	856	0	0	0
E3 (0.6 – 2.5 lb.)	100	3,132	3,132	734	2,128	2,912
E4 (2.6 – 5 lb.)	2,130	2,190	2,190	479	1,143	1,432
E5 (6 – 10 lb.)	1,400	14,370	14,370	94	448	495
E6 (11 – 20 lb.)	140	500	500	8	49	54
E7 (21 – 60 lb.)	30	322	322	0	0	0
E8 (61 – 100 lb.)	54	77	77	4	10	11
E9 (101 – 250 lb.)	7	2	2	0	0	0
E10 (251 – 500 lb.)	5	8	8	0	8	10
E11 (501 – 650 lb.)	4	1	1	20	25	27
E12 (651 – 1,000 lb.)	27	133	133	0	0	0
E13 (1,001 – 1,740 lb.)	0	0	0	0	0	0
E14 (1,741 – 3,625 lb.)	0	0	0	3	3	4

lb.: pound(s)

Table 3.0-11: Explosives for Non-Annual Training and Testing Activities in the Study Area over a 5-Year Period (Including Ship Shock Trial Testing)[1]

Source Class (Net Explosive Weight)	Number of Explosives (per activity) for Training Activities			Number of Explosives (per activity) for Testing Activities		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
E1 (0.1-0.25 lb.)	0	0	0	0	600	600
E2 (0.26-0.5 lb.)	0	2	2	0	0	0
E4 (2.6-5 lb.)	0	2	2	0	0	0
E16[2] (7,251 – 14,500 lb.)	0	0	0	0	12	12
E17[2] (14,501 – 58,000 lb.)	0	0	0	0	4	4

lb.: pound(s)

[1] The portion of this table describing use of explosive during non-annual activities other than ship shock trials was inadvertently left out of the AFTT Draft EIS/OEIS. The impacts due to the activities, however, were analyzed in the AFTT Draft EIS/OEIS.

[2] Up to one aircraft carrier full ship shock trial (source class E17), one DDG full ship shock trial (source class E16), and two Littoral Combat Ship full ship shock trials (source class E16) could occur within a five-year period. Each full ship shock trial would include up to four detonations spaced approximately one week apart.

Table 3.0-12: Number and Location of In-Air Explosions

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Missiles						
Northeast	0	4	4	0	0	0
VACAPES	72	72	72	0	38	38
Navy Cherry Point	20	51	51	0	0	0
JAX	15	52	52	0	9	9
Key West	0	8	8	0	0	0
GOMEX	0	8	8	0	0	0
Total	**107**	**195**	**195**	**0**	**47**	**47**
Large-Caliber Projectiles						
VACAPES	0	1,760	1,760	0	1,797	1,797
JAX	0	1,100	1,100	0	339	339
Key West	0	0	0	0	339	339
Total	**0**	**2,860**	**2,860**	**0**	**2,475**	**2,475**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; VACAPES: Virginia Capes Range Complex

Table 3.0-13: Number and Location of Surface Explosions

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
100 lb. NEW Charges						
VACAPES	0	4	4	0	0	0
Total	**0**	**4**	**4**	**0**	**0**	**0**
60 lb. NEW Charges						
VACAPES	0	144	144	0	0	0
Navy Cherry Point	0	4	4	0	0	0
JAX	0	4	4	0	0	0
Key West	0	2	2	0	0	0
GOMEX	0	2	2	0	0	0
Total	**0**	**156**	**156**	**0**	**0**	**0**
20 lb. NEW Charges						
VACAPES (W-50)	12	0	0	0	0	0
VACAPES	0	112	112	0	0	0
Navy Cherry Point (UNDET Area)	10	0	0	0	0	0
Navy Cherry Point	0	2	2	0	0	0
JAX (UNDET Areas North and South)	6	0	0	0	0	0
JAX	0	4	4	0	0	0
Key West	0	2	2	0	0	0
GOMEX	0	2	2	0	0	0
Total	**28**	**122**	**122**	**0**	**0**	**0**
10 lb. NEW Charges						
VACAPES	0	4	4	0	0	0
Navy Cherry Point	0	2	2	0	0	0
JAX	0	2	2	0	0	0
Key West	0	2	2	0	0	0
GOMEX	0	2	2	0	0	0
Total	**0**	**12**	**12**	**0**	**0**	**0**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; lb.: pound(s); NEW: Net Explosive Weight; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Table 3.0-13: Number and Location of Surface Explosions (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Bombs						
VACAPES (Air-K)	20	0	0	0	0	0
VACAPES	0	64	64	0	0	0
Navy Cherry Point	0	32	32	0	0	0
JAX	0	32	32	0	0	0
GOMEX (W-155 Hotbox)	4	0	0	0	0	0
GOMEX	0	4	4	0	0	0
Other AFTT Areas (SINKEX Box)	1	1	1	0	0	0
Total	**25**	**133**	**133**	**0**	**0**	**0**
Rockets						
Northeast	0	0	0	0	0	0
VACAPES	0	3,800	3,800	0	184	202
Navy Cherry Point	0	0	0	0	0	0
JAX	0	3,800	3,800	0	184	202
Key West	0	0	0	0	0	0
GOMEX	0	380	380	0	0	0
Total	**0**	**7,980**	**7,980**	**0**	**368**	**404**
Missiles						
Northeast	0	0	0	0	8	8
VACAPES (W-386, W-72, R-6604)	0	0	0	5	0	0
VACAPES [W-386 (Air E, F, I, J, K), W-72A]	106	0	0	0	0	0
VACAPES	0	118	118	0	56	60
Navy Cherry Point [W-122 (16/17, 18/19/20/21)]	24	0	0	0	0	0
Navy Cherry Point	0	40	40	0	0	0
JAX (MLTR)	73	0	0	5	0	0
JAX	0	126	126	0	27	30
Gulf of Mexico	0	0	0	0	4	4
Other AFTT Areas (SINKEX Box)	11	11	11	0	0	0
Total	**214**	**295**	**295**	**10**	**94**	**101**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MLTR: Missile Laser Training Range; Northeast: Northeast Range Complexes; SINKEX: sinking exercise; VACAPES: Virginia Capes Range Complex; W: warning area

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Table 3.0-13: Number and Location of Surface Explosions (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Large-Caliber Projectiles						
VACAPES (5-C/D, 7-C/D, 8-C/D, 1C-1/2)	858	0	0	0	0	0
VACAPES	0	4,884	4,884	0	0	0
Navy Cherry Point [W-122 (4/5, 13/14)]	78	0	0	0	0	0
Navy Cherry Point	0	866	866	0	0	0
JAX (BB,CC)	390	0	0	0	0	0
JAX	0	3,348	3,348	0	0	0
NSWC PCD	0	0	0	0	40	50
GOMEX	0	284	284	0	0	0
Other AFTT Areas (SINKEX Box)	700	700	700	0	0	0
Other AFTT Areas	0	96	96	0	0	0
AFTT Study Area	0	0	0	0	3,920	4,900
Total	**2,026**	**10,178**	**10,178**	**0**	**3,960**	**4,950**
Medium-Caliber Projectiles						
VACAPES	0	49,936	49,936	0	10,200	11,200
Navy Cherry Point	0	21,226	21,226	0	200	200
JAX	0	46,120	46,120	0	10,200	11,200
GOMEX	0	6,352	6,352	0	0	0
Other AFTT Areas	0	320	320	0	0	0
AFTT Study Area	0	0	0	0	2,800	3,500
Total	**0**	**123,954**	**123,954**	**0**	**23,400**	**26,100**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SINKEX: sinking exercise; VACAPES: Virginia Capes Range Complex; W: warning area

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Table 3.0-14: Number and Location of Underwater Explosions

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Torpedoes						
Other AFTT Areas (SINKEX Box)	1	1	1	8	0	0
AFTT Study Area	0	0	0	0	8	8
Total	**1**	**1**	**1**	**8**	**8**	**8**
Sonobuoys						
Northeast	340	170	170	224	320	514
VACAPES	360	443	443	172	796	950
Cherry Point	360	183	183	112	112	204
JAX	360	1,113	1,113	152	152	244
Key West	0	0	0	0	1,312	1,512
GOMEX	0	0	0	112	112	204
Gulf of Mexico	351	70	70	0	0	0
Other AFTT Areas	0	0	0	184	184	368
Total	**1,771**	**1,979**	**1,979**	**956**	**2,988**	**3,996**
Anti-Swimmer Grenades						
Northeast	0	52	52	0	0	0
VACAPES	0	74	74	0	0	0
Cherry Point	0	28	28	0	0	0
JAX (Charleston OPAREA UNDET Boxes North and South)	80	0	0	0	0	0
JAX	0	24	24	0	0	0
GOMEX (CC UNDET Box E3)	20	0	0	0	0	0
GOMEX	0	28	28	0	0	0
Total	**100**	**206**	**206**	**0**	**0**	**0**
Line Charges						
NSWC PCD	0	0	0	3	3	4
Total	**0**	**0**	**0**	**3**	**3**	**4**
LCS/DDG Ship Shock Charge						
VACAPES or JAX	0	0	0	0	12	12
Total	**0**	**0**	**0**	**0**	**12**	**12**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; LCS/DDG: Littoral Combat Ships/Destroyers; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; OPAREA: operating area; SINKEX: sinking exercise; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Table 3.0-14: Number and Location of Underwater Explosions (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Aircraft Carrier Ship Shock Charge						
VACAPES or JAX	0	0	0	0	4	4
Total	**0**	**0**	**0**	**0**	**4**	**4**
650 lb. NEW Charges						
VACAPES	0	0	0	0	5	6
NSWC PCD	0	0	0	24	16	16
Total	**0**	**0**	**0**	**24**	**21**	**22**
100 lb. NEW Charges						
VACAPES	0	4	4	0	0	0
Gulf of Mexico	0	0	0	0	6	7
Total	**0**	**4**	**4**	**0**	**6**	**7**
75 lb. NEW Charges						
NSWC PCD	0	0	0	3	0	0
Total	**0**	**0**	**0**	**3**	**0**	**0**
60 lb. NEW Charges						
VACAPES (Little Creek)	0	6	6	0	0	0
VACAPES	0	144	144	0	0	0
Cherry Point	0	4	4	0	0	0
JAX	0	4	4	0	0	0
Key West	0	2	2	0	0	0
GOMEX	0	2	2	0	0	0
Total	**0**	**162**	**162**	**0**	**0**	**0**
20 lb. NEW Charges						
Northeast	0	1	1			
VACAPES (W-50)	12	0	0	0	0	0
VACAPES (Little Creek)	0	60	60	0	0	0
VACAPES	0	113	113	0	0	0
Cherry Point (Onslow Bay UNDET Area)	10	0	0	0	0	0
Cherry Point	0	3	3	0	0	0
JAX (Charleston OPAREA UNDET Boxes North and South)	6	0	0	0	0	0
JAX	0	5	5	0	0	0
Key West	0	2	2	0	0	0
NSWC PCD	0	0	0	4	4	4
GOMEX	0	3	3	0	0	0
Total	**28**	**187**	**187**	**4**	**4**	**4**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; lb.: pound(s); NEW: Net Explosive Weight; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; OPAREA: operating area; SINKEX: sinking exercise; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Table 3.0-14: Number and Location of Underwater Explosions (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
10 lb. NEW Charges						
VACAPES	0	4	4	0	0	0
Cherry Point	0	2	2	0	0	0
JAX	0	2	2	0	20	20
Key West	0	2	2	0	0	0
NSWC PCD	0	0	0	51	0	0
GOMEX	0	2	2	0	0	0
Gulf of Mexico	0	0	0	0	20	20
Total	**0**	**12**	**12**	**51**	**40**	**40**
5 lb. NEW Charges						
VACAPES (W-50)	30	0	0	0	0	0
VACAPES (W-50, W-72)	0	0	0	90	0	0
VACAPES (Little Creek)	0	12	12	0	0	0
VACAPES	0	60	60	0	126	145
JAX	0	0	0	0	24	32
NSWC PCD	0	0	0	40	161	171
GOMEX	0	20	20	0	0	0
Gulf of Mexico	0	0	0	0	12	14
Total	**30**	**92**	**92**	**130**	**323**	**362**
.25 lb. NEW Charges						
VACAPES (Little Creek)	0	1,440	1,440	0	0	0
Total	**0**	**1,440**	**1,440**	**0**	**0**	**0**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; lb.: pound(s); NEW: New Explosive Weight; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; VACAPES: Virginia Capes Range Complex; W: warning area

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

Explosives introduce loud, impulsive, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: (1) the weight of the explosive warhead, (2) the type of explosive material, and (3) the detonation depth. The net explosive weight, the explosive power of a charge expressed as the equivalent weight of trinitrotoluene (TNT), accounts for the first two parameters. The properties of explosive detonations are discussed in Section 3.04 (Acoustic and Explosives Primer).

In general, explosive events would consist of a single explosion or multiple explosions over a short period. Detonations of projectiles during anti-air warfare would occur far above the water surface; with the exception of high-speed anti-radiation missiles and 5 in. round air bursts, both of which would occur approximately 30 m above the surface. During training, all large, high-explosive bombs would be detonated near the surface over deep water. High-explosive bombs would be fused to detonate on contact with the water. Other detonations would occur near but above the surface upon impact with a target; these detonations are conservatively assumed to occur at a depth of 1 m (3 ft.) for purposes of

analysis. Table 3.0-15 shows the depths at which representative explosive source classes are assumed to detonate underwater for purposes of analysis.

Table 3.0-15: Representative Ordnance, Net Explosive Weights, and Detonation Depths

Representative Ordnance	Explosive Source Class (Net Explosive Weight)	Representative Underwater Detonation Depth[1]
Medium-Caliber Projectiles	E1 (0.1-0.25 lb.)	1 m (3 ft.)
Medium-Caliber Projectiles	E2 (0.26-0.5 lb.)	1 m (3 ft.)
Large-Caliber Projectiles	E3 (0. 6-2.5 lb.)	1 m (3 ft.)
Improved Extended Echo Ranging Sonobuoy	E4 (2.6-5 lb.)	20 m (66 ft.), 198 m (650 ft.)
5 in. Projectiles	E5 (6-10 lb.)	1 m (3 ft.)
15 lb. Shaped Charge	E6 (11-20 lb.)	1 m (3 ft.)
Demo Block/Shaped Charge	E7 (21-60 lb.)	15 m (50 ft.)
250 lb. Bomb	E8 (61-100 lb.)	1 m (3 ft.)
500 lb. Bomb	E9 (101-250 lb.)	1 m (3 ft.)
1,000 lb. Bomb	E10 (251-500 lb.)	1 m (3 ft.)
650 lb. Mine	E11 (501-650 lb.)	6 m (20 ft.), 10 m (33 ft.)
2,000 lb. Bomb	E12 (651-1,000 lb.)	1 m (3 ft.)
Ship Shock Charge	E15 (3,626-7,250 lb.)	61 m (200 ft.)
	E16 (7,251-14,500 lb.)	
	E17 (14,501-58,000 lb.)	

ft.: feet; in.: inch; lb.: pound(s); m: meters

[1]Underwater detonation depths listed are those assumed for purposes of acoustic impacts modeling. Detonations assumed to occur at a depth of 3 ft. (1 m) include detonations that would actually occur at or just above the water surface.

Since most explosive sources used in military activities are munitions that detonate essentially upon impact, the effective source depths are quite shallow and, therefore, the surface-image interference effect can be pronounced (Section 3.04, Acoustic and Explosives Primer). This effect would reduce peak pressures and potential impacts near the water surface.

The locations for training and testing in the Study Area are shown in Figures 2.6-2 through 2.6-4.

Explosives in Training

Training activities using explosives would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area. Most explosions would occur in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. In general, use of explosives would increase under Alternatives 1 and 2 compared to the No Action Alternative. Many of these changes would be to amounts of similar activities at similar locations as under the No Action Alternative. The most notable changes in activities using explosives under Alternatives 1 and 2 compared to the No Action Alternative include:

- Reduced use of sonobuoys (source class E4) in Navy Cherry Point and GOMEX Range Complexes.
- Increased use of explosives during:
    - Bombing exercises (air-to-surface) (source class E12) in VACAPES, Navy Cherry Point, and JAX Range Complexes.

  - Firing exercises (source class E5) at VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.
  - Anti-submarine warfare using explosive sonobuoys (source class E4) in VACAPES and JAX Range Complexes.
  - Gunnery exercises (source classes E1, E2, E3, and E5) in VACAPES, Navy Cherry Point, JAX, and Gulf of Mexico Range Complexes.
  - Mine neutralization (source classes E4, E5, E6, E7, and E8) in VACAPES Range Complex.
- New explosives use during mine neutralization in Key West Range Complex (source classes E5, E6, and E7).

The number of training activities using explosives and their proposed locations under each alternative are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).

Explosives in Testing

Testing activities using explosives would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Living Marine Ecosystems, as well as the Gulf Stream Open Ocean Area. Activities would also occur in the Caribbean Sea Large Marine Ecosystem under Alternatives 1 and 2. Most explosions associated with testing activities would occur at Naval Surface Warfare Center, Panama City Division Testing Range, and in the Northeast, VACAPES, JAX, and GOMEX Range Complexes, plus the Key West Range Complex under Alternatives 1 and 2. Most detonations would occur away from shorelines, with the exception of testing events at Naval Surface Warfare Center, Panama City Division Testing Range, which could occur up to the surf line. Use of explosives would increase under Alternatives 1 and 2 compared to the No Action Alternative. Some increases would be to similar activities at similar locations as under the No Action Alternative. The most notable changes analyzed under Alternatives 1 and 2 compared to the No Action Alternative include:

- Increased use of explosives during:
  - Air-to-surface gunnery tests (source class E1) at VACAPES and JAX Range Complexes.
  - Anti-submarine warfare tracking test- sonobuoy (source classes E3 and E4) throughout the Study Area.
  - Rocket testing (source class E5) at VACAPES and JAX Range Complexes.
  - Air-to-surface missile test (source class E6) at VACAPES and JAX Range Complexes.
- New explosive use during:
  - Aircraft carrier sea trial gun testing (source class E1) and missile testing (source class E6) at VACAPES, Navy Cherry Point, and JAX Range Complexes.
  - At-sea explosives testing (source class E5) at JAX and GOMEX Range Complexes.
  - Mission package testing (source classes E4 and E6) in VACAPES and JAX Range Complexes.
  - Sonobuoy lot acceptance testing (source classes E3 and E4) at Key West Range Complex.
  - Mine countermeasure/neutralization testing at GOMEX Range Complex (source class E8) and VACAPES Range Complex (source class E4).
  - Full Ship Shock Trial Testing of the Littoral Combat Ships (source class E16), DDG 1000 destroyer (source class E16), and aircraft carrier (source class E17) in the VACAPES and JAX Range Complexes.

The number of testing activities using explosives and their proposed locations under each alternative are shown in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

Ship Shock Trials

Because the largest proposed detonations would occur during a ship shock trial testing event (see Section 2.4.2.2.2, Shock Trials), these detonations are discussed in further detail. Ship shock trials consist of a series of underwater detonations that propagate a shock wave through a ship's hull under deliberate and controlled conditions simulating near misses from underwater explosions. A representative ship from a new ship class is exposed to four detonations at a rate of up to two per week to allow time to perform detailed inspections of the ship's systems and assess the ability of the ship and crew to withstand near-miss situations.

Some parameters of past ship shock explosions using 10,000 lb. (4,536 kg) high blast explosive charges (source class E16) were predicted under prior analyses (U.S. Department of the Navy 2008a). The shock wave would reach the seafloor and be reflected from it without any major sediment disturbance. The spherical bubble produced by each explosion would expand to a maximum radius of 62 ft. (19 m). The bubble would migrate upward and collapse beneath the surface, where it would re-expand and emerge into the atmosphere. The water that would be ejected would form a roughly hemispherical mass of plumes with an estimated maximum height of 540 ft. (165 m).

In addition to impacts due to propagation of the shock wave and acoustic waves, these large underwater detonations may cause a region of bulk cavitation near the surface due to the reflected shock wave. Cavitation occurs when compression (shock) waves propagate to the surface and are reflected back into the water as rarefaction (or negative pressure) waves. This causes a state of tension, or very low pressure, to occur within a large region of water. Since water cannot ordinarily sustain a significant amount of tension, it cavitates and the surrounding pressure drops to the vapor pressure of water. A water hammer pulse is generated when the upper and lower layers of the cavitation region rejoin (close). As an example, Figure 3.0-19 shows that estimated bulk cavitation region for an explosive source class E16 (7,251-14,500 lb. net explosive weight) detonation at a depth of 200 ft. (61 m)(U.S. Department of the Navy 2008a). The maximum lateral extent (radius) of this cavitation area is predicted to be 2,250 ft. (686 m). A charge of this size or greater would only be detonated during ship shock trials.

Two potential locations for the proposed shock trials are the Norfolk, Virginia and Jacksonville, Florida locations defined in the Final EIS for the Mesa Verde (LPD 19) ship shock trial (U.S. Department of the Navy 2008a). Selection of these locations for the proposed shock trials was based on operational requirements (proximity to support, munition storage/loading, and repair facilities), environmental features (avoidance of hard bottom and coral reefs), safety considerations, Gulf Stream avoidance, and water depth. In both locations the minimum water depth is 600 ft. (183 m). The charges are detonated at 200 ft. (61 m) below the water surface.

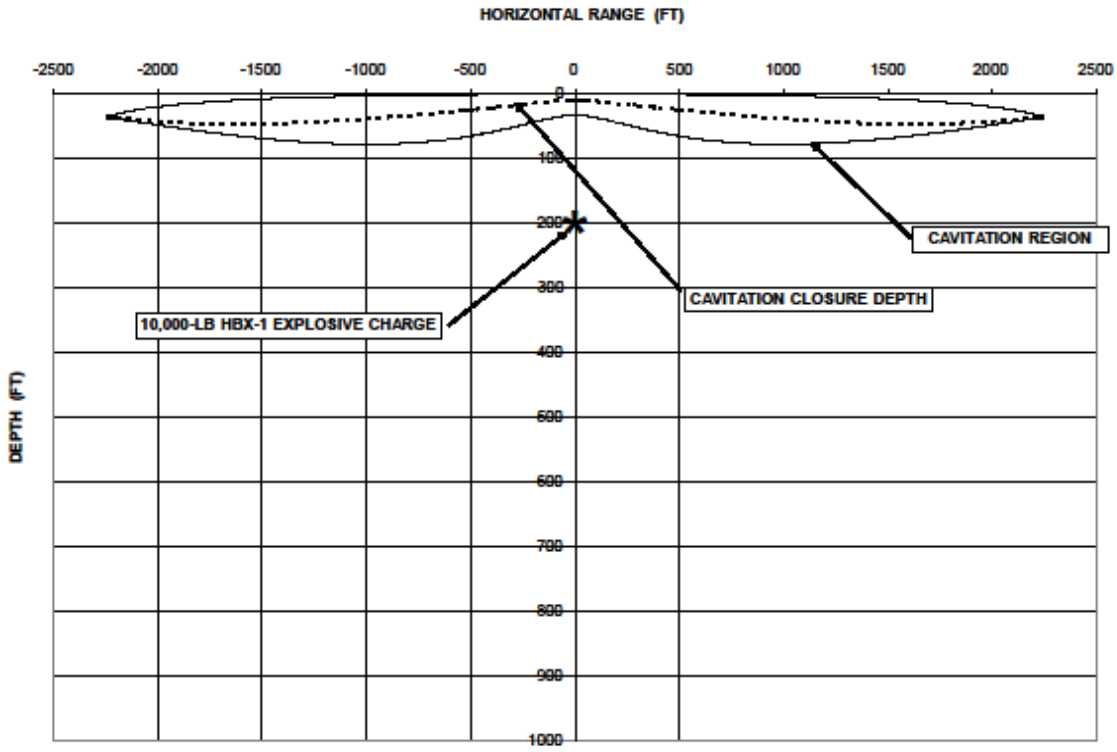

Figure 3.0-19: Calculated Bulk Cavitation Region and Closure Depth for a 10,000 lb. (4,536 kg) High Blast Explosive Charge (Source Class E16) Detonated at a Depth of 200 ft. (61 m)
(U.S. Department of the Navy 2008a)

3.0.5.3.1.3 Pile Driving

Impact pile driving and vibratory pile removal would occur during construction of an elevated causeway system during Joint Logistics Over-the-Shore training. A separate environmental assessment has been prepared to address impacts due to all activities that occur during Joint Logistics Over-the-Shore training, with the exception of impacts due to in-water noise generated during construction of the elevated causeway. This EIS/OEIS includes analysis of the impact of underwater noise generated by pile driving during elevated causeway construction to facilitate holistic analysis of impacts due to all underwater noise generated during testing and training in the Study Area.

Construction of the elevated causeway system, a temporary pier allowing offloading of supply ships, would require pile driving and pile removal. Construction of the elevated causeway system during training would occur once per year under Alternatives 1 and 2 at one of the following locations: in the VACAPES Range Complex (Joint Expeditionary Base West [Little Creek], Virginia or Joint Expeditionary Base East [Fort Story], Virginia) or in the Navy Cherry Point Range Complex (Marine Corps Base Camp Lejeune, North Carolina). The length of the pier, and therefore the number of piles required, would be determined by the distance from shore to the appropriate water depth for ship off-loading. Construction of the elevated causeway system would involve intermittent impact pile driving of 24-inch (in.), uncapped, steel pipe piles over approximately two weeks. Crews work 24 hours a day and can drive approximately eight piles in that period. Each pile takes about 10 minutes to drive. When training events that use the elevated causeway system are complete, the structure would be removed using vibratory methods over approximately six days. Crews can remove about 14 piles per 24-hour period, each taking about six minutes to remove. Table 3.0-16 summarizes the pile driving and pile removal activities that would occur during a 24-hour period.

Impact pile driving creates repetitive impulsive sound. An impact pile driver generally operates in the range of 36 to 50 blows per minute. Vibratory pile driving creates a nearly continuous sound made up of a series of short duration rapid impulses at a much lower source level than impact pile driving. The sounds are emitted both in the air and in the water.

Table 3.0-16: Summary of Pile Driving and Removal Activities Per 24-Hour Period

Method	Piles Per 24-Hour Period	Time Per Pile	Total Estimated Time of Noise Per 24-Hour Period
Pile Driving (Impact)	8	10 minutes	80 minutes
Pile Removal (Vibratory)	14	6 minutes	84 minutes

Pile driving for elevated causeway system training would occur in shallower water, and sound could be transmitted on direct paths through the water, be reflected at the water surface or bottom, or travel through bottom substrate. Soft substrates such as sand bottom at the proposed elevated causeway system locations, would absorb or attenuate the sound more readily than hard substrates (rock), which may reflect the acoustic wave. Most acoustic energy would be concentrated below 1,000 Hz. Average underwater sound levels for driving piles similar to those that would be installed for elevated causeway systems are shown in Table 3.0-17.

Table 3.0-17: Average Pile Driving Underwater Sound Levels

Pile Size &Type	Installation Method	Water Depth	Average Sound Pressure Level (peak)*	Average Sound Pressure Level (rms)*
0.61-m (24 in.) Steel Pipe Pile	Impact	5 m (15 ft.)	203 dB re 1 µPa (peak) at 10 m	190 dB re 1 µPa (rms) at 10 m
1-m (36 in.) Steel Pipe Pile	Vibratory	5 m (15 ft.)	180 dB re 1 µPa (peak) at 10 m	170 dB re 1 µPa (rms) at 10 m

dB: decibel; ft.: feet; in.: inch; m: meter(s); µPa: micro pascal; rms: root mean square
*(California Department of Transportation 2009)

3.0.5.3.1.4 Swimmer Defense Airguns

Swimmer defense airguns would be used for pierside integrated swimmer defense testing (at pierside locations at Joint Expeditionary Base West [Little Creek] and in the Rhode Island Sound Restricted Areas) and during stationary source testing at Naval Surface Warfare Center, Panama City Division Testing Range. Airguns would be fired a limited number of times (up to 100) during each activity at an irregular interval as required for the testing objectives. These areas adjacent to Navy pierside integrated swimmer defense testing locations are industrialized, and the waterways carry a high volume of vessel traffic in addition to Navy vessels using the pier.

Underwater impulses would be generated using small (approximately 60 cubic inch [$in.^3$]) airguns, which are essentially stainless steel tubes charged with high-pressure air via a compressor. An impulsive sound is generated when the air is almost instantaneously released into the surrounding water, an effect similar to popping a balloon in air. Generated impulses would have short durations, typically a few hundred milliseconds. The root mean square sound pressure level and sound exposure level at a distance 1 m from the airgun would be approximately 200–210 dB re 1 µPa and 185–195 dB re 1 μPa^2-s, respectively. Swimmer defense airguns lack the strong shock wave and rapid pressure increase that would be expected from explosive detonations.

3.0.5.3.1.5 Weapons Firing, Launch, and Impact Noise

Noise associated with weapons firing and the impact of non-explosive practice munitions could happen at any location within the Study Area but generally would occur at locations greater than 12 nm from shore for safety reasons. These testing and training events are concentrated in the VACAPES, Navy Cherry Point, and JAX Range Complexes, but could occur throughout the Study Area, including while ships are in transit. Weapons noise associated with training would occur with less frequency in the GOMEX and Northeast Range Complexes. Testing activities involving weapons firing noise would be those events involved with testing weapons and launch systems. These activities would also take place throughout the Study Area but would be more concentrated in the GOMEX and Northeast Range Complexes.

The firing of a weapon may have several components of associated noise. Firing of guns could include sound generated by firing the gun (muzzle blast), vibration from the blast propagating through a ship's hull, and sonic booms generated by the projectile flying through the air (Table 3.0-18). Missiles and targets would produce noise during launch. In addition, the impact of non-explosive practice munitions at the water surface can introduce sound into the water. Detonations of high-explosive projectiles are considered in Section 3.0.4.1.4 (Categories of Sound).

Table 3.0-18: Representative Weapons Noise Characteristics

Noise Source	Sound Level
In-Water	
Naval Gunfire Muzzle Noise (5-inch/54-caliber)	Approximately 200 dB re 1 µPa directly under gun muzzle at 5 ft. (1.5 m) below the water surface[1]
Airborne	
Naval Gunfire Muzzle Noise (5-inch/54-caliber)	178 dB re 20 µPa directly below the gun muzzle above the water surface[1]
Hellfire Missile Launch from Aircraft	149 dB re 20 µPa at 15 ft. (4.5 m)[2]
7.62-millimeter M-60 Machine Gun	90 dBA re 20 µPa at 50 ft. (15 m)[3]
0.50-Caliber Machine Gun	98 dBA re 20 µPa at 50 ft. (15 m)[3]

db: decibel; dBA: decibel, A-weighted; ft.: feet; m: meters; µPa: micro pascal; re: referenced to
[1] Yagla and Stiegler (2003) [2] U.S. Department of the Army (1999) [3] Investigative Science and Engineering (1997)

Naval Gunfire Noise

Firing a ship deck gun produces a muzzle blast in air that propagates away from the muzzle in all directions, including toward the water surface. As explained in Section 3.0.4 (Acoustic and Explosives Primer) most sound enters the water in a narrow cone beneath the sound source (within 13° of vertical). In-water sound levels were measured during the muzzle blast of a 5 in. deck-mounted gun, the largest caliber gun currently used in proposed Navy activities. The highest sound level in the water (on average 200 dB re 1 µPa measured 5 ft. below the surface) was obtained when the gun was fired at the lowest angle, placing the blast closest to the water surface (U.S. Department of the Navy 2000; Yagla and Stiegler 2003). The average impulse at that location was 19.6 Pa-s. The corresponding average peak in-air pressure was 178 dB re 20 µPa, measured at the water surface below the firing point.

Gunfire also sends energy through the ship structure, into the water, and away from the ship. This effect was investigated in conjunction with the measurement of 5-in. gun blasts described above. The energy

transmitted through the ship to the water for a typical round was about 6 percent of that from the air blast impinging on the water. Therefore, sound transmitted from the gun through the hull into the water is a minimal component of overall weapons firing noise.

The projectile shock wave in air by a shell in flight at supersonic speeds propagates in a cone (generally about 65°) behind the projectile in the direction of fire (Pater 1981). Measurements of a 5-in. projectile shock wave ranged from 140 to 147 dB re 20 µPa taken at the surface at 0.59 nm distance from the firing location and 10° off the line of fire for safety (approximately 623 ft. [190 m] from the shell's trajectory). Sound level intensity decreases with increased distance from the firing location and increased angle from the line of fire (Pater 1981). Like sound from the gun firing blast, sound waves from a projectile in flight would enter the water primarily in a narrow cone beneath the sound source. The region of underwater sound influence from a single traveling shell would be relatively narrow, the duration of sound influence would be brief at any point, and sound level would diminish as the shell gains altitude and loses speed. Multiple, rapid gun firings would occur from a single firing point toward a target area. Vessels participating in gunfire activities would maintain enough forward motion to maintain steerage, normally at speeds of a few knots. Acoustic impacts from weapons firing would often be concentrated in space and duration.

Launch Noise

Missiles can be rocket or jet propelled. Sound due to missile and target launches is typically at a maximum at initiation of the booster rocket. It rapidly fades as the missile or target reaches optimal thrust conditions and the missile or target reaches a downrange distance where the booster burns out and the sustainer engine continues. Launch noise level for the Hellfire missile, which is launched from aircraft, is about 149 dB re 20 µPa at 14.8 ft. (4.5 m) (U.S. Department of the Army 1999).

Non-Explosive Munitions Impact Noise

Large-caliber non-explosive projectiles, non-explosive bombs, and intact missiles and targets could produce a large impulse upon impact with the water surface (McLennan 1997). Sounds of this type are produced by the kinetic energy transfer of the object with the target surface and are highly localized to the area of disturbance. Sound associated with impact events is typically of low frequency (less than 250 Hz) and of short duration.

3.0.5.3.1.6 Vessel Noise

Naval vessels (including ships, small craft, and submarines) would produce low-frequency, broadband underwater sound. In the east coast Exclusive Economic Zone, Navy ships are estimated to contribute roughly 1 percent of the total energy due to large vessel broadband noise (Mintz and Filadelfo 2011).

Exposure to vessel noise would be greatest in the areas of highest naval vessel traffic. The locations and concentration areas of Navy vessel use is discussed in 3.0.5.3.3.1 (Vessels). In summary, naval vessel traffic is heaviest in the VACAPES and JAX Range Complexes, although vessels would be used during many of testing and training activities proposed throughout the Study Area. Noise exposure due to naval vessels would be greatest near naval port facilities, especially around and between the ports of Norfolk, Virginia, and Jacksonville, Florida (Mintz and Parker 2006).

Radiated noise from Navy ships ranges over several orders of magnitude. The quietest Navy warships radiate much less broadband noise than a typical fishing vessel, while the loudest Navy ships are almost on par with large oil tankers (Mintz and Filadelfo 2011). For comparison, a typical commercial cargo vessel radiates broadband noise at a source level around 172 dB re 1 µPa and a typical fishing vessel

radiates noise at a source level of about 158 dB re 1 µPa (Richardson et al. 1995; Urick 1983). Typical large vessel ship-radiated noise is dominated by tonals related to blade and shaft sources at frequencies below about 50 Hz and by broadband components related to cavitation and flow noise at higher frequencies (approximately around the one-third octave band centered at 100 Hz) (Richardson et al. 1995; Urick 1983).

The acoustic signatures of naval vessels are classified information. Anti-submarine warfare platforms (such as guided missile destroyers and Ticonderoga-class guided missile cruisers) and submarines make up a large part of Navy traffic but contribute little noise to the overall sound budget of the oceans as these vessels are designed to be quiet to minimize detection. These platforms are much quieter than Navy oil tankers, for example, which have a smaller presence but contribute substantially more broadband noise than anti-submarine warfare platforms (Mintz and Filadelfo 2011). Sound produced by vessels will typically increase with speed. During training, speeds of most larger naval vessels (greater than 60 ft. [18 m]) generally operate at speeds in the range of 10 to 15 knots for fuel conservation; however, ships will, on occasion, operate at higher speeds within their specific operational capabilities.

A variety of smaller craft, such as service vessels for routine operations and opposition forces used during training events, would be operating within the Study Area. These small craft types, sizes, and speeds vary, but in general, they will emit higher-frequency noise than larger ships.

While commercial traffic (and, therefore, broadband noise generated by it) is relatively steady throughout the year, Navy traffic is episodic in the ocean. Vessels engaged in training and testing may consist of a single vessel involved in unit-level activity for a few hours or multiple vessels involved in a major training exercise that could last a few days within a given area. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours to up to two weeks. Navy vessels do contribute to the overall increased ambient noise in inland waters near Navy ports, although their contribution to the overall noise in these environments is minimal because these areas typically have large amounts of commercial and recreational vessel traffic.

3.0.5.3.1.7 Aircraft Overflight Noise

Fixed- and rotary-wing aircraft are used for a variety of training and testing activities throughout the Study Area, contributing both airborne and underwater sound to the ocean environment. Aircraft used in training and testing generally have reciprocating, turboprop, or jet engines. Motors, propellers, and rotors produce the most noise, with some noise contributed by aerodynamic turbulence. Aircraft sounds have more energy at lower frequencies. Takeoffs and landings occur at established airfields as well as on vessels at sea throughout the Study Area. Most aircraft noise would be produced around air stations in the range complexes. Military activities involving aircraft generally are dispersed over large expanses of open ocean but can be highly concentrated in time and location. Source levels for some typical aircraft used during training and testing in the Study Area are shown in Table 3.0-19.

Table 3.0-19: Representative Aircraft Sound Characteristics

Noise Source	Sound Pressure Level
In-Water	
F/A-18 Subsonic at 1,000 ft. (300 m) Altitude	148 dB re 1 µPa at 6 ft. (2 m) below water surface[1]
F/A-18 Subsonic at 10,000 ft. (3,000 m) Altitude	128 dB re 1 µPa at 6 ft. (2 m) below water surface[1]
H-60 Helicopter Hovering at 82 ft. (25 m) Altitude	Approximately 145 dB re 1 µPa at 3 ft. (1 m) below water surface[2]
Airborne	
Jet Aircraft under Military Power	144 dBA re 20 µPa at 50 ft.(15 m) from source[3]
Jet Aircraft under Afterburner	148 dBA re 20 µPa at 50 ft. (15 m) from source[3]
H-60 Helicopter Hovering	113 dBA re 20 µPa at 82 ft. (25 m) from source[3]

dB: decibel; dBA: decibel, A-weighted; ft.: feet; m: meter(s); µPa: micro pascal; re: referenced to
[1]Eller and Cavanagh (2000) [2]estimate based on in-air level [3] Bousman and Kufield (2005)

Fixed-Wing Aircraft

Noise generated by fixed-wing aircraft is transient in nature and extremely variable in intensity. Most fixed-wing aircraft sorties would occur above 3,000 ft. (900 m). Air combat maneuver altitudes generally range from 5,000 to 30,000 ft. (1.5 to 9.1 km) and typical airspeeds range from very low (less than 100 knots) to high subsonic (less than 600 knots). Sound exposure levels at the sea surface from most air combat maneuver overflights are expected to be less than 85 dBA (based on an FA-18 aircraft flying at an altitude of 5,000 ft. [1,500 m] and at a subsonic airspeed [400 knots])(U.S. Department of the Navy 2009). Exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead.

Helicopters

Noise generated from helicopters is transient in nature and extremely variable in intensity. In general, helicopters produce lower-frequency sounds and vibration at a higher intensity than fixed-wing aircraft (Richardson et al. 1995). Helicopter sounds contain dominant tones from the rotors that are generally below 500 Hz. Helicopters often radiate more sound forward than backward. The underwater noise produced is generally brief when compared with the duration of audibility in the air.

Helicopter unit level training typically entails a high volume of single-aircraft sorties over water that start and end at an air station, although flights may occur from ships at sea. Individual flights typically last about two to four hours. Some events require low-altitude flights over a defined area, such as mine countermeasure activities deploying towed systems. Most helicopter sorties associated with mine countermeasures would occur at altitudes as low as 75 to 100 ft. (23 to 31 m). Likewise, in some anti-submarine warfare events, a dipping sonar is deployed from a line suspended from a helicopter hovering at low altitudes over the water.

Underwater Transmission of Aircraft Noise

Sound generated in air is transmitted to water primarily in a narrow area directly below the aircraft (Section 3.0.4, Acoustic and Explosives Primer). A sound wave propagating from an aircraft must enter the water at an angle of incidence of 13° or less from the vertical for the wave to continue propagating under the water's surface. At greater angles of incidence, the water surface acts as an effective reflector

of the sound wave and allows very little penetration of the wave below the water (Urick 1983). Water depth and bottom conditions strongly influence propagation and levels of underwater noise from passing aircraft. For low-altitude flights, sound levels reaching the water surface would be higher, but the transmission area would be smaller. As an aircraft gains altitude, sound reaching the water surface diminishes, but the possible transmission area increases. Estimates of underwater sound pressure level are provided for representative aircraft in Table 3.0-19.

Underwater sound from aircraft overflights has been modeled for some airframes. Eller and Cavanagh (2000) modeled underwater sound pressure level as a function of time at various depths (2, 10, and 50 m) for F/A-18 Hornet aircraft subsonic overflights (250 knots) at various altitudes (300; 1,000; and 3,000 m). For the worst modeled case of an F/A-18 at the lowest altitude (300 m), the sound level at two meters below the surface peaked at 152 dB re 1 µPa, and the sound level at 50 meters below the surface peaked at 148 dB re 1 µPa. When F/A-18 flight was modeled at 3,000 meters altitude, peak sound level at 2 meters depth dropped to 128 dB re 1 µPa.

Sonic Booms

An intense but infrequent type of aircraft noise is the sonic boom, produced when an aircraft exceeds the speed of sound. Supersonic aircraft flights are usually limited to altitudes above 30,000 ft. (9,100 m) or locations more than 30 nm from shore. Several factors influence sonic booms: weight, size, shape of aircraft or vehicle; altitude; flight paths; and atmospheric conditions. A larger and heavier aircraft must displace more air and create more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft. Consequently, the larger and heavier the aircraft, the stronger the shock waves (U.S. Department of the Navy and Department of Defense 2007).

Of all the factors influencing sonic booms, increasing altitude is the most effective method of reducing sonic boom intensity. The width of the boom "carpet" or area exposed to sonic boom beneath an aircraft is about 1 mile (1.6 km) for each 1,000 ft. (300 m) of altitude. For example, an aircraft flying supersonic, straight, and level at 50,000 ft. (15,000 m) can produce a sonic boom carpet about 50 miles (80 km) wide. The sonic boom, however, would not be uniform, and its intensity at the water surface would decrease with greater aircraft altitude. Maximum intensity is directly beneath the aircraft and decreases as the lateral distance from the flight path increases until shock waves refract away from the ground and the sonic boom attenuates. The lateral spreading of the sonic boom depends only on altitude, speed, and the atmosphere and is independent of the vehicle's shape, size, and weight. The ratio of the aircraft length to maximum cross-sectional area also influences the intensity of the sonic boom. The longer and more slender the aircraft, the weaker the shock waves. The wider and more blunt the aircraft, the stronger the shock waves can be (U.S. Department of the Navy and Department of Defense 2007).

F/A-18 Hornet supersonic flight was modeled to obtain peak sound pressure levels and energy flux density at the water surface and at depth (Laney and Cavanagh 2000). These results are shown in Table 3.0-20.

Table 3.0-20: Sonic Boom Underwater Sound Levels Modeled for F/A-18 Hornet Supersonic Flight

Mach Number*	Aircraft Altitude (km)	Peak Pressure (dB re 1 µPa)			Energy Flux Density (dB re 1 μPa^2-s)		
		At surface	50 m Depth	100 m Depth	At surface	50 m Depth	100 m Depth
1.2	1	176	138	126	160	131	122
	5	164	132	121	150	126	117
	10	158	130	119	144	124	115
2	1	178	146	134	161	137	128
	5	166	139	128	150	131	122
	10	159	135	124	144	127	119

dB: decibel; km: kilometer(s); m: meters; µPa: micro pascal; μPa^2-s: squared micro pascal-second; re: referenced to

* Mach number equals aircraft speed divided by the speed of sound.

3.0.5.3.2 Energy Stressors

This section describes the characteristics of energy introduced into the water through Navy training and testing activities and the relative magnitude and location of these activities to provide the basis for analysis of potential electromagnetic and laser impacts on resources in the remainder of Chapter 3 (Affected Environment and Environmental Consequences).

3.0.5.3.2.1 Electromagnetic Devices

Electromagnetic energy emitted from magnetic influence mine neutralization systems is analyzed in this document. The training and testing activities that involve the use of magnetic influence mine neutralization systems are detailed in Tables 3.0-21 – 3.0-22. The number and location of events that use these electromagnetic devices are detailed in Table 3.0-23.

Table 3.0-21: Training Activities That Involve the Use of Electromagnetic Devices

Training
Mine Warfare
• Airborne Mine Countermeasures (Towed-Mine Neutralization)
• Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises
• Civilian Port Defense

Table 3.0-22: Testing Activities That Involve the Use of Electromagnetic Devices

Testing
Mine Warfare
• Airborne Towed Minesweeping Test • Mine Countermeasure/Neutralization Testing
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Electromagnetic Operations • Mine Countermeasure/Neutralization Testing
South Florida Ocean Measurement Facility Testing Range Activities
• Mine Research, Development, Testing, and Evaluation Activities

Table 3.0-23: Annual Number and Location of Events Using Electromagnetic Devices

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
VACAPES (W-50, Lower Chesapeake Bay)	980	0	0	0	0	0
VACAPES (W-50, W-72)	0	0	0	30	0	0
VACAPES	0	882	882	0	36	40
Navy Cherry Point (ARG Mine Training Area)	183	0	0	0	0	0
Navy Cherry Point	0	185	185	0	0	0
JAX (CSG Mine Training Areas)	134	0	0	0	0	0
JAX	0	157	157	0	0	0
SFOMF	0	0	0	0	21	33
NSWC PCD	0	0	0	99	78	87
GOMEX	0	96	96	0	0	0
Gulf of Mexico	0	0	0	0	12	14
Northeast, VACAPES, Navy Cherry Point, JAX, GOMEX	0	1	1		0	0
Total	**1,297**	**1,321**	**1,321**	**129**	**147**	**174**

ARG: Amphibious Readiness Group; CSG: Carrier Strike Group; GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

The majority of devices involved in the activities described above include towed or unmanned mine warfare systems that simply mimic the electromagnetic signature of a vessel passing through the water. None of the devices include any type of electromagnetic "pulse." An example of a representative device is the Organic Airborne and Surface Influence Sweep that would be used by a MH-60S helicopter at sea. The Organic Airborne and Surface Influence Sweep is towed from a forward flying helicopter and works by emitting an electromagnetic field and mechanically generated underwater sound to simulate the presence of a ship. The sound and electromagnetic signature cause nearby mines to detonate.

Generally, voltage used to power these systems is around 30 volts relative to seawater. This amount of voltage is comparable to two automobile batteries. Since saltwater is an excellent conductor, only very moderate voltages of 35 volts (capped at 55 volts) are required to generate the current. These small levels represent no danger of electrocution in the marine environment, because the difference in electric charge is very low in saltwater.

The static magnetic field generated by the electromagnetic devices is of relatively minute strength. Typically, the maximum magnetic field generated would be approximately 23 gauss (G). This level of electromagnetic density is very low compared to magnetic fields generated by other everyday items. The magnetic field generated is between the levels of a refrigerator magnet (150-200 G) and a standard household can opener (up to 4 G at 4 in.). The strength of the electromagnetic field decreases quickly away from the cable. The magnetic field generated at a distance of 13.12 ft. (4 m) from the source is

comparable to the earth's magnetic field, which is approximately 0.5 G. The strength of the field at just under 26 ft. (8 m) is only 40 percent of the earth's field, and only 10 percent at 79 ft. (24 m). At a radius of 656 ft. (200 m) the magnetic field would be approximately 0.002 G (U.S. Department of the Navy 2005).

The kinetic energy weapon (commonly referred to as the rail gun) is under development and will likely be tested and eventually used in training events aboard surface vessels, firing non-explosive projectiles at land or sea-based targets. The system uses stored electrical energy to accelerate the projectiles, which are fired at supersonic speeds over great distances. The system charges for two minutes, and fires in less than a second, therefore, any electromagnetic energy released would be done so over a very short period. Also, the system would likely be shielded so as not to affect shipboard controls and systems. The amount of electromagnetic energy released from this system would likely be low and contained on the surface vessel. Therefore, this device is not expected to result in any impacts and will not be further analyzed for biological resources in this document.

3.0.5.3.2.2 Lasers

The devices discussed here include lasers that can be organized into two categories: (1) low energy lasers and (2) high energy lasers. Low energy lasers are used to illuminate or designate targets, to guide weapons, and to detect or classify mines. High energy lasers are used as weapons to disable surface targets.

Low Energy Lasers

Within the category of low energy lasers, the highest potential level of exposure would be from an airborne laser beam directed at the ocean's surface. An assessment on the use of low energy lasers by the Navy determined that low energy lasers, including those involved in the training and testing activities in this EIS/OEIS, have an extremely low potential to impact marine biological resources (Swope 2010). The assessment determined that the maximum potential for laser exposure is at the ocean's surface, where laser intensity is greatest (Swope 2010). As the laser penetrates the water, 96 percent of a laser beam is absorbed, scattered, or otherwise lost (Ulrich 2004). Based on the parameters of the low energy lasers and the behavior and life history of major biological groups, it was determined the greatest potential for impact would be to the eye of a marine mammal or sea turtle. However, an animal's eye would have to be exposed to a direct laser beam for at least 10 seconds or longer to sustain damage. Swope (2010) assessed the potential for damage based on species specific eye/vision parameters and the anticipated output from low energy lasers and determined that no animals were predicted to incur damage. Therefore, low energy lasers are not further analyzed in this document for biological resources.

High Energy Lasers

There are no training activities that involve the use of high energy lasers. Testing activities involving high energy lasers include the high energy laser weapons test.

High energy laser weapons testing involves an approximately 25 kilowatt high energy laser intended to be used as a weapon against stationary and mobile, small surface vessels. The high energy laser would be employed from a hovering or forward flight helicopter and is designed to disable the surface or air target, rendering it immobile. The high energy laser would have a range of up to 4 mi. (6 km). Typically, small boats or other unmanned surface targets would be used during the high energy laser test.

These high energy laser weapons tests would be conducted only in the VACAPES Range Complex. The number of events and locations involving high energy laser weapons tests are detailed in Table 3.0-24: Number and Location of High Energy Laser Events.

Table 3.0-24: Annual Number and Location of High Energy Laser Events

Activity Area	Training			Testing		
	No Action	Alternative 1	Alternative 2	No Action	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem						
VACAPES	0	0	0	0	98	108

VACAPES: Virginia Capes Range Complex

3.0.5.3.3 Physical Disturbance and Strike Stressors

This section describes the characteristics of physical disturbance and strike stressors from Navy training and testing activities. It also describes the relative magnitude and location of these activities to provide the basis for analyzing the potential physical disturbance and strike impacts on resources in the remainder of Chapter 3.

3.0.5.3.3.1 Vessels

Vessels used as part of the Proposed Action include ships (e.g., aircraft carriers, surface combatants), support craft, and submarines ranging in size from 5 to over 300 m. Table 3.0-25: Representative Vessel Types, Lengths, and Speeds provides examples of the types of vessels, length, and speeds used in both testing and training activities. The U.S. Navy Fact Files on the World Wide Web provide the latest information on the quantity and specifications of the vessels operated by the Navy.

Navy ships transit at speeds that are optimal for fuel conservation or to meet operational requirements. Large Navy ships (greater than 60 ft. [18 m] in length) generally operate at average speeds in the range of 10 to 15 knots, and submarines generally operate at speeds in the range of 8 to 13 knots. Small craft (for purposes of this discussion – less than 60 ft. [18 m] in length), which are all support craft, have much more variable speeds (dependent on the mission). While these speeds are considered averages and representative of most events, some vessels need to operate outside of these parameters. For example, to produce the required relative wind speed over the flight deck, an aircraft carrier vessel group engaged in flight operations must adjust its speed through the water accordingly. Conversely, there are other instances such as launch and recovery of a small rigid hull inflatable boat, vessel boarding, search, and seizure training events or retrieval of a target when vessels would be dead in the water or moving slowly ahead to maintain steerage. There are a few specific events, including high speed tests of newly constructed vessels such as aircraft carriers, amphibious assault ships and the joint high speed vessel (which would operate at an average speed of 35 knots) where vessels would operate at higher speeds.

The number of Navy vessels in the Study Area at any given time varies and is dependent on local training or testing requirements. Most activities include either one or two vessels and may last from a few hours up to two weeks. Vessel movement as part of the Proposed Action would be widely dispersed throughout the Study Area, but more concentrated in portions of the Study Area near ports, naval installations, range complexes, and testing ranges.

Table 3.0-25: Representative Vessel Types, Lengths, and Speeds

Type	Example(s)	Length	Typical Operating Speed	Max Speed
Aircraft Carrier	Aircraft Carrier (CVN)	>300 m	10 to 15 knots	30+ knots
Surface Combatant	Cruisers (CG), Destroyers (DDG), Frigates (FFG), Littoral Combat Ships (LCS)	100-200 m	10 to 15 knots	30+ knots
Amphibious Warfare Ship	Amphibious Assault Ship (LHA, LHD), Amphibious Transport Dock (LPD), Dock Landing Ship (LSD)	100-300 m	10 to 15 knots	20+ knots
Combat Logistics Force Ships	Fast Combat Support Ship (T-AOE), Dry Cargo/Ammunition Ship (T-AKE), Fleet Replenishment Oilers (T-AO)	200-230 m	8 to 12 knots	25 knots
Support Craft/Other	Amphibious Assault Vehicle (AAV); Combat Rubber Raiding Craft (CRRC); Landing Craft, Mechanized (LCM); Landing Craft, Utility (LCU); Submarine Tenders (AS); Yard Patrol Craft (YP)	5-45 m	Variable	20 knots
Support Craft/Other – Specialized High Speed	High Speed Ferry/Catamaran; Patrol Coastal Ships (PC); Rigid Hull Inflatable Boat (RHIB)	20-40 m	Variable	50+ knots
Submarines	Fleet Ballistic Missile Submarines (SSBN), Attack Submarines (SSN), Guided Missile Submarines (SSGN)	100-200 m	8 to 13 knots	20+ knots

AAV: amphibious assault ship; AS: submarine tenders; CRRC: combat rubber raiding craft; CVN: aircraft carrier; DDG: destroyers; FFG: frigates; LCM: landing craft, mechanized; LCS: littoral combat ship; LCU: landing craft, utility; LHA, LHD: amphibious assault ships; LPD: amphibious transport dock; LSD: dock landing ship; m: meters; PC: patrol coastal ships; RHIB: rigid hull inflatable boat; SSBN: fleet ballistic missile submarines; SSGN: guided missile submarines; SSN: attack submarines; T-AKE: dry cargo/ammunition ship; T-AO: fleet replenishment oilers; T-AOE: fast combat support ship; YP: yard patrol craft

In an attempt to determine traffic patterns for Navy and non-Navy vessels, the Center for Naval Analysis (Mintz and Parker 2006) conducted a review of historic data for commercial vessels, coastal shipping patterns, and Navy vessels. Commercial and non-Navy traffic, which included cargo vessels, bulk carriers, passenger vessels, and oil tankers (all over 65 ft. [20 m] in length), was heaviest near the major shipping ports from the Gulf of Maine to southern Florida, as well as in specific international shipping lanes. Compared to coastal vessel activity, there was relatively little concentration of vessels in the other portions of the Study Area (Mintz and Parker 2006). Navy traffic was heaviest just offshore of Norfolk, Virginia and Jacksonville, Florida, as well as along the coastal waters between the two ports.

Data from 2009 were analyzed by Mintz and Filadelfo (2011) and indicated that along the Atlantic U.S. Exclusive Economic Zone, Navy vessels accounted for slightly less than 6 percent of the total large vessel traffic (from estimated hours) in that area. In the VACAPES and JAX Range Complexes where Navy vessel activity is concentrated, the Navy vessels accounted for seven and 9 percent (respectively) of the total large vessel traffic. Barco et al. (2009) found that military vessels were approximately 18 percent of the total vessels transiting (inbound and outbound) the Chesapeake Bay channel, an area of highly concentrated Navy activity because of the proximity of Naval Station Norfolk. Military vessels would probably comprise an even smaller proportion of total vessels, if smaller vessels (less than 65 ft. [20 m] in length) were factored into these analyses.

The training and testing activities listed in Tables 3.0-26 through 3.0-35 involve the use of vessels.

Table 3.0-26: Training Activities That Involve the Use of Aircraft Carriers

Training
Anti-Air Warfare
• Air Defense Exercises
Anti-Submarine Warfare
• Anti-Submarine Warfare for Composite Training Unit Exercise
• Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise

Table 3.0-27: Testing Activities That Involve the Use of Aircraft Carriers

Testing
Other Testing
• Test and Evaluation Catapult Launch
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trial – Propulsion Testing
• Aircraft Carrier Sea Trial – Gun Testing – Small-Caliber; Medium-Caliber
• Aircraft Carrier Sea Trial – Missile Testing
• Aircraft Carrier Sea Trial – Bomb Testing
• Post-Homeporting Testing (All Classes)
Ship Shock Trials
• Aircraft Carrier Full Ship Shock Trial
Life Cycle Activities
• Ship Signature Testing
• Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Countermeasure Testing – Acoustic System Testing

Table 3.0-28: Training Activities That Involve the Use of Surface Combatants

Training
Anti-Air Warfare
• Air Defense Exercises • Gunnery Exercise (Surface-to-Air) – Large-Caliber • Gunnery Exercise (Surface-to-Air) – Medium-Caliber • Missile Exercise (Surface-to-Air)
Amphibious Warfare
• Naval Surface Fire Support Exercise – Land-Based Target • Naval Surface Fire Support Exercise – At Sea • Marine Expeditionary Unit Certification Exercise
Anti-Surface Warfare
• Maritime Security Operations • Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber; Medium-Caliber; Large-Caliber • Missile Exercise (Surface-to-Surface) • Laser Targeting • Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Surface • Tracking Exercise/Torpedo Exercise – Helo • Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Submarine Command Course • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise
Electronic Warfare
• Electronic Warfare Operations • Counter Targeting Chaff Exercise – Ship

Table 3.0-29: Testing Activities That Involve the Use of Surface Combatants

Testing
Anti-Submarine Warfare
• Sonobuoy Lot Acceptance test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Propulsion Testing • Surface Combatant Sea Trials – Gun Testing – Large-Caliber • Surface Combatant Sea Trials – Missile Testing • Surface Combatant Sea Trials – Decoy Testing • Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber
• Surface Combatant Sea Trials – Anti-Submarine Warfare Testing • Other Class Ship Sea Trial – Propulsion Testing • Other Class Ship Sea Trial – Gun Testing Small-Caliber • Anti-Submarine Warfare Mission Package Testing • Surface Warfare Mission Package Testing – Gun Testing Small-Caliber; Medium-Caliber; Large-Caliber • Surface Warfare Mission Package Testing – Missile/Rocket Testing • Mine Countermeasure Mission Package Testing • Post-Homeporting Testing (all classes)
Ship Shock Trials
• DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial • Littoral Combat Ship Full Ship Shock Trial
Life Cycle Activities
• Ship Signature Testing • Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports) • Combat System Ship Qualification Trial – Air Defense • Combat System Ship Qualification Trial – Surface Warfare • Combat System Ship Qualification Trial – Undersea Warfare

Table 3.0-28: Training Activities That Involve the Use of Surface Combatants (Continued)

Training
Mine Warfare
• Mine Countermeasures Exercise – Ship Sonar • Airborne Mine Countermeasures – Towed Mine Neutralization • Airborne Mine Countermeasures – Mine Detection • Mine Countermeasures – Mine Neutralization Small- and Medium-Caliber • Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicle • Civilian Port Defense
Other Training Exercises
• Precision Anchoring • Surface Ship Object Detection • Surface Ship Sonar Maintenance (in OPAREAs and Ports)

Table 3.0-29: Testing Activities That Involve the Use of Surface Combatants (Continued)

Testing
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Surface Operations • Sonar Operations • Electromagnetic Operations • Ordnance Operations • Projectile Firing • Mine Countermeasure/Neutralization Testing • Countermeasure Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Torpedo Testing
South Florida Ocean Measurement Facility Testing Range Activities
• Signature Analysis Activities • Mine Testing Activities
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Missile Testing • Kinetic Energy Weapon Testing • Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing • Countermeasure Testing – Acoustic System Testing • Countermeasure Testing • At-Sea Sonar Testing
Mine Warfare Testing
• Mine Detection and Classification • Mine Countermeasure/Neutralization Testing
Shipboard Protection Systems and Swimmer Defense Testing
• Shipboard Protection Systems Testing • Chemical/Biological Simulant Testing
Other Testing
• Radio Frequency Communications Testing

Table 3.0-30: Training Activities That Involve the Use of Amphibious Warfare Ships

Training
Anti-Air Warfare
• Air Defense Exercises
Amphibious Warfare
• Marine Expeditionary Unit Certification Exercise • Amphibious Assault • Amphibious Raid/Humanitarian Assistance Operations

Table 3.0-31: Testing Activities That Involve the Use of Amphibious Warfare Ships

Testing
Ship Construction and Maintenance
New Ship Construction
• Other Class Ship Sea Trial – Propulsion Testing • Other Class Ship Sea Trial – Gun Testing Small-Caliber • Post-Homeporting Testing (All Classes)
Life Cycle Activities
• Ship Signature Testing • Combat System Ship Qualification Trial – Air Defense • Combat System Ship Qualification Trial – Surface Warfare
South Florida Ocean Measurement Facility Testing Range Activities
• Signature Analysis Activities
Mine Warfare Testing
• Mine Detection and Classification • Mine Countermeasure/Neutralization Testing

Table 3.0-32: Training Activities That Involve the Use of Support Craft

Training
Amphibious Warfare
• Naval Surface Fire Support Exercise – At Sea
• Marine Expeditionary Unit Certification Exercise
• Amphibious Assault
• Amphibious Raid/Humanitarian Assistance Operations
Strike Warfare
• High-Speed Anti-Radiation Missile Exercise (Air-to- Surface)
Anti-Surface Warfare
• Maritime Security Operations
• Maritime Security Operations- Anti-swimmer Grenades
• Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber; Medium-Caliber
• Laser Targeting
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Submarine
• Tracking Exercise/Torpedo Exercise – Surface
• Tracking Exercise/Torpedo Exercise – Helo
• Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft
Mine Warfare
• Mine Neutralization/Explosive Ordnance Disposal
• Underwater Mine Countermeasure Raise, Tow, Beach, and Exploitation Operations
• Airborne Mine Countermeasures – Towed Mine Neutralization
• Airborne Mine Countermeasures – Mine Detection
• Civilian Port Defense
Other Training Exercises
• Search and Rescue

Table 3.0-33: Testing Activities That Involve the Use of Support Craft

Testing
Anti-Surface Warfare
• High Energy Laser Weapon Test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Missile Testing
• Other Class Ship Sea Trial – Propulsion Testing
• Other Class Ship Sea Trial – Gun Testing Small-Caliber
• Post-Homeporting Testing (All Classes)
Ship Shock Trials
• Aircraft Carrier Full Ship Shock Trial
• DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial
• Littoral Combat Ship Full Ship Shock Trial
Life Cycle Activities
• Ship Signature Testing
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Surface Operations
• Subsurface Operations
• Sonar Operations
• Electromagnetic Operations
• Ordnance Operations
• Projectile Firing
• Unmanned Underwater Vehicle Demonstration
• Mine Detection and Classification Testing
• Stationary Source Testing
• Unmanned Underwater Vehicle Testing
• Ordnance Testing – Line Charge Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Launcher Testing
• Torpedo Testing
• Towed Equipment Testing
• Unmanned Underwater Vehicle Testing
• Unmanned Surface Vehicle Testing
• Unmanned Aerial System Testing
• Semi-Stationary Equipment Testing
• Unmanned Underwater Vehicle Demonstrations
• Pierside Integrated Swimmer Defense Testing

Table 3.0-33: Testing Activities That Involve the Use of Support Craft (Continued)

South Florida Ocean Measurement Facility Testing Range Activities
• Mine Testing Activities • Surface Testing Activities • Subsurface Testing Activities • Unmanned Underwater Vehicle Demonstrations
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing
Shipboard Protection Systems and Swimmer Defense Testing
• Pierside Integrated Swimmer Defense
Unmanned Vehicle Testing
• Unmanned Vehicle Development and Payload Testing
Other Testing
• Special Warfare • Radio-Frequency Communications Testing

Table 3.0-34: Training Activities That Involve the Use of Submarines

Training
Anti-Surface Warfare
• Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Submarine • Tracking Exercise/Torpedo Exercise – Surface • Tracking Exercise/Torpedo Exercise – Helo • Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Submarine Command Course • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise
Other Training Exercises
• Submarine Navigational • Submarine Under Ice Certification • Submarine Sonar Maintenance (in OPAREAs and Ports)

Table 3.0-35: Testing Activities That Involve the Use of Submarines

Testing
Ship Construction and Maintenance
New Ship Construction
• Submarine Sea Trial – Propulsion Testing • Submarine Sea Trial – Weapons System Testing • Submarine Sea Trial – Anti-Submarine Warfare Testing
Life Cycle Activities
• Ship Signature Testing • Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Subsurface Operations • Mine Detection and Classification Testing • Special Warfare Testing
South Florida Ocean Measurement Facility Testing Range Activities
• Signature Analysis Activities • Mine Research, Development, Testing, and Evaluation Activities
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Anti-Submarine Warfare Torpedo Test • Anti-Submarine Warfare Tracking Test – Helicopter • Anti-submarine Warfare Tracking Test – Maritime Patrol Aircraft • Missile Testing • Electronic Warfare Testing • Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing • At-Sea Sonar Testing
Unmanned Vehicle Testing
• Underwater Deployed Unmanned Aerial System Testing
Other Testing
• Special Warfare • Radio–Frequency Communications Testing • Hydrodynamic Testing

Figures 3.0-20 and 3.0-21 provide estimates of relative vessel use by location, the Preferred Alternative, which is based on the estimated number of events that include the use of vessels for each alternative (See Table 3.0-36: Number and Location of Events Including Vessel Movement). The location and hours of Navy vessel usage for testing and training activities are most dependent upon the locations of Navy

ports, piers and established at-sea testing and training areas. With the exception of the establishment of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future.

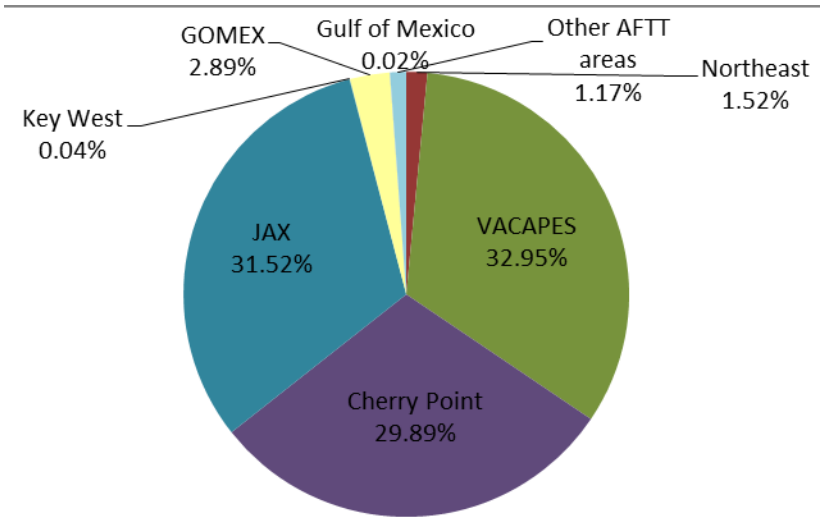

Figure 3.0-20: Vessel Use by Area for Training Under the Preferred Alternative

AFTT: Atlantic Fleet Training and Testing; Gulf of Mexico refers to the body of water; Navy Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

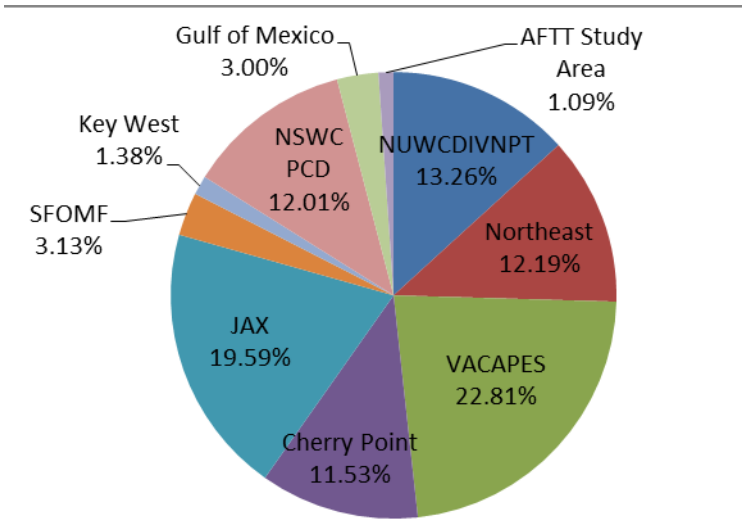

Figure 3.0-21: Vessel Use by Area for Testing Under the Preferred Alternative

AFTT: Atlantic Fleet Training and Testing; Navy Cherry Point: Navy Cherry Point Range Complex; Gulf of Mexico refers to the body of water; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area. AFTT Study Area means it could occur anywhere within the Study Area.

Table 3.0-36: Annual Number and Location of Events Including Vessel Movement

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
NUWCDIVNPT	0	0	0	0	452	499
Northeast	533	470	470	321	417	459
VACAPES	4,957	10,206	10,210	225	803	859
Navy Cherry Point	4,013	9,261	9,263	0	410	434
JAX	3,395	9,759	9,767	2	706	738
SFOMF	0	0	0	0	98	118
Key West	0	12	12	2	45	52
NSWC PCD	0	0	0	365	397	452
GOMEX	222	895	895	17	0	0
Gulf of Mexico	49	5	5	0	101	113
Other AFTT areas	6	361	363	2	0	0
AFTT Study Area	0	0	0	0	36	41
Total	**13,176**	**30,969**	**30,985**	**934**	**3,465**	**3,765**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; Northeast: Northeast Range Complexes; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area. AFTT Study Area means it could occur anywhere within the Study Area, typically to those events that occur while vessels are in transit.

While these estimates provide the average distribution of vessels; actual locations and hours of Navy vessel usage are dependent upon requirements, deployment schedules, annual budgets, and other unpredictable factors. Consequently, vessel use can be highly variable. The difference between the No Action Alternative and Alternatives 1 and 2 includes an expansion of the Study Area and an increase in the number of activities. Multiple activities usually occur from the same vessel, so the increased number of activities is not expected to result in an increase in vessel use or transit. The concentration of use in and the manner in which the Navy uses vessels to accomplish its training and testing activities are likely to remain consistent with the range of variability observed over the last decade. Consequently, the Navy is not proposing appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade.

3.0.5.3.3.2 In-Water Devices

In-water devices as discussed in this analysis include unmanned vehicles such as remotely operated vehicles, unmanned surface vehicles, unmanned underwater vehicles, and towed devices. These devices are self-propelled and unmanned or towed through the water from a variety of platforms, including helicopters, unmanned underwater vehicles, and surface ships. In-water devices are generally smaller than most Navy vessels ranging from several inches to about 15 m (49 ft.). See Table 3.0-37 for a range of in-water devices used. These devices can operate anywhere from the water surface to the benthic zone. Certain devices do not have a realistic potential to strike living marine resources because they

either move slowly through the water column (e.g., most unmanned undersurface vehicles) or are closely monitored by observers manning the towing platform (e.g., most towed devices). Because of their size and potential operating speed, unmanned surface vehicles are the in-water devices that operate in a manner with the potential to strike living marine resources.

Table 3.0-37: Representative Types, Sizes, and Speeds of In-Water Devices

Type	Example(s)	Length	Typical Operating Speed
Towed Device	Minehunting SONAR (AQS) Systems; Improved Surface Tow Target (ISTT); Towed SONAR System; MK-103, MK-104 and MK-105 Minesweeping Systems; Organic Airborne and Surface Influence Sweep (OASIS), Orion, Shallow Water Intermediate Search System, Towed Pinger Locator 30	< 10 m	10-40 knots
Unmanned Surface Vehicle	MK-33 Seaborne Power Target (SEPTAR) Drone Boat, QST-35A Seaborne Powered Target, Ship Deployable Seaborne Target (SDST), Small Waterplane Area Twin Hull (SWATH), Unmanned Influence Sweep System (UISS)	< 15 m	Variable, up to 50+ knots
Unmanned Undersea Vehicle	Acoustic Mine Targeting System, Airborne Mine Neutralization System (AMNS), AN/AQS Systems, Archerfish Common Neutralizer, Crawlers, CURV 21, Deep Drone 8000, Deep Submergence Rescue Vehicle, Gliders, Expendable Mobile Anti-Submarine Warfare Training Targets (EMATTs), Light and Heavy Weight Torpedoes, Magnum Remotely Operated Vehicle (ROV), Manned Portables, MINIROVs, MK 30 ASW Targets, Remote Multi-Mission Vehicle (RMMV), Remote Minehunting System (RMS), Unmanned Influence Sweep System (UISS)	< 15 m	1-15 knots

AMNS: airborne mine neutralization system; AQS: minehunting sonar system; ASW: anti-submarine warfare; EMATTs: expendable mobile anti-submarine warfare training targets; ISTT: improved surface tow target; OASIS: orgainic airborne and surface influence sweep; RMMV: remote multi-mission vehicle; RMS: remote minehunting system; ROV: remotely operated vehicle; SDST: ship deployable seaborne target; SEPTAR: seaborne power target; SWATH: small waterpane area twin hull; UISS: unmanned influence sweep system

Training and testing activities that employ towed in-water devices are listed in Tables 3.0-38 through 3.0-43.

Table 3.0-38: Training Activities That Involve the Use of Towed Devices

Training
Anti-Surface Warfare
• Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber; Medium-Caliber • Gunnery Exercise Surface-to-Surface (Boat) – Medium-Caliber • Missile Exercise (Surface-to-Surface) • Gunnery Exercise (Air-to-Surface) – Small-Caliber; Medium-Caliber • Missile Exercise (Air-to-Surface) – Rocket • Missile Exercise (Air-to-Surface)
Anti-Submarine Warfare
• Integrated Anti-Submarine Warfare Course • Group Sail
Mine Warfare
• Mine Countermeasures Exercise – Ship Sonar • Airborne Mine Countermeasures – Towed Mine Neutralization • Airborne Mine Countermeasures – Mine Detection • Coordinated Unit Level Helicopter Airborne Mine Counter Measure Exercises • Civilian Port Defense

Table 3.0-39: Testing Activities That Involve the Use of Towed Devices

Testing
Mine Warfare
• Airborne Towed Minesweeping Test • Airborne Towed Minehunting Sonar Test
Ship Construction and Maintenance
New Ship Construction
• Mine Countermeasure Mission Package Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Surface Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Electromagnetic Operations • Countermeasure Testing – Acoustic Systems Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Towed Equipment Testing • Unmanned Underwater Vehicle Testing
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Countermeasure Testing – Acoustic System Testing

Table 3.0-40: Training Activities That Involve the Use of Unmanned Surface Vehicles

Training
Amphibious Warfare
• Amphibious Raid/Humanitarian Assistance Operations
Anti-Surface Warfare
• Maritime Security Operations • Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber; Medium-Caliber; Large-Caliber • Missile Exercise (Surface-to-Surface) • Gunnery Exercise (Air-to-Surface) – Small-Caliber; Medium-Caliber • Missile Exercise (Air-to-Surface)
Mine Warfare
• Airborne Mine Countermeasures – Towed Mine Neutralization • Airborne Mine Countermeasures – Mine Detection • Civilian Port Defense

Table 3.0-41: Testing Activities That Involve the Use of Unmanned Surface Vehicles

Testing
Anti-Surface Warfare
• High Energy Laser Weapon Test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Towed Equipment Testing • Unmanned Surface Vehicle Testing • Unmanned Aerial System Testing
South Florida Ocean Measurement Facility Testing Range Activities
• Mine Testing Activities • Surface Testing Activities
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Missile Testing
Shipboard Protection Systems and Swimmer Defense Testing
• Shipboard Protection Systems Testing
Unmanned Vehicle Testing
• Unmanned Vehicle Development and Payload Testing

Table 3.0-42: Training Activities That Involve the Use of Unmanned Underwater Vehicles

Training
Anti-Surface Warfare
• Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Submarine • Tracking Exercise/Torpedo Exercise – Surface • Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Integrated Anti-Submarine Warfare Course • Group Sail • Submarine Command Course Operations • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise
Mine Warfare
• Mine Countermeasures Exercise – Ship Sonar • Underwater Mine Countermeasure Raise, Tow, Beach, and Exploitation Operations • Airborne Mine Countermeasures – Mine Detection • Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicle • Coordinated Unit Level Helicopter Airborne Mine Countermeasures Exercises • Civilian Port Defense

Table 3.0-43: Testing Activities That Involve the Use of Unmanned Underwater Vehicles

Testing
Anti-Submarine Warfare
• Anti-Submarine Warfare Torpedo Test • Anti-Submarine Tracking Test – Helicopter • Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft
Mine Warfare
• Airborne Mine Neutralization Systems Test – ASQ-235 • Airborne Laser-Based Mine Detection and Classification • Mine Countermeasure/Neutralization Testing
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Anti-Submarine Warfare Testing • Submarine Sea Trial – Weapons System Testing • Submarine Sea Trial – Anti-Submarine Warfare Testing • Anti-Submarine Warfare Mission Package Testing • Mine Countermeasure Mission Package Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Undersea Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Subsurface Operations • Unmanned Underwater Vehicle Demonstrations • Mine Detection and Classification Testing • Mine Countermeasure/Neutralization Testing • Unmanned Underwater Vehicle Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Launcher Testing • Torpedo Testing • Unmanned Underwater Vehicle Testing • Unmanned Underwater Vehicle Demonstrations
South Florida Ocean Measurement Facility Testing Range Activities
• Signature Analysis Activities • Mine Testing, Activities • Subsurface Testing Activities • Unmanned Underwater Vehicle Demonstrations

Table 3.0-43: Testing Activities That Involve the Use of Unmanned Underwater Vehicles (Continued)

Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing • Countermeasure Testing
Unmanned Vehicle Testing
• Underwater Deployed Unmanned Aerial System Testing

Table 3.0-44 provides estimates of relative in-water device use and location, for each of the alternatives. These are based on the estimated number of events that include the use of in-water devices for each alternative. While these estimates provide the average distribution of in-water devices, actual locations and hours of Navy in-water device usage are dependent upon military training and testing requirements, deployment schedules, annual budgets, and other unpredictable factors.

Table 3.0-44: Annual Number and Location of Events Including In-Water Devices

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
NUWCDIVNPT	0	0	0	0	312	345
Northeast	268	111	111	207	67	75
VACAPES	3,869	7,470	7,474	124	513	556
Navy Cherry Point	1,233	1,502	1,504	0	20	22
JAX	1,984	3,425	3,433	10	291	296
SFOMF	0	0	0	0	98	118
Key West	0	0	0	0	9	9
NSWC PCD	0	0	0	445	550	621
GOMEX	138	798	798	4	0	0
Gulf of Mexico	15	5	5	0	39	43
Other AFTT Areas	0	284	286	2	0	0
AFTT Study Area	0	0	0	0	4	4
Total	**7,508**	**13,595**	**13,611**	**792**	**1,903**	**2,089**

Navy Cherry Point: Navy Cherry Point Range Complex; GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area. AFTT Study Area means it could occur anywhere within the Study Area, typically to those events that occur while vessels are in transit.

3.0.5.3.3.3 Military Expended Materials

Military expended materials include: (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, ship hulks, expendable targets and unrecovered aircraft stores (fuel tanks, carriages, dispensers, racks, or similar types of support systems on aircraft).

While disturbance or strike from any material as it falls through the water column is possible, it is not likely because the object will slow in velocity as it sinks toward the bottom and can be avoided by highly mobile organisms. For living marine resources in the water column, the discussion of military expended

material strikes focuses on the potential of a strike at the surface of the water. The effect of materials settling on the bottom will be discussed as an alteration of the bottom substrate and associated organisms (i.e., invertebrates and vegetation).

Training and testing activities that involve the use of non-explosive practice munitions (small-, medium-, and large-caliber missiles, rockets, bombs, torpedoes, and neutralizers), fragments from high-explosives, and materials other than munitions (flares, chaff, sonobuoys, parachutes, aircraft stores and ballast, and targets) are detailed in Tables 3.0-45 through 3.0-71.

Table 3.0-45: Training Activities That Expend Non-Explosive Small-Caliber Projectiles

Training
Anti-Surface Warfare
• Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber • Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber • Gunnery Exercise Air-to-Surface – Small-Caliber • Sinking Exercise
Mine Warfare
• Mine Countermeasures – Mine Neutralization, Small- and Medium-Caliber

Table 3.0-46: Testing Activities That Expend Non-Explosive Small-Caliber Projectiles

Testing
Anti-Air Warfare
• Air Platform Weapons Integration Test • Air to Air Weapons Systems Test
Mine Warfare
• Airborne Projectile-Based Mine Clearance System
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trials – Gun Testing Small-Caliber • Other Class Ship Sea Trials – Gun Testing Small-Caliber • Surface Warfare Mission Package Testing – Gun Testing Small-Caliber
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Projectile Firing • Ordnance Testing – Gun Testing Small-Caliber
Shipboard Protection Systems and Swimmer Defense Testing
• Shipboard Protection Systems Testing

Table 3.0-47: Training Activities That Expend Non-Explosive Medium-Caliber Projectiles

Training
Anti-Air Warfare
• Gunnery Exercise (Air-to-Air) - Medium-Caliber • Gunnery Exercise (Surface-to-Air) – Medium-Caliber
Anti-Surface Warfare
• Gunnery Exercise Surface-to-Surface (Ship) – Medium-Caliber • Gunnery Exercise Surface-to-Surface (Boat) – Medium-Caliber • Gunnery Exercise (Air-to-Surface) – Medium-Caliber • Sinking Exercise
Mine Warfare
• Mine Countermeasures – Mine Neutralization, Small- and Medium-Caliber

Table 3.0-48: Testing Activities That Expend Non-Explosive Medium-Caliber Projectiles

Testing
Anti-Air Warfare
• Air Platform Weapons Integration Test • Air to Air Weapons Systems Test • Air to Air Gunnery Test – Medium-Caliber
Anti-Surface Warfare
• Air-to-Surface Gunnery Test
Mine Warfare
• Airborne Projectile-Based Mine Clearance System
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trial – Gun Testing Medium-Caliber • Surface Warfare Mission Package Testing – Gun Testing – Medium-Caliber
Life Cycle Activities
• Combat System Ship Qualification Trial – Air Defense • Combat System Ship Qualification Trial – Surface Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Projectile Firing • Ordnance Testing – Gun Testing – Medium-Caliber

Table 3.0-49: Training Activities That Expend Non-Explosive Large-Caliber Projectiles

Training
Anti-Air Warfare
• Gunnery Exercise (Surface-to-Air) – Large-Caliber
Amphibious Warfare
• Naval Surface Fire Support Exercise – At Sea
Anti-Surface Warfare
• Gunnery Exercise Surface-to-Surface (Ship) – Large-Caliber • Sinking Exercise

Table 3.0-50: Testing Activities That Expend Non-Explosive Large-Caliber Projectiles

Testing
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Gun Testing – Large-Caliber • Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber • Surface Warfare Mission Package Testing – Gun Testing Large-Caliber
Life Cycle Activities
• Combat System Ship Qualification Trial – Air Defense • Combat System Ship Qualification Trial – Surface Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Projectile Firing • Ordnance Testing – Gun Testing – Large-Caliber
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Kinetic Energy Weapon Testing

Table 3.0-51: Training Activities That Expend Non-Explosive Bombs

Training
Anti-Surface Warfare
• Bombing Exercise (Air-to-Surface) • Sinking Exercise

Table 3.0-52: Testing Activities That Expend Non-Explosive Bombs

Testing
Anti-Air Warfare
• Air Platform Weapons Integration Test
Anti-Surface Warfare
• Air-to-Surface Bombing Test
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trial – Bomb Testing

Table 3.0-53: Training Activities That Expend Non-Explosive Missiles or Rockets

Training
Anti-Air Warfare
• Missile Exercise (Air-to-Air) • Missile Exercise (Surface-to-Air)
Anti-Surface Warfare
• Missile Exercise (Surface-to-Surface) • Missile Exercise (Air-to-Surface)-Rocket • Sinking Exercise

Table 3.0-54: Testing Activities That Expend Non-Explosive Missiles or Rockets

Testing
Anti-Air Warfare
• Air Platform Weapons Integration Test • Air to Air Weapons Systems Test • Air to Air Missile Test
Anti-Surface Warfare
• Air-to-Surface Missile Test • Rocket Test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Missile Testing • Surface Warfare Mission Package Testing – Missile/Rocket Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Air Defense • Combat System Ship Qualification Trial – Surface Warfare
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Missile Testing

Table 3.0-55: Testing Activities That Expend Aircraft Stores

Testing
Anti-Air Warfare
• Air Platform/Vehicle Test • Air Platform Weapons Integration Test

Table 3.0-56: Training Activities That Expend Non-Explosive Sonobuoys

Training
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Tracking Exercise/Torpedo Exercise – Helo • Tracking Exercise/Torpedo Exercise – Maritime Patrol Advanced Extended Echo Ranging Sonobuoys • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise

Table 3.0-57: Testing Activities That Expend Non-Explosive Sonobuoys

Testing
Anti-Submarine Warfare
• Anti-Submarine Warfare Torpedo Test • Sonobuoy Lot Acceptance Test • Anti-Submarine Tracking Test – Helicopter • Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Anti-Submarine Warfare Testing • Anti-Submarine Warfare Mission Package Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Undersea Warfare
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing

Table 3.0-58: Training Activities That Expend Parachutes

Training
Anti-Air Warfare
• Missile Exercise (Air-to-Air)
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise /Sustainment Exercise

Table 3.0-59: Testing Activities That Expend Parachutes

Testing
Anti-Air Warfare
• Air to Air Missile Test
Anti-Submarine Warfare
• Anti-submarine Warfare Torpedo Test • Sonobuoy Lot Acceptance test • Anti-Submarine Tracking Test – Helicopter • Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft
Ship Construction and Maintenance
New Ship Construction
• Anti-Submarine Warfare Mission Package Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Undersea Warfare
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing • Countermeasure Testing

Table 3.0-60: Training Activities That Expend Chaff

Training
Electronic Warfare
• Counter Targeting Chaff Exercise – Ship • Counter Targeting Chaff Exercise – Aircraft

Table 3.0-61: Testing Activities That Expend Chaff

Testing
Electronic Warfare
• Chaff Test

Table 3.0-62: Training Activities That Expend Flares

Training
Electronic Warfare
• Missile Exercise (Air-to-Air) • Missile Exercise (Surface-to-Air) • Counter Targeting Flare Exercise

Table 3.0-63: Testing Activities That Expend Flares

Testing
Electronic Warfare
• Flare Test

Table 3.0-64: Training Activities That Expend Fragments from High-Explosive Munitions

Training
Anti-Air Warfare
• Missile Exercise (Air-to-Air)
• Gunnery Exercise (Surface-to-Air) – Large-Caliber
• Missile Exercise (Surface-to-Air)
Amphibious Warfare
• Naval Surface Fire Support Exercise – At Sea
Strike Warfare
• High-Speed Anti-Radiation Missile Exercise (Air-to-Surface)
Anti-Surface Warfare
• Maritime Security Operations – Anti-Swimmer Grenades
• Gunnery Exercise Surface-to-Surface (Ship) – Medium-Caliber
• Gunnery Exercise Surface-to-Surface (Ship) – Large-Caliber
• Gunnery Exercise Surface-to-Surface (Boat) – Medium-Caliber
• Missile Exercise (Surface-to-Surface)
• Gunnery Exercise (Air-to-Surface) – Medium-Caliber
• Missile Exercise (Air-to-Surface) – Rocket
• Missile Exercise (Air-to-Surface)
• Bombing Exercise (Air-to-Surface)
• Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys
• Group Sail
• Anti-Submarine Warfare for Composite Training Unit Exercise
• Anti-Submarine Warfare for Joint Task Force Exercise /Sustainment Exercise
Mine Warfare
• Mine Neutralization/Explosive Ordnance Disposal
• Mine Countermeasure – Mine Neutralization – Remotely Operated Vehicles
• Civilian Port Defense

Table 3.0-65: Testing Activities That Expend Fragments from High-Explosive Munitions

Testing
Anti-Surface Warfare
• Air-to-Surface Missile Test
• Air-to-Surface Gunnery Test
• Rocket Test
Anti-Submarine Warfare
• Sonobuoy Lot Acceptance Test
• Anti-Submarine Tracking Test – Helicopter
• Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft
Mine Warfare
• Airborne Mine Neutralization Systems Test – ASQ-235
• Airborne Projectile-Based Mine Clearance System
• Airborne Towed Minesweeping Test
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trial – Gun Testing Medium-Caliber; Missile Testing
• Surface Warfare Mission Package Testing – Missile/Rocket Testing
Ship Shock Trials
• Aircraft Carrier Full Ship Shock Trial
• DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial
• Littoral Combat Ship Full Ship Shock Trial
Life Cycle Activities
• Combat System Ship Qualification Trial – Air Defense
• Combat System Ship Qualification Trial – Surface Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Ordnance Operations
• Mine Countermeasure/Neutralization Testing
• Ordnance Testing – Line Charge Testing
• Ordnance Testing – Gun Testing – Large-Caliber
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Explosive) Testing
Other Testing
• At-Sea Explosives Testing

Table 3.0-66: Training Activities That Expend Targets

Training
Anti-Surface Warfare (ASUW)
• Gunnery Exercise (Surface to-Surface) – Ship Small-Caliber; Medium-Caliber; Large-Caliber • Gunnery Exercise (Surface-to-Surface) – Boat Small-Caliber; Medium-Caliber • Gunnery Exercise (Air-to-Surface) – Small-Caliber; Medium-Caliber • Missile Exercise (Air-to-Surface) • Bombing Exercise (Air-to-Surface) • Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Surface • Tracking Exercise/Torpedo Exercise – Helicopter • Tracking Exercise/Torpedo Exercise - Maritime Patrol Aircraft • Tracking Exercise - Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Submarine Command Course Operations • Anti-Submarine Warfare For Composite Training Unit Exercise • Anti-Submarine Warfare For Joint Task Force Exercise/Sustainment Exercise
Mine Warfare (MIW)
• Mine Laying • Mine Neutralization – Explosive Ordnance Disposal

Table 3.0-67: Testing Activities That Expend Targets

Testing
Anti-Air Warfare
• Air-to-Air Weapons System Test • Air-to-Air Gunnery Test – Medium-Caliber • Air-to-Air Missile Test
Anti-Surface Warfare (ASUW)
• Air-to-Surface Missile Test • Air-to-Surface Gunnery Test • Rocket Test • Air-to-Surface Bombing Test
Anti-Submarine Warfare (ASW)
• Anti-Submarine Warfare Torpedo Test • Anti-Submarine Warfare Tracking Test – Helicopter • Anti-Submarine Warfare Tracking Test - Maritime Patrol Aircraft
Mine Warfare (MIW)
• Airborne Mine Neutralization Systems Test – AQS-235 • Airborne Projectile-Based Mine Clearance System • Airborne Towed Minesweeping Test • Mine Laying Test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Anti-Submarine Warfare Testing • Submarine Sea Trials - Anti-Submarine Warfare Testing • Anti-Submarine Warfare Mission Package Testing • Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber • Aircraft Carrier Sea Trial – Bombing Test • Mine Countermeasure Mission Package Testing
Anti-Surface Warfare (ASUW)/Anti-Submarine Warfare (ASW) Testing
• Kinetic Energy Weapon Testing • Torpedo (Explosive) Testing • Torpedo (Non-Explosive) Testing

Table 3.0-67 Testing Activities That Expend Targets (Continued)

Testing
Mine Warfare (MIW) Testing
• Mine Detection and Classification Testing • Mine Countermeasure/Neutralization Testing
Shipboard Protection Systems and Swimmer Defense Testing
• Shipboard Protection Systems Testing

Table 3.0-68: Training Activities That Expend Torpedo Accessories

Training
Anti-Surface Warfare
• Sinking Exercise
Anti-Submarine Warfare (ASW)
• Tracking Exercise/Torpedo Exercise – Submarine • Tracking Exercise/ Torpedo Exercise – Surface • Tracking Exercise/Torpedo Exercise-Helicopter • Tracking Exercise/Torpedo Exercise-Maritime Patrol Aircraft • Submarine Command Course

Table 3.0-69: Testing Activities That Expend Torpedo Accessories

Testing
Anti-Submarine Warfare (ASW)
• Anti-Submarine Warfare Torpedo Test
Ship Construction and Maintenance
New Ship Construction
• Anti-Submarine Warfare Mission Package Testing
Life Cycle Activities
• Combat System Ship Qualification Trial - Undersea Warfare
Naval Undersea Warfare Center Division, Newport Testing Range
• Torpedo Testing
Anti-Surface Warfare (ASUW)/Anti-Submarine Warfare (ASW) Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing • Countermeasure Testing

Table 3.0-70: Annual Number and Location of Non-Explosive Practice Munitions Expended

Location	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Airborne Mine Neutralization System Neutralizers						
VACAPES	180	570	570	0	24	77
Navy Cherry Point	27	71	71	0	0	0
JAX	27	71	71	0	24	32
NSWC PCD	0	0	0	80	120	140
GOMEX	0	112	112	0	0	0
Total	**234**	**824**	**824**	**80**	**168**	**249**
Torpedoes						
VACAPES	0	0	0	2	28	30
JAX	0	0	0	2	6	7
Total	**0**	**0**	**0**	**4**	**34**	**37**
Bombs						
VACAPES	555	610	610	655	823	905
Navy Cherry Point	811	1,163	1,163	0	0	0
JAX	696	1,261	1,261	0	240	240
GOMEX	292	335	335	0	0	0
Total	**2,354**	**3,369**	**3,369**	**655**	**1,063**	**1,145**
Rockets						
VACAPES	3,700	0	0	264	1,897	2,102
JAX	0	0	0	113	496	561
Total	**3,700**	**0**	**0**	**377**	**2,393**	**2,663**
Missiles						
Northeast	0	0	0	4	0	0
VACAPES	112	2	2	128	591	658
Navy Cherry Point	8	0	0	0	0	0
JAX	15	2	2	5	57	62
Key West	0	0	0	0	3	3
GOMEX	0	0	0	4	8	10
AFTT Study Area	0	0	0	0	1	1
Total	**135**	**4**	**4**	**141**	**660**	**734**

Table 3.0-70: Annual Number and Location of Non-Explosive Practice Munitions Expended (Continued)

Location	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Large-Caliber Projectiles						
Northeast	0	0	0	148	296	296
VACAPES	3,844	1,644	1,804	0	4,611	4,811
Navy Cherry Point	1,392	854	934	0	0	0
JAX	2,372	1,672	1,832	0	769	769
Key West	0	0	0	0	561	561
NSWC PCD	0	0	0	300	260	280
GOMEX	1,240	1,276	1,276	148	0	0
Gulf of Mexico	0	0	0	0	148	148
Other AFTT Areas	0	457	537	0	0	0
AFTT Study Area	0	0	0	0	6,680	7,100
Total	**8,848**	**5,903**	**6,383**	**596**	**13,325**	**13,965**
Medium-Caliber Projectiles						
Northeast	0	700	700	0	1,400	1,400
VACAPES	226,750	807,810	807,810	42,210	153,670	162,590
Navy Cherry Point	39,075	215,149	215,149	0	22,200	22,200
JAX	68,825	415,075	415,075	16,000	65,600	68,600
Key West	36,000	56,000	56,000	0	6,000	6,000
NSWC PCD	0	0	0	5,272	17,030	18,718
GOMEX	34,880	24,388	24,388	0	0	0
Gulf of Mexico	0	0	0	0	1,400	1,400
Other AFTT Areas	0	33,520	33,520	0	0	0
AFTT Study Area	0	0	0	0	2,800	3,500
Total	**405,530**	**1,552,642**	**1,552,642**	**63,482**	**270,100**	**284,408**
Small-Caliber Projectiles						
Northeast	0	27,500	27,500	0	0	0
VACAPES	1,299,600	3,857,600	3,857,600	800	6,334	7,634
Navy Cherry Point	199,240	543,740	543,740	0	3,333	3,333
JAX	502,440	1,534,500	1,534,500	0	3,333	3,333
NSWC PCD	0	0	0	6,000	6,000	7,000
GOMEX	39,600	73,200	73,200	2,000	0	0
Gulf of Mexico	0	0	0	0	24,000	28,000
Other AFTT Areas	0	227,500	227,500	0	0	0
AFTT Study Area	0	0	0	0	2,000	2,500
Total	**2,040,880**	**6,264,040**	**6,264,040**	**8,800**	**45,000**	**51,800**

Source data: Tables 2.8-1 through 2.8-3

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Multiple: any combination of locations; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-71: Annual Number and Location of High-Explosives That May Result in Fragments

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Torpedoes						
Other AFTT Areas (SINKEX Box)	1	1	1	8	0	0
AFTT Study Area	0	0	0	0	8	8
Total	**1**	**1**	**1**	**8**	**8**	**8**
Sonobuoys						
Northeast	340	170	170	224	320	514
VACAPES	340	443	443	172	796	950
Navy Cherry Point	340	183	183	112	112	204
JAX	340	1,113	1,113	152	152	244
Key West	0	0	0	0	1312	1,512
GOMEX	0	0	0	112	112	204
Gulf of Mexico	340	70	70	0	0	0
Other AFTT Areas	0	0	0	184	184	368
Total	**1,700**	**1,979**	**1,979**	**956**	**2,988**	**3,996**
Neutralizers						
VACAPES (W-50)	30	0	0	0	0	0
VACAPES (W-50, W-72)	0	0	0	90	0	0
VACAPES (Little Creek)	0	12	12	0	0	0
VACAPES	0	60	60	0	126	145
JAX	0	0	0	0	24	32
NSWC PCD	0	0	0	40	161	171
GOMEX	0	20	20	0	0	0
Gulf of Mexico	0	0	0	0	12	14
Total	**30**	**92**	**92**	**130**	**323**	**362**
Anti-Swimmer Grenades						
Northeast	0	52	52	0	0	0
VACAPES	0	74	74	0	0	0
Navy Cherry Point	0	28	28	0	0	0
JAX (Charleston OPAREA UNDET Boxes North and South)	80	0	0	0	0	0
JAX	0	24	24	0	0	0
GOMEX (CC UNDET Box E3)	20	0	0	0	0	0
GOMEX	0	28	28	0	0	0
Total	**100**	**206**	**206**	**0**	**0**	**0**

Source data: Tables 2.8-1 through 2.8-3

CC: Corpus Christi; GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MLTR: Missile Laser Training Range; Multiple: any combination of locations; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; OPAREA: operating area; SINKEX: sinking exercise; SFOMF: South Florida Ocean Measurement Facility Testing Range; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-71: Annual Number and Location of High-Explosives That May Result in Fragments (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Bombs						
VACAPES (Air-K)	20	0	0	0	0	0
VACAPES	0	64	64	0	0	0
Navy Cherry Point	0	32	32	0	0	0
JAX	0	32	32	0	0	0
GOMEX (W-155 Hotbox)	4	0	0	0	0	0
GOMEX	0	4	4	0	0	0
Other AFTT Areas (SINKEX Box)	1	1	1	0	0	0
Total	**25**	**133**	**133**	**0**	**0**	**0**
Rockets						
Northeast	0	0	0	0	0	0
VACAPES	0	3,800	3,800	0	184	202
Navy Cherry Point	0	0	0	0	0	0
JAX	0	3,800	3,800	0	184	202
Key West	0	0	0	0	0	0
GOMEX	0	380	380	0	0	0
Total	**0**	**7,980**	**7,980**	**0**	**368**	**404**
Missiles						
Northeast	0	4	4	0	8	8
VACAPES (W-386, W-72, R-6604)	0	0	0	5	0	0
VACAPES [W-386 (Air E, F, I, J, K), W-72A]	106	0	0		0	0
VACAPES	72	190	190	0	94	98
Navy Cherry Point [W-122 (16/17, 18/19/20/21)]	24	0	0	0	0	0
Navy Cherry Point	20	91	91	0	0	0
JAX (MLTR)	73	0	0	5	0	0
JAX	15	178	178	0	36	39
Key West	0	8	8	0	0	0
GOMEX	0	8	8	0	0	0
AFTT Study Area	0	0	0	0	4	4
Other AFTT Areas (SINKEX Box)	11	11	11	0	0	0
Total	**321**	**490**	**490**	**10**	**142**	**149**

Source data: Tables 2.8-1 through 2.8-3

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; MLTR: Missile Laser Training Range; Multiple: any combination of locations; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SINKEX: sinking exercise; SFOMF: South Florida Ocean Measurement Facility Testing Range; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex; W: warning area

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-71: Annual Number and Location of High-Explosives That May Result in Fragments (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Large-Caliber Projectiles						
VACAPES (5-C/D, 7-C/D, 8-C/D, 1C-1/2)	858	0	0	0	0	0
VACAPES	0	6,644	6,644	0	1,797	1,797
Navy Cherry Point [W-122 (4/5, 13/14)]	78	0	0	0	0	0
Navy Cherry Point	0	866	866	0	0	0
JAX (BB,CC)	390	0	0	0	0	0
JAX	0	4,448	4,448	0	339	339
Key West	0	0	0	0	339	339
NSWC PCD	0	0	0	0	40	50
GOMEX	0	284	284	0	0	0
Other AFTT Areas (SINKEX Box)	700	700	700	0	0	0
Other AFTT Areas	0	96	96	0	0	0
AFTT Study Area	0	0	0	0	3,920	4,900
Total	**2,026**	**13,038**	**13,038**	**0**	**6,435**	**7,425**
Medium-Caliber Projectiles						
VACAPES	0	49,936	49,936	0	10,200	11,200
Navy Cherry Point	0	21,226	21,226	0	200	200
JAX	0	46,120	46,120	0	10,200	11,200
GOMEX	0	6,352	6,352	0	0	0
Other AFTT Areas	0	320	320	0	0	0
AFTT Study Area	0	0	0	0	2,800	3,500
Total	**0**	**123,954**	**123,954**	**0**	**23,400**	**26,100**

Source data: Tables 2.8-1 through 2.8-3

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SINKEX: sinking exercise; SFOMF: South Florida Ocean Measurement Facility Testing Range; UDNET: underwater detonation; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-72: Annual Number and Location of Targets Expended

Location	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Sub-Surface Targets						
Northeast	272	116	116	16	111	128
VACAPES	210	444	444	71	428	471
VACAPES, Navy Cherry Point, JAX	6	8	8	0	0	0
Navy Cherry Point	266	122	122	8	5	9
JAX	818	1,489	1,489	27	181	199
GOMEX	0	0	0	7	29	35
Gulf of Mexico	48	5	5	0	4	4
Other AFTT Areas	0	122	122	5	8	16
Total	**1,621**	**2,306**	**2,306**	**134**	**766**	**862**
Surface Targets						
Northeast	0	11	11	2	4	4
VACAPES	667	1,538	1,538	360	850	936
Navy Cherry Point	187	364	364	0	0	0
JAX	519	1,067	1,067	40	273	287
GOMEX	67	92	92	2	8	10
Gulf of Mexico	0	0	0	0	2	2
Other AFTT Areas	0	44	44	2	0	0
AFTT Study Area	0	0	0	0	3	3
Total	**1,440**	**3,116**	**3,116**	**406**	**1,140**	**1,242**
Air Targets						
VACAPES	0	0	0	110	110	121
Total	**0**	**0**	**0**	**110**	**110**	**121**
Mine Shapes						
VACAPES	0	48	48	42	98	114
Navy Cherry Point	0	24	24	0	0	0
JAX	0	12	12	50	108	118
NSWC PCD	0	0	0	112	395	435
Gulf of Mexico	0	0	0	0	6	7
Total	**0**	**84**	**84**	**204**	**607**	**674**
Ship Hulk						
Other AFTT Areas (SINKEX Box)	6	1	1	0	0	0
Total	**6**	**1**	**1**	**0**	**0**	**0**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SINKEX: sinking exercise; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-73: Annual Number and Location of Other Military Expended Materials Expended

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Anchor Blocks						
VACAPES	12	422	422	164	203	230
Cherry Point	10	20	20	0	0	0
JAX	6	38	38	50	53	64
SFOMF	0	0	0	0	51	66
Key West	0	6	6	0	0	0
NSWC PCD	0	0	0	378	1,079	1,203
GOMEX	0	36	36	0	0	0
Total	**28**	**522**	**522**	**592**	**1,386**	**1,563**
Lightweight Torpedo Accessories						
Northeast	5	1	1	9	127	127
VACAPES	8	5	5	13	227	249
Cherry Point	9	2	2	0	0	0
JAX	31	25	25	17	166	185
Gulf of Mexico	2	1	1	0	12	12
Other AFTT Areas	0	2	2	12	0	0
AFTT Study Area	0	0	0	0	20	20
Total	**55**	**36**	**36**	**51**	**554**	**593**
Heavyweight Torpedo Accessories						
Northeast	22	19	19	34	122	122
VACAPES	7	6	6	0	41	54
Cherry Point	10	1	1	0	0	0
JAX	32	20	20	25	222	271
Gulf of Mexico	1	0	0	0	44	44
Other AFTT Areas	0	34	34	17	0	0
AFTT Study Area	0	0	0	0	28	28
Total	**72**	**80**	**80**	**75**	**455**	**519**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; ; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges, but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-73: Annual Number and Location of Other Military Expended Materials Expended (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Non-Explosive Sonobuoys						
Northeast	2,134	2,055	2,055	460	1,549	1,977
VACAPES	4,444	4,501	4,501	1,076	5,292	5,923
Navy Cherry Point	1,472	1,464	1,464	224	200	360
JAX	19,837	20,360	20,360	526	2,313	2,647
Key West	0	0	0	0	2,640	3,120
GOMEX	0	0	0	206	488	672
Gulf of Mexico	66	149	149	0	36	36
Other AFTT Areas	428	438	438	620	320	640
AFTT Study Area	0	0	0	0	420	420
Total	**28,381**	**28,967**	**28,967**	**3,112**	**13,258**	**15,795**
Parachutes						
Northeast	2,985	2,426	2,426	474	1,652	2,097
VACAPES	5,394	5,666	5,666	1,270	6,050	6,756
Cherry Point	2,276	1,897	1,897	231	205	369
JAX	21,530	23,898	23,898	561	2,526	2,883
Key West	0	12	12	0	2,640	3,120
GOMEX	0	12	12	211	517	707
Gulf of Mexico	472	221	224	0	38	38
Other AFTT Areas	428	584	584	625	328	656
AFTT Study Area	0	0	0	0	432	432
Total	**33,085**	**34,716**	**34,719**	**3,372**	**14,388**	**17,058**
Aircraft Stores, Ballast, Weapon Carriages						
VACAPES	0	0	0	4,830	6,330	6,576
JAX	0	0	0	516	516	567
Key West	0	0	0	30	30	36
GOMEX	0	0	0	75	75	84
AFTT Study Area	0	0	0	1,275	1,275	1,404
Total	**0**	**0**	**0**	**6,726**	**8,226**	**8,667**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; ; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Table 3.0-73: Annual Number and Location of Other Military Expended Materials Expended (Continued)

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Pistons or Endcaps						
Northeast	0	6	6	72	144	144
VACAPES	20,654	2,420	2,420	3,852	6,592	7,172
Cherry Point	6,741	9,266	9,266	155	1,400	1,565
JAX	5,199	7,456	7,456	155	1,652	1,817
Key West	34,500	34,512	34,512	0	0	0
GOMEX	5,604	2,580	2,580	1,560	8,200	9,020
Gulf of Mexico	0	0	0	0	72	72
Total	**72,698**	**56,240**	**56,240**	**5,794**	**18,060**	**19,790**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; VACAPES: Virginia Capes Range Complex

3.0.5.3.3.4 Seafloor Devices

Seafloor devices represent items used during training or testing activities that are deployed onto the seafloor. These items include moored mine shapes, anchors, bottom placed instruments, and robotic vehicles referred to as "crawlers." Seafloor devices are either stationary or move very slowly along the bottom and do not pose a threat to highly mobile organisms. The effect of devices on the bottom will be discussed as an alteration of the bottom substrate and associated living resources (i.e., invertebrates and vegetation).

Training and testing activities that include the deployment of seafloor devices are listed in Tables 3.0-74 and 3.0-75. The location and number of events including seafloor devices are summarized in Table 3.0-76.

Table 3.0-74: Training Activities That Deploy Sea Floor Devices

Training
Mine Warfare
• Mine Countermeasure Exercise – Ship Sonar • Mine Neutralization/Explosive Ordnance Disposal • Underwater Mine Countermeasure – Raise, Tow, Beach, and Exploitation Operations • Airborne Mine Countermeasures – Towed Mine Neutralization • Airborne Mine Countermeasures – Mine Detection • Mine Countermeasures – Mine Neutralization, Small- and Medium-Caliber • Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicles • Coordinated Unit Level Helicopter Airborne Mine Countermeasure • Civilian Port Defense
Other Training Exercises
• Precision Anchoring

Table 3.0-75: Testing Activities That Deploy Sea Floor Devices

Testing
Mine Warfare
• Airborne Mine Neutralization Systems Test – ASQ-235 • Airborne Projectile-Based Mine Clearance System • Airborne Towed Minesweeping Test • Mine Laying Test
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Subsurface Operations • Unmanned Underwater Vehicle Demonstration • Unmanned Underwater Vehicle Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Unmanned Underwater Vehicle Demonstrations • Pierside Integrated Swimmer Defense Testing
South Florida Ocean Measurement Facility Testing Range Activities
• Mine Testing Activities • Subsurface Testing Activities • Unmanned Underwater Vehicle Demonstrations
Shipboard Protection Systems and Swimmer Defense Testing
• Pierside Integrated Swimmer Defense
Unmanned Vehicle Testing
• Unmanned Vehicle Development and Payload Testing

Table 3.0-76: Annual Number and Location of Events Including Seafloor Devices

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
NUWCDIVNPT	0	0	0	5	1	1
Northeast	0	0	0	1	20	22
VACAPES	2,532	3,854	3,854	164	183	203
Navy Cherry Point	630	656	656	0	20	22
JAX	678	831	831	0	78	80
SFOMF	0	0	0	0	52	67
NSWC PCD	0	0	0	549	1,040	1,171
GOMEX	0	566	566	0	0	0
Gulf of Mexico	0	0	0	0	27	30
Pierside	0	0	0	5	7	9
Total	**3,840**	**5,908**	**5,908**	**724**	**1,428**	**1,605**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

3.0.5.3.3.5 Aircraft Strikes

Aircraft involved in Navy training and testing activities are separated into three categories: (1) fixed-wing aircraft, (2) rotary-wing aircraft, and (3) unmanned aerial systems. Fixed-wing aircraft include, but are not limited to, planes such as F-35, P-8, F/A-18, and F/A-18G. Rotary-wing aircraft are generally helicopters (e.g., MH-60), but also include other platforms (e.g., MV-22). Unmanned aerial systems include a variety of platforms, including but not limited to, STUAS/Tier II, MQ-4C Triton Broad Area Maritime Surveillance, MQ-8 Fire Scout, and Unmanned Combat Air System Demonstration. Aircraft strikes are only applicable to birds.

Tables 3.0-77 through 3.0-82 list the training and testing activities that include the use of various types of aircraft. The location and number of events, including aircraft movement are summarized in Table 3.0-83.

Table 3.0-77: Training Activities That Include Fixed-Wing Aircraft

Training
Anti-Air Warfare
• Air Combat Maneuver • Air Defense Exercises • Gunnery Exercise (Air-to-Air) – Medium-Caliber • Missile Exercise (Air-to-Air)
Amphibious Warfare
• Marine Expeditionary Unit Certification Exercise
Strike Warfare
• High Speed Anti-Radiation Missile Exercise (Air-to-Surface)
Anti-Surface Warfare
• Gunnery Exercise (Air-to-Surface) – Medium-Caliber • Missile Exercise (Air-to-Surface) – Rocket • Missile Exercise (Air-to-Surface) • Bombing Exercise (Air-to-Surface) • Laser Targeting • Sinking Exercise
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft • Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys • Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Anti-Submarine Warfare for Joint Task Force Exercise /Sustainment Exercise
Electronic Warfare
• Electronic Warfare Operations • Counter Targeting – Flare Exercise • Counter Targeting Chaff Exercise – Aircraft
Mine Warfare
• Mine Laying

Table 3.0-78: Testing Activities That Include Fixed-Wing Aircraft

Testing
Anti-Air Warfare
• All Activities
Anti-Surface Warfare
• Air-to-Surface Missile Test • Air-to-Surface Gunnery Test – Medium-Caliber • Rocket Test • Air-to-Surface Bombing Test • Laser Targeting
Electronic Warfare
• Electronic Systems Evaluation • Chaff Test • Flare Test
Anti-Submarine Warfare
• Anti-Submarine Warfare Torpedo Test • Sonobuoy Lot Acceptance Test • Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft
Mine Warfare
• Mine Laying Test
Other Testing
• Test and Evaluation Catapult Launch • Air Platform Shipboard Integrate Test • Shipboard Electronic Systems Evaluation • Maritime Security
Ship Construction and Maintenance
New Ship Construction
• Aircraft Carrier Sea Trial – Gun Testing Medium-Caliber • Aircraft Carrier Sea Trial – Bomb Testing
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Air Operations
South Florida Ocean Measurement Facility Testing Range
• Mine Testing Activities
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing
Shipboard Protection Systems and Swimmer Defense Testing
• Chemical/Biological Simulant Testing

Table 3.0-79: Training Activities That Include Rotary-Wing Aircraft

Training
Amphibious Warfare
• Marine Expeditionary Unit Certification Exercise • Amphibious Assault
Anti-Surface Warfare
• Maritime Security Operations • Gunnery Exercise (Air-to-Surface) – Small-Caliber • Gunnery Exercise (Air-to-Surface) – Medium-Caliber • Missile Exercise (Air-to-Surface) – Rocket • Missile Exercise (Air-to-Surface) • Laser Targeting • Sinking Exercise
Anti-Submarine Warfare
• Anti-Submarine Warfare Tactical Development Exercise • Integrated Anti-Submarine Warfare Course • Group Sail • Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise
Electronic Warfare
• Electronic Warfare Operations • Counter Targeting – Flare Exercise • Counter Targeting Chaff Exercise – Aircraft
Mine Warfare
• Mine Neutralization/Explosive Ordnance Disposal • Underwater Mine Countermeasure – Raise, Tow, Beach, and Exploitation Operations • Airborne Mine Countermeasures – Towed Mine Neutralization • Airborne Mine Countermeasures – Mine Detection • Mine Countermeasures – Mine Neutralization, Small and Medium-Caliber • Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicles • Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercise • Civilian Port Defense
Other Training Exercises
• Search and Rescue

Table 3.0-80: Testing Activities That Include Rotary-Wing Aircraft

Testing
Anti-Air Warfare
• Air Platform/Vehicle Test • Air Platform Weapons Integration Test • Air to Air Weapons Systems Test
Anti-Surface Warfare
• Air-to-Surface Missile Test; Gunnery Test • Rocket Test • Laser Targeting • High Energy Laser Weapon Test
Electronic Warfare
• Electronic System Evaluation • Chaff Test • Flare Test
Anti-Submarine Warfare
• Anti-Submarine Warfare Torpedo Test • Kilo Dip • Anti-Submarine Tracking Test – Helicopter
Mine Warfare
• Airborne Mine Neutralization Systems Test – ASQ-235 • Airborne Projectile-Based Mine Clearance System • Airborne Towed Minesweeping Test • Airborne Towed Minehunting Sonar Test • Airborne Laser-Based Mine Detection System Test • Mine Detection and Classification • Mine Countermeasure/Neutralization Testing
Other Testing
• Shipboard Electronic Systems Evaluation • Maritime Security
Ship Construction and Maintenance
New Ship Construction
• Anti-Submarine Warfare Mission Package Testing • Surface Warfare Mission Package Testing – Missile/Rocket Testing • Mine Countermeasure Mission Package Testing

Table 3.0-80: Testing Activities That Include Rotary-Wing Aircraft (Continued)

Life Cycle Activities
• Combat System Ship Qualification Trial – Undersea Warfare
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Air Operations • Electromagnetic Operations • Ordnance Operations • Mine Detection and Classification Testing • Mine Countermeasure/Neutralization Testing • Ordnance Testing – Gun Testing – Small-Caliber; Gun Testing – Medium-Caliber; Gun Testing – Large-Caliber
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing

Table 3.0-81: Training Activities That Include Unmanned Aerial Systems

Training
Anti-Air Warfare
• Air Defense Exercises • Missile Exercise (Air-to-Air) • Missile Exercise (Surface-to-Air)
Amphibious Warfare
• Naval Surface Fire Support Exercise – Land-Based Target • Amphibious Raid/Humanitarian Assistance Operations
Anti-Surface Warfare
• Maritime Security Operations • Missile Exercise (Air-to-Surface) – Rocket
Anti-Submarine Warfare
• Anti-Submarine Warfare for Composite Training Unit Exercise • Anti-Submarine Warfare for Joint Task Force Exercise /Sustainment Exercise

Table 3.0-82: Testing Activities That Include Unmanned Aerial Systems

Testing
Anti-Air Warfare
• Air Platform/Vehicle Test • Air Platform Weapons Integration Test • Air to Air Weapons Systems Test • Air to Air Missile Test • Air to Air Gunnery Test • Intelligence, Surveillance, and Reconnaissance Test
Ship Construction and Maintenance
New Ship Construction
• Surface Combatant Sea Trials – Missile Testing • Aircraft Carrier Sea Trial – Missile Testing
Life Cycle Activities
• Combat System Ship Qualification Trial – Air Defense
Naval Surface Warfare Center, Panama City Division Testing Range Activities
• Mine Detection and Classification Testing
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Unmanned Aerial System Testing
Mine Warfare Testing
• Mine Detection and Classification
Unmanned Vehicle Testing
• Underwater Deployed Unmanned Aerial System Testing • Unmanned Vehicle Development and Payload Testing

Table 3.0-83: Annual Number and Location of Events Including Aircraft Movement

Activity Area	Training Activities			Testing Activities		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
NUWCDIVNPT	0	0	0	0	15	17
Northeast	302	147	147	17	362	406
VACAPES	9,728	11,613	11,613	6,135	6,194	6,705
Navy Cherry Point	5,029	11,508	11,508	3,107	1,487	1,660
JAX	3,669	11,572	11,576	3,347	2,203	2,431
SFOMF	0	0	0	0	21	33
Key West	9,636	9,690	9,690	10	43	51
NSWC PCD	0	0	0	548	1,138	1,257
GOMEX	959	1,303	1,303	177	311	348
Gulf of Mexico	49	5	5	0	37	41
Other AFTT Areas	6	181	181	7	8	16
AFTT Study Area	0	0	0	425	9,662	10,629
Total	**29,378**	**46,019**	**46,022**	**13,773**	**21,481**	**23,594**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area. AFTT Study Area means it could occur anywhere within the Study Area, typically to those events that occur while vessels are in transit.

3.0.5.3.4 Entanglement Stressors

This section describes the entanglement stressors introduced into the water through naval training and testing and the relative magnitude and location of these activities to provide the basis for analysis of potential impacts on resources in the remainder of Chapter 3 (Affected Environment and Environmental Consequences). To assess the entanglement risk of materials expended during training and testing, the Navy examined the characteristics of these items (such as size and rigidity) for their potential to entangle marine animals. For a constituent of military expended materials to entangle a marine animal, it must be long enough to wrap around the appendages of marine animals. Another critical factor is rigidity; the item must be flexible enough to wrap around appendages or bodies. This analysis includes the potential impacts from two types of military expended materials including: (1) fiber optic cables and guidance wires, and (2) parachutes.

Unlike typical fishing nets and lines the Navy's equipment is not designed for trapping or entanglement purposes. The Navy deploys equipment designed for military purposes and strives to reduce the risk of accidental entanglement posed by any item it releases into the sea.

3.0.5.3.4.1 Fiber Optic Cables and Guidance Wires

Fiber Optic Cables

The only type of cable expended during Navy training and testing is a fiber optic cable. Fiber optic cable is flexible, durable, and abrasion or chemical-resistant and the physical characteristics of the fiber optic material render the cable brittle and easily broken when kinked, twisted, or bent sharply (i.e., to a radius greater than 360 degrees). The cable is often designed with controlled buoyancy to minimize the cable's effect on vehicle movement. The fiber optic cable would be suspended within the water column during the activity, and then be expended to sink to the sea floor.

Tables 3.0-84 and 3.0-85 list the training and testing activities that include the use of fiber optic cables. The estimated location and number of expended fiber optic cables are detailed below in Table 3.0-86.

Table 3.0-84: Training Activities That Expend Fiber Optic Cables

Training
Mine Warfare
• Mine Countermeasure – Mine Neutralization – Remotely Operated Vehicle
• Coordinated Unit Level Helicopter Airborne Mine Countermeasure

Table 3.0-85: Testing Activities That Expend Fiber Optic Cables

Testing
Mine Warfare
• Airborne Mine Neutralization Systems Test – AQS-235

Table 3.0-86: Annual Number and Location of Fiber Optic Cables Expended

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
VACAPES (W-50)	840	0	0	0	0	0
VACAPES (W-50, W-72)	0	0	0	480	0	0
VACAPES	0	2,520	2,520	0	720	888
Navy Cherry Point (Onslow Bay UNDET Area)	108	0	0	0	0	0
Navy Cherry Point	0	284	284	0	0	0
JAX (Charleston OPAREA UNDET Boxes North and South)	108	0	0	0	0	0
JAX	0	284	284	0	192	256
NSWC PCD	0	0	0	480	1,124	1,244
GOMEX	0	528	528	0	0	0
Gulf of Mexico	0	0	0	0	48	56
Total	**1,056**	**3,616**	**3,616**	**960**	**2,084**	**2,444**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Navy Cherry Point: Navy Cherry Point Range Complex; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; OPAREA: operating area; UNDET: underwater detonation; VACAPES: Virginia Capes Range Complex; W: warning area

Guidance Wires

The only types of wires expended during Navy training and testing activities are guidance wires from heavy-weight torpedoes and tube-launched, optically tracked, wire guided missiles. Guidance wires are used to help the firing platform control and steer the torpedo or missile. They trail behind the torpedo or missile as it moves through the water or air. Finally, the guidance wire is released from both the firing platform and the torpedo or tube-launched, optically tracked, wire guided missile and sinks to the ocean floor.

The torpedo guidance wire is a single-strand, thin gauge, coated copper alloy. The tensile breaking strength of the wire is a maximum of 42 lb. (19 kg) and can be broken by hand (Environmental Sciences Group 2005), contrasting with the rope or lines associated with commercial fishing towed gear (trawls), stationary gear (traps), or entanglement gear (gillnets) that utilize lines with substantially higher (up to 500–2,000 lb. [227–907 kg]) breaking strength as their "weak links" to minimize entanglement of marine animals (National Marine Fisheries Service 2008). The physical characteristics of the wire prevent it from tangling, unlike the monofilament fishing lines and polypropylene ropes identified in the literature (U.S. Department of the Navy 1996). Torpedo guidance wire sinks at an estimated rate of 0.7 ft. (0.2 m) per second.

The tube-launched, optically tracked, wire guided missile system has two thin (5.75 mils or 0.146 mm diameter) wires. Two wire dispensers containing several thousand meters each of single-strand wire with a minimum tensile strength of 10 lb. are mounted on the rear of the missile. The length of wire dispensed would generally be equal to the distance the missile travels to impact the target and any undispensed wire would be contained in the dispensers upon impact. While degradation rates for the wire may vary because of changing environmental conditions in seawater, assuming a sequential failure

or degradation of the enamel coating (degradation time is about two months), the copper plating (degradation time is about 1.5–25 months), and the carbon-steel core (degradation time is about 8–18 months), degradation of the tube-launched, optically tracked, wire guided missile guide wire would take 12–45 months. Tables 3.0-87 and 3.0-88 list the training and testing activities that include the use of guidance wires. The estimated number of wires and where they would be expended are detailed below in Table 3.0-89.

Table 3.0-87: Training Activities That Expend Guidance Wires

Training
Anti-Surface Warfare
• Sinking Exercise • Missile Exercise (Air-to-Surface)- Navy Cherry Point Range Complex only
Anti-Submarine Warfare
• Tracking Exercise/Torpedo Exercise – Submarine • Submarine Command Course Operations

Table 3.0-88: Testing Activities That Expend Guidance Wires

Testing
Anti-Submarine Warfare
• Anti-Submarine Warfare Torpedo Test
Naval Undersea Warfare Center Division, Newport Testing Range Activities
• Torpedo Testing
Anti-Surface Warfare/Anti-Submarine Warfare Testing
• Torpedo (Non-Explosive) Testing • Torpedo (Explosive) Testing

Table 3.0-89: Annual Number and Location of Guidance Wires Expended

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Northeast	22	19	19	52	146	152
VACAPES	7	6	6	13	225	256
Navy Cherry Point [W-122 (16/17)]	8	0	0	0	0	0
Navy Cherry Point	10	17	17	0	0	0
JAX	32	20	20	35	262	316
Gulf of Mexico	1	0	0	0	44	44
Other AFTT Areas	0	35	35	11	16	16
Total	**80**	**97**	**97**	**111**	**693**	**784**

Gulf of Mexico refers to the body of water; JAX: Jacksonville Range Complex; Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; TORPEX: Torpedo Exercise; VACAPES: Virginia Capes Range Complex; W: warning area

Note: Other AFTT Areas are those areas outside of named range complexes and testing ranges but still within the AFTT Study Area.

3.0.5.3.4.2 Parachutes

Aircraft-launched sonobuoys, lightweight torpedoes (such as the MK 46 and MK 54), illumination flares, and targets use nylon decelerators or parachutes ranging in size from 18 to 48 in. (46 to 122 cm) in diameter. The majority of expended parachutes are cruciform decelerators (hereafter referred to as parachutes) associated with sonobuoys, which are relatively small (18 in.), and have short attachment lines. Parachutes are made of cloth and nylon, and many have weights attached to the lines for rapid sinking. At water impact, the parachute assembly is expended, and it sinks away from the unit. The parachute assembly may remain at the surface for 5 to 15 seconds before the parachute and its housing sink to the seafloor, where it becomes flattened (Environmental Sciences Group 2005). Some parachutes are weighted with metal clips that facilitate their descent to the seafloor. Once settled on the bottom the canopy may temporarily billow if bottom currents are present. Training and testing activities that expend parachutes are listed in Tables 3.0-58 and 3.0-59. The estimated number of parachutes and locations where they would be expended were detailed above in Table 3.0-73.

3.0.5.3.5 Ingestion Stressors

This section describes the ingestion stressors introduced into the water through naval training and testing and the relative magnitude and location of these activities to provide the basis for analysis of potential impacts on resources in the remainder of Chapter 3 (Affected Environment and Environmental Consequences). To assess the ingestion risk of materials expended during training and testing, the Navy examined the characteristics of these items (such as buoyancy and size) for their potential to be ingested by marine animals in the Study Area. The Navy expends the following types of materials that could become ingested during training and testing in the Study Area: non-explosive practice munitions (small- and medium-caliber), fragments from high-explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and parachutes. Other military expended materials such as targets, large-caliber projectiles, intact training and testing bombs, guidance wires, 55-gallon drums, sonobuoy tubes, and marine markers are too large for marine organisms to consume and are eliminated from further discussion.

Solid metal materials, such as small-caliber projectiles, or fragments from high-explosive munitions, sink rapidly to the seafloor. Lighter items may be caught in currents and gyres or entangled in floating *Sargassum* and could remain in the water column for hours to weeks or indefinitely before sinking (e.g., plastic end caps or pistons).

3.0.5.3.5.1 Non-Explosive Practice Munitions

Only small- or medium-caliber projectiles would be small enough for marine animals to ingest. This would vary depending on the resource and will be discussed in more detail within each resource section. Small- and medium-caliber projectiles include all sizes up to and including those that are 2.25 in. (57 mm) in diameter. These solid metal materials would quickly move through the water column and settle to the sea floor.

The training and testing activities that involve the use of small- and medium-caliber non-explosive practice munitions are listed in Tables 3.0-45 through 3.0-48.

The overall number of events per year that expend small- and medium-caliber non-explosive practice munitions and locations where they occur are detailed below in Table 3.0-90.

3.0.5.3.5.2 Fragments from High-Explosive Munitions

Many different types of high-explosive munitions can result in fragments that are expended at sea during training and testing activities.

Types of high-explosive munitions that can result in fragments include demolition charges, grenades, projectiles, missiles, and bombs. Fragments would result from fractures in the munition casing and would vary in size depending on the size of the net explosive weight and munition type; however, typical sizes of fragments are unknown. These solid metal materials would quickly sink through the water column and settle to the seafloor. Training and testing activities that involve fragments from high-explosives are listed in Tables 3.0-64 and 3.0-65. The overall number of events per year that expend fragments from high-explosive munitions and locations where they occur were detailed above in Table 3.0-71.

3.0.5.3.5.3 Military Expended Materials Other Than Munitions

Several different types of materials other than munitions are expended at sea during training and testing activities.

Table 3.0-90: Annual Number and Location of Small- and Medium-Caliber Non-Explosive Practice Munitions Expended

Location	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Small-Caliber Projectiles						
Northeast	0	27,500	27,500	0	0	0
VACAPES	1,299,600	3,857,600	3,857,600	800	6,334	7,634
Navy Cherry Point	199,240	543,740	543,740	0	3,333	3,333
JAX	502,440	1,534,500	1,534,500	0	3,333	3,333
NSWC PCD	0	0	0	6,000	6,000	7,000
GOMEX	39,600	73,200	73,200	2,000	0	0
Gulf of Mexico	0	0	0	0	24,000	28,000
Other AFTT Areas	0	227,500	227,500	0	0	0
AFTT Study Area	0	0	0	0	2,000	2,500
Total	**2,040,880**	**6,264,040**	**6,264,040**	**8,800**	**45,000**	**51,800**
Medium-Caliber Projectiles						
Northeast	0	700	700	0	1,400	1,400
VACAPES	226,750	807,810	807,810	42,210	153,670	162,590
Navy Cherry Point	39,075	215,149	215,149	0	22,200	22,200
JAX	68,825	415,075	415,075	16,000	65,600	68,600
Key West	36,000	56,000	56,000	0	6,000	6,000
NSWC PCD	0	0	0	5,272	17,030	18,718
GOMEX	34,880	24,388	24,388	0	0	0
Gulf of Mexico	0	0	0	0	1,400	1,400
Other AFTT Areas	0	33,520	33,520	0	0	0
AFTT Study Area	0	0	0	0	2,800	3,500
Total	**405,530**	**1,552,642**	**1,552,642**	**63,482**	**270,100**	**284,408**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Northeast: Northeast Range Complexes; Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Target-Related Materials

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. However, if they are used during activities that utilize high-explosives then they may result in fragments. Expendable targets that may result in fragments would include air-launched decoys, surface targets (such as marine markers, paraflares, cardboard boxes, and 10 ft. diameter red balloons), and mine shapes. Most target fragments would sink quickly to the seafloor. Floating material, such as Styrofoam, may be lost from target boats and remain at the surface for some time (see Section 2.3.3, Targets, for additional information on targets). Only targets that may result in smaller fragments are included in the analyses of ingestion potential.

The training and testing activities that may expend targets are listed in Tables 3.0-66 and 3.0-67. There are additional types of targets discussed previously, but only surface targets, air targets, and mine shapes would be expected to result in fragments when high-explosive munitions are used. The number and location per year of targets used during training and testing activities with the potential to result in small fragments are detailed below in Table 3.0-91.

Table 3.0-91: Annual Number and Location of Targets That May Result in Fragments

Location	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Surface Targets						
Northeast	0	11	11	2	4	4
VACAPES	667	1,538	1,538	360	850	936
Navy Cherry Point	187	364	364	0	0	0
JAX	519	1,067	1,067	40	273	287
GOMEX	67	92	92	2	8	10
Gulf of Mexico	0	0	0	0	2	2
Other AFTT Areas	0	44	44	2	0	0
AFTT Study Area	0	0	0	0	3	3
Total	**1,440**	**3,116**	**3,116**	**406**	**1,140**	**1,242**
Air Targets						
VACAPES	0	0	0	110	110	121
Total	**0**	**0**	**0**	**110**	**110**	**121**
Mine Shapes						
VACAPES	0	48	48	42	98	114
Navy Cherry Point	0	24	24	0	0	0
JAX	0	12	12	50	108	118
NSWC PCD	0	0	0	112	395	435
Gulf of Mexico	0	0	0	0	6	7
Total	**0**	**84**	**84**	**204**	**607**	**674**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); JAX: Jacksonville Range Complex; Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; VACAPES: Virginia Capes Range Complex

Note: Other AFTT Areas are areas outside of named range complexes and testing ranges but still within the AFTT Study Area. Events in Other AFTT Areas typically refer to those events that occur while vessels are in transit.

Chaff

Chaff consists of reflective, aluminum-coated glass fibers used to obscure ships and aircraft from radar-guided systems. Chaff, which is stored in canisters, is either dispensed from aircraft or fired into the air from the decks of surface ships when an attack is imminent. The glass fibers create a radar cloud that

mask the position of the ship or aircraft. Chaff is composed of an aluminum alloy coating on glass fibers of silicon dioxide (U.S. Air Force 1997). Chaff is released or dispensed in cartridges or projectiles that contain millions of fibers. When deployed, a diffuse cloud of fibers is formed that is undetectable to the human eye. Chaff is a very light material, similar to fine human hair. It can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (Arfsten et al. 2002; U.S. Air Force 1997). Doppler radar has tracked chaff plumes containing approximately 900 g of chaff drifting 200 mi. (322 km) from the point of release, with the plume covering greater than 400 $mi.^3$ (1,667 km^3) (Arfsten et al. 2002).

The chaff concentrations that marine animals could be exposed to following the release of multiple cartridges (e.g., following a single day of training) is difficult to accurately estimate because it depends on several factors. First, specific release points are not recorded and tend to be random, and chaff dispersion in air depends on prevailing atmospheric conditions. After falling from the air, chaff fibers would be expected to float on the sea surface for some period, depending on wave and wind action. The fibers would be dispersed farther by sea currents as they float and slowly sink toward the bottom. Chaff concentrations in benthic habitats following the release of a single cartridge would be lower than the values noted in this section, based on dispersion by currents and the dilution capacity of the ocean.

Several literature reviews and controlled experiments indicate that chaff poses little risk to organisms, except at concentrations substantially higher than those that could reasonably occur from military training (Arfsten et al. 2002; Hullar et al. 1999; U.S. Air Force 1997). Nonetheless, some marine animal species within the Study Area could be exposed to chaff through direct body contact, inhalation, and ingestion. Chemical alteration of water and sediment from decomposing chaff fibers is not expected to occur. Based on the dispersion characteristics of chaff, it is likely that marine animals would occasionally come in direct contact with chaff fibers while either at the water's surface or while submerged, but such contact would be inconsequential. Because of the flexibility and softness of chaff, external contact would not be expected to impact most wildlife (U.S. Air Force 1997) and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (U.S. Air Force 1997). The potential exists for marine animals to inhale chaff fibers if they are at the surface while chaff is airborne. Arfsten et al. (2002), Hullar et al. (1999), and U.S. Air Force (1997) reviewed the potential impacts of chaff inhalation on humans, livestock, and other animals and concluded that the fibers are too large to be inhaled into the lungs. The fibers were predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled.

In laboratory studies conducted by the University of Delaware (Hullar et al. 1999), blue crabs and killifish were fed a food-chaff mixture daily for several weeks and no significant mortality was observed at the highest exposure treatment. Similar results were found when chaff was added directly to exposure chambers containing filter-feeding menhaden. Histological examination indicated no damage from chaff exposures. A study on cow calves that were fed chaff found no evidence of digestive disturbance or other clinical symptoms (U.S. Air Force 1997).

Chaff cartridge plastic end caps and pistons would also be released into the marine environment, where they would persist for long periods and could be ingested by marine animals. Chaff end caps and pistons sink in saltwater (Spargo 2007).

The training and testing activities that involve chaff are listed in Tables 3.0-60 and 3.0-61. The estimated number of events per year that would involve expending chaff and locations where they occur are detailed below in Table 3.0-92.

Table 3.0-92: Annual Number and Location of Chaff Cartridges and Canisters Expended

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Northeast	0	0	0	72	144	144
VACAPES	19,978	1,792	1,792	2,000	3,592	3,872
Navy Cherry Point	6,164	7,304	7,304	120	1,200	1,345
JAX	4,684	5,788	5,788	120	1,452	1,597
Key West	30,000	30,000	30,000	0	0	0
GOMEX	3,764	728	728	672	4,200	4,620
Gulf of Mexico	0	0	0	0	72	72
Total	**64,590**	**45,612**	**45,612**	**2,984**	**10,660**	**11,650**

GOMEX: Gulf of Mexico Range Complex (Gulf of Mexico refers to the body of water); Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; VACAPES: Virginia Capes Range Complex

Flares

Flares are pyrotechnic devices used to defend against heat-seeking missiles, where the missile seeks out the heat signature from the flare rather than the aircraft's engines. Similar to chaff, flares are also dispensed from aircraft and fired from ships. The flare device consists of a cylindrical cartridge approximately 1.4 in. (3.6 cm) in diameter and 5.8 in. (14.7 cm) in length. Flares are designed to burn completely. The only material that would enter the water would be a small, round, plastic end cap (approximately 1.4 in. [3.6 cm] in diameter).

An extensive literature review and controlled experiments conducted by the U.S. Air Force revealed that self-protection flare use poses little risk to the environment or animals (U.S. Air Force 1997).

The training and testing activities that involve the use of flares are listed in Tables 3.0-62 and 3.0-63. The overall number of events per year that expend flares is detailed below in Table 3.0-93.

Table 3.0-93: Annual Number and Location of Flares Expended

Activity Area	Training			Testing		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Northeast	0	6	6	0	0	0
VACAPES	676	628	628	1,852	3,000	3,300
Navy Cherry Point	577	1,962	1,962	35	200	220
JAX	515	1,668	1,668	35	200	220
Key West	4,500	4,512	4,512	0	0	0
GOMEX	1,840	1,852	1,852	888	4,000	4,400
Total	**8,108**	**10,628**	**10,628**	**2,810**	**7,400**	**8,140**

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; Navy Cherry Point: Navy Cherry Point Range Complex; Northeast: Northeast Range Complexes; VACAPES: Virginia Capes Range Complex

Parachutes

Aircraft-launched sonobuoys, lightweight torpedoes (such as the MK 46 and MK 54), and targets use nylon parachutes ranging in size from 18 to 48 in. (46 to 122 cm) in diameter. Training and testing

activities that expend parachutes were listed above in Tables 3.0-58 and 3.0-59. The estimated number of parachutes and locations where they would be expended were detailed above in Table 3.0-73.

3.0.5.4 Resource-Specific Impacts Analysis for Individual Stressors

The direct and indirect impacts of each stressor carried forward for further analysis were analyzed for each resource in their respective section. Quantitative and semi-quantitative methods were used to the extent possible, but inherent scientific limitations required the use of qualitative methods for most stressor/resource interactions. Resource-specific methods are described in sections of Chapter 3, where applicable. While specific methods used to analyze the impacts of individual stressors varied by resource, the following generalized approach was used for all stressor/resource interactions:

- The frequency, duration, and spatial extent of exposure to stressors were analyzed for each resource. The frequency of exposure to stressors or frequency of a proposed activity was characterized as intermittent or continuous, and was quantified in terms of number per unit of time when possible. Duration of exposure was expressed as short- or long-term and was quantified in units of time (e.g., seconds, minutes, and hours) when possible. The spatial extent of exposure was generally characterized as widespread or localized, and the stressor footprint or area (e.g., $ft.^2$, nm^2) was quantified when possible.
- An analysis was conducted to determine whether and how resources are likely to respond to stressor exposure or be altered by stressor exposure based upon available scientific knowledge. This step included reviewing available scientific literature and empirical data. For many stressor/resource interactions, a range of likely responses or endpoints was identified. For example, exposure of an organism to sound produced by an underwater explosion could result in no response, a physiological response such as increased heart rate, a behavioral response such as being startled, injury, or mortality.
- The information obtained was used to analyze the likely impacts of individual stressors on a resource and to characterize the type, duration, and intensity (severity) of impacts. The type of impact was generally defined as beneficial or adverse and was further defined as a specific endpoint (e.g., change in behavior, mortality, change in concentration, loss of habitat, loss of fishing time). When possible, the endpoint was quantified. The duration of an impact was generally characterized as short-term (e.g., minutes, days, weeks, months, depending on the resource), long-term (e.g., months, years, decades, depending on the resource), or permanent. The intensity of an impact was then determined. For biological resources, the analysis started with individual organisms and their habitats, and then addressed populations, species, communities, and representative ecosystem characteristics, as appropriate.

3.0.5.5 Resource-Specific Impacts Analysis for Multiple Stressors

The stressors associated with the proposed training and testing activities could affect the environment individually or in combination. The impacts of multiple stressors may be different when considered collectively rather than individually. Therefore, following the resource-specific impacts analysis for individual stressors, the combined impacts of all stressors were analyzed for that resource. This step determines the overall impacts of the alternatives on each resource, and it considers the potential for impacts that are additive (where the combined impacts on the resource are equal to the sum of the individual impacts), synergistic (where impacts combine in such a way as to amplify the effect on the resource), and antagonistic (where impacts will cancel each other out or reduce a portion of the effect on the resource). In some ways, this analysis is similar to the cumulative impacts analysis described below, but it only considers the activities in the alternatives and not other past, present, and reasonably

foreseeable future actions. This step helps focus the next steps of the approach (cumulative impacts analysis) and make overall impact conclusions for each resource.

Evaluating the combined impacts of multiple stressors can be complex, especially when the impacts associated with a stressor are hard to measure. Therefore, some general assumptions were used to help determine the potential for individual stressors to contribute to combined impacts. For this analysis, combined impacts were considered more likely to occur in the following situations:

- Stressors co-occur in time and space, causing a resource to be simultaneously affected by more than one stressor.
- A resource is repeatedly affected by multiple stressors or is re-exposed before fully recovering from a previous exposure.
- The impacts of individual stressors are permanent or long-term (years or decades) versus short-term (minutes, days, or months).
- The intensity of the impacts from individual stressors is such that mitigation would be necessary to offset adverse impacts.

The resource-specific impacts analysis for multiple stressors included the following steps:

- Information obtained from the analysis of individual stressors was used to develop a conceptual model to predict the combined impacts of all stressors on each resource. This conceptual model incorporated factors such as the co-occurrence of stressors in space and time; the impacts or assessment endpoints of individual stressors (e.g., mortality, injury, changes in animal behavior or physiology, habitat alteration, or changes in human use); and the duration and intensity of the impacts of individual stressors.
- To the extent possible, additive impacts on a given resource were considered by summing the impacts of individual stressors. This summation was only possible for stressors with identical and quantifiable assessment endpoints. For example, if one stressor disturbed 0.25 nm^2 of benthic habitat, a second stressor disturbed 0.5 nm^2, and all other stressors did not disturb benthic habitat, then the total benthic habitat disturbed would be 0.75 nm^2. For stressors with identical but not quantifiable assessment endpoints, available scientific knowledge, best professional judgment, and the general assumptions outlined above were used to evaluate potential additive impacts.
- For stressors with differing impacts and assessment endpoints, the potential for additive, synergistic, and antagonistic effects were evaluated based on available scientific knowledge, professional judgment, and the general assumptions outlined above.

3.0.5.6 Cumulative Impacts

A cumulative impact is the impact on the environment that results when the incremental impact of an action is added to other past, present, and reasonably foreseeable future actions. The cumulative impacts analysis (Chapter 4, Cumulative Impacts) considers other actions regardless of what agency (federal or nonfederal) or person undertakes the actions. Cumulative impacts result when individual actions combine with similar actions taking place over a period of time to produce conditions that frequently alter the historical baseline (40 C.F.R. § 1508.7). The goal of the analysis is to provide the decision makers with information relevant to reasonably foresee potentially significant impacts. See Chapter 4 (Cumulative Impacts) for the specific approach used for determining cumulative impacts.

3.0.5.7 Biological Resource Methods

The analysis of impacts on biological resources focused on the likelihood of encountering the stressor, the primary stimulus, response, and recovery of individual organisms. Where appropriate, the differential potential of biological resources to overlap with stressors was considered at the level of specific geographic areas (large marine ecosystems, open ocean areas, range complexes, operating areas, and other training and testing areas). Additionally, the different aspects of training versus testing activities were considered with regard to how they may impact the resource.

3.0.5.7.1 Conceptual Framework for Assessing Effects from Sound-Producing Activities

This conceptual framework describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for the individual and population. The conceptual framework is central to the assessment of acoustic-related effects and is consulted multiple times throughout the process. It describes potential effects and the pathways by which an acoustic stimulus or sound-producing activity can potentially affect animals. The conceptual framework qualitatively describes costs to the animal (e.g., expended energy or missed feeding opportunity) that may be associated with specific reactions. Finally, the conceptual framework outlines the conditions that may lead to long-term consequences for the individual and population if the animal cannot fully recover from the short-term effects. Within each biological resource section (e.g., marine mammals, birds, and fish) the detailed methods to predict effects on specific taxa are derived from this conceptual framework.

An animal is considered "exposed" to a sound if the received sound level at the animal's location is above the background ambient noise level within a similar frequency band. A variety of effects may result from exposure to sound-producing activities. The severity of these effects can vary greatly between minor effects that have no real cost to the animal, to more severe effects that may have lasting consequences. Whether a marine animal is significantly affected must be determined from the best available scientific data regarding the potential physiological and behavioral responses to sound-producing activities and the possible costs and long-term consequences of those responses.

The major categories of potential effects are:

- Direct trauma
- Auditory fatigue
- Auditory masking
- Behavioral reactions
- Physiological stress

Direct trauma refers to injury to organs or tissues of an animal as a direct result of an intense sound wave or shock wave impinging upon or passing through its body. Potential impacts on an animal's internal tissues and organs are assessed by considering the characteristics of the exposure and the response characteristics of the tissues. Trauma can be mild and fully recoverable, with no long-term repercussions to the individual or population, or more severe, with the potential for lasting effects or, in some cases, mortality.

Auditory fatigue may result from over-stimulation of the delicate hair cells and tissues within the auditory system. The most familiar effect of auditory fatigue is hearing loss, also called a noise-induced threshold shift, meaning an increase in the hearing threshold.

Audible natural and artificial sounds can potentially result in auditory masking, a condition that occurs when noise interferes with an animal's ability to hear other sounds. Masking occurs when the perception of a sound is interfered with by a second sound, and the probability of masking increases as the two sounds increase in similarity and the masking sound increases in level. It is important to distinguish auditory fatigue, which persists after the sound exposure, from masking, which only occurs during the sound exposure.

Marine animals naturally experience physiological stress as part of their normal life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with conspecifics (members of the same species), and interactions with predators all contribute to the stress a marine animal naturally experiences. The physiological response to a stressor, often termed the stress response, is an adaptive process that helps an animal cope with changing external and internal environmental conditions. However, too much of a stress response can be harmful to an animal, resulting in physiological dysfunction. In some cases, naturally occurring stressors can have profound impacts on animals. Sound-producing activities have the potential to provide additional stress, which must be considered, not only for its direct impact on an animal's behavior but also for contributing to an animal's chronic stress level.

A sound-producing activity can cause a variety of behavioral reactions in animals ranging from very minor and brief, to more severe reactions such as aggression or prolonged flight. The acoustic stimuli can cause a stress reaction (i.e., startle or annoyance); they may act as a cue to an animal that has experienced a stress reaction in the past to similar sounds or activities, or that acquired a learned behavioral response to the sounds from conspecifics. An animal may choose to deal with these stimuli or ignore them based on the severity of the stress response, the animal's past experience with the sound, as well as other stimuli present in the environment. If an animal chooses to react to the acoustic stimuli, then the behavioral responses fall into two categories: alteration of natural behavior patterns or avoidance. The specific type and severity of these reactions helps determine the costs and ultimate consequences to the individual and population.

3.0.5.7.1.1 Flowchart

Figure 3.0-22 is a flowchart that diagrams the process used to evaluate the potential effects on marine animals from sound-producing activities. The shape and color of each box on the flowchart represent either a decision point in the analysis (green diamonds); specific processes such as responses, costs, or recovery (blue rectangles); external factors to consider (purple parallelograms); and final outcomes for the individual or population (orange ovals and rectangles). Each box is labeled for reference throughout the following sections. For simplicity, *sound* is used here to include not only acoustic waves but also shock waves generated from explosive sources. The supporting text clarifies those instances where it is necessary to distinguish between the two phenomena.

Box A1, the *Sound-Producing Activity*, is the source of the sound stimuli and therefore the starting point in the analysis. Each of the five major categories of potential effects (i.e., direct trauma, auditory fatigue, masking, behavioral response, and stress) are presented as pathways that flow from left to right across the diagram. Pathways are not exclusive, and each must be followed until it can be concluded that an animal is not at risk for that specific effect. The vertical columns show the steps in the analysis used to examine each of the effects pathways. These steps proceed from the *Stimuli,* to the *Physiological Responses*, to any potential *Behavioral Responses*, to the *Costs to the Animal*, to the *Recovery* of the animal, and finally to the *Long-Term Consequences* for the *Individual* and *Population*.

3.0.5.7.1.2 Stimuli

The first step in predicting whether a sound-producing activity is capable of causing an effect on a marine animal is to define the *Stimuli* experienced by the animal. The *Stimuli* include the *sound-producing activity*, the surrounding acoustical environment, the characteristics of the sound when it reaches the animal, and whether the animal can detect the sound.

Sounds emitted from a *sound-producing activity* (Box A1) travel through the environment to create a spatially variable sound field. There can be any number of individual sound sources in a given activity, each with its own unique characteristics. For example, a Navy training exercise may involve several ships and aircraft, several types of sonar, and several types of munition. Each of the individual sound sources has unique characteristics: source level, frequency, duty cycle, duration, and rise-time (i.e., impulsive vs. non-impulsive). Each source also has a range, depth/altitude, bearing and directionality, and movement relative to the animal. Environmental factors such as temperature, salinity, bathymetry, bottom type, and sea state all impact how sound spreads through the environment and how sound decreases in amplitude between the source and the receiver (individual animal). Mathematical calculations and computer models are used to predict how the characteristics of the sound will change between the source and the animal under a range of realistic environmental conditions for the locations where sound-producing activities occur.

The details of the overall activity may also be important to place the potential effects into context and help predict the range of severity of the probable reactions. The overall activity level (e.g., number of ships and aircraft involved in exercise); the number of sound sources within the activity; the activity duration; and the range, bearing, and movement of the activity relative to the animal are all considered.

The *received sound at the animal* and the number of times the sound is experienced (i.e., repetitive exposures) (Box A2) determines the range of possible effects. Sounds that are higher than the ambient noise level and within an *animal's hearing sensitivity* range (Box A3) have the potential to cause effects. Very high exposure levels may have the potential to cause trauma; high-level exposures, long-duration exposures, or repetitive exposures may potentially cause auditory fatigue; lower-level exposures may potentially lead to masking; all perceived levels may lead to stress; and many sounds, including sounds that are not detectable by the animal, would have *no* e*ffect* (Box A4).

3.0.5.7.1.3 Physiological Responses

Physiological Responses include direct trauma, hearing loss, auditory masking, and stress. The magnitude of the involuntary response is predicted based on the characteristics of the acoustic stimuli and the characteristics of the animal (species, susceptibility, life history stage, size, and past experiences).

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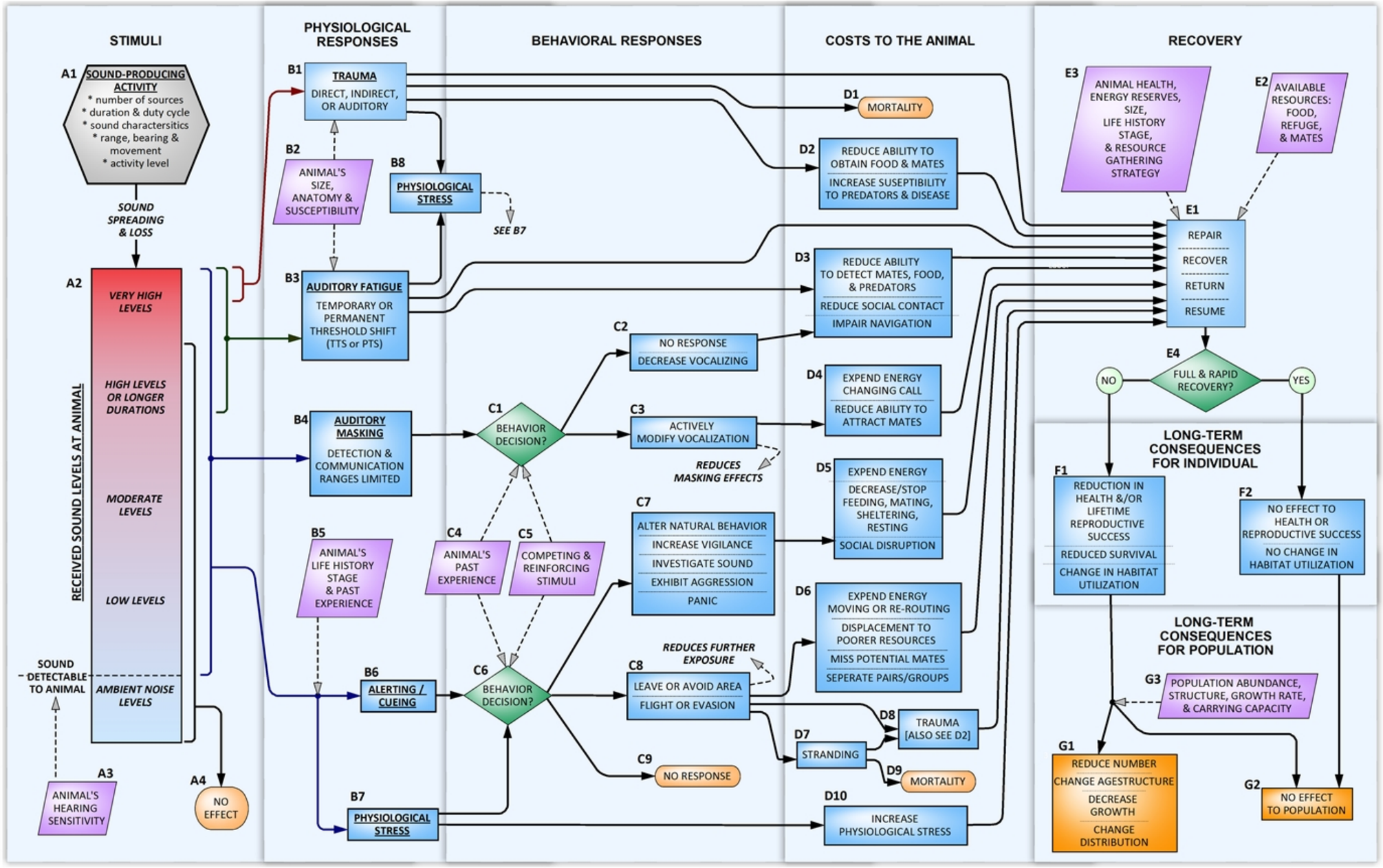

Figure 3.0-22: Flow Chart of the Evaluation Process of Sound-Producing Activities
PTS: permanent threshold shift; TTS: temporary threshold shift

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Trauma

Physiological responses to sound stimulation may range from mechanical vibration (with no resulting adverse effects) to tissue trauma (injury). Direct *trauma* (Box B1) refers to the direct injury of tissues and organs by sound waves impinging upon or traveling through an animal's body. Marine animals' bodies, especially their auditory systems, are well adapted to large hydrostatic pressures and large, but relatively slow, pressure changes that occur with changing depth. However, mechanical trauma may result from exposure to very-high-amplitude sounds when the elastic limits of the auditory system are exceeded or when animals are exposed to intense sounds with very rapid rise times, such that the tissues cannot respond adequately to the rapid pressure changes. Trauma to marine animals from sound exposure requires high received levels. Trauma effects therefore normally only occur with very-high-amplitude, often impulsive, sources, and at relatively close range, which limits the number of animals likely exposed to trauma-inducing sound levels.

Direct *trauma* includes both auditory and non-auditory trauma. Auditory trauma is the direct mechanical injury to hearing-related structures, including tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as the organ of Corti and the associated hair cells. Auditory *trauma* differs from auditory fatigue in that the latter involves the overstimulation of the auditory system at levels below those capable of causing direct mechanical damage. Auditory *trauma* is always injurious but can be temporary. One of the most common consequences of auditory trauma is hearing loss (see Auditory Fatigue section below for a description of hearing loss).

Non-auditory trauma can include hemorrhaging of small blood vessels and the rupture of gas-containing tissues such as the lung, swim bladder, or gastrointestinal tract. After the ear (or other sound-sensing organs), these are usually the most sensitive organs and tissues to acoustic trauma. An *animal's size and anatomy* are important in determining its *susceptibility to trauma* (Box B2), especially non-auditory trauma. Larger size indicates more tissue to protect vital organs that might be otherwise susceptible (i.e., there is more attenuation of the received sound before it impacts non-auditory structures). Therefore, larger animals should be less susceptible to trauma than smaller animals. In some cases, acoustic resonance of a structure may enhance the vibrations resulting from noise exposure and result in an increased susceptibility to trauma. Resonance is a phenomenon that exists when an object is vibrated at a frequency near its natural frequency of vibration, or the particular frequency at which the object vibrates most readily. The size, geometry, and material composition of a structure determine the frequency at which the object will resonate. The potential for resonance is determined by comparing the sound frequencies with the resonant frequency and damping of the tissues. Because most biological tissues are heavily damped, the increase in susceptibility from resonance is limited.

Vascular and tissue bubble formation resulting from sound exposure is a hypothesized mechanism of indirect *trauma* to marine animals. The risk of bubble formation from one of these processes, called rectified diffusion, is based on the amplitude, frequency, and duration of the sound (Crum and Mao 1996) and an animal's tissue nitrogen gas saturation at the time of the exposure. Rectified diffusion is the growth of a bubble that fluctuates in size because of the changing pressure field caused by the sound wave. An alternative, but related hypothesis has also been suggested: stable microbubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of gas-supersaturated tissues. Bubbles have also been hypothesized to result from changes in the dive behavior of marine mammals as a result of sound exposure (Jepson et al. 2003). Vascular bubbles produced by this mechanism would not be a physiological response to the sound exposure, but a cost to the animal because of the change in behavior (3.0.5.7.1.5, Costs to the Animal).

Under either of these hypotheses, several things could happen: (1) bubbles could grow to the extent that vascular blockage (emboli) and tissue hemorrhage occur; (2) bubbles could develop to the extent that a complement immune response is triggered or the nervous tissue is subjected to enough localized pressure that pain or dysfunction occurs; or (3) the bubbles could be cleared by the lung without negative consequence to the animal. Although rectified diffusion is a known phenomenon, its applicability to diving marine animals exposed to sound is questionable; animals would need to be highly supersaturated with gas and very close to a high-level sound source (Crum et al. 2005). The other two hypothesized phenomena are largely theoretical and have not been demonstrated under realistic exposure conditions.

Auditory Fatigue

Auditory fatigue is a reduction in hearing ability resulting from overstimulation to sounds. The mechanisms responsible for auditory fatigue differ from auditory trauma and may consist of a variety of mechanical and biochemical processes, including physical damage or distortion of the tympanic membrane (not including tympanic membrane rupture) and cochlear hair cell stereocilia, oxidative stress-related hair cell death, changes in cochlear blood flow, and swelling of cochlear nerve terminals resulting from glutamate excitotoxicity (Henderson et al. 2006; Kujawa and Liberman 2009). Although the outer hair cells are the most prominent target for fatigue effects, severe noise exposures may also result in inner hair cell death and loss of auditory nerve fibers (Henderson et al. 2006). Auditory fatigue is possibly the best studied type of effect from sound exposures in marine and terrestrial animals, including humans. The characteristics of the received sound stimuli are used and compared to the *animal's hearing sensitivity* and susceptibility to noise (Box A3) to determine the potential for auditory fatigue.

Auditory fatigue manifests itself as hearing sensitivity loss, called a noise-induced threshold shift. A threshold shift may be either permanent threshold shift (PTS), or temporary threshold shift (TTS). Note that the term "auditory fatigue" is often used to mean a TTS; however, in this analysis, a more general meaning to differentiate fatigue mechanisms (e.g., metabolic exhaustion and distortion of tissues) from auditory trauma mechanisms (e.g., physical destruction of cochlear tissues occurring at the time of exposure) is used.

The distinction between PTS and TTS is based on whether there is a complete recovery of hearing sensitivity following a sound exposure. If the threshold shift eventually returns to zero (the animal's hearing returns to pre-exposure value), the threshold shift is a TTS. If the threshold shift does not return to zero but leaves some finite amount of threshold shift, then that remaining threshold shift is a PTS. Figure 3.0-23 shows one hypothetical threshold shift that completely recovers, a TTS, and one that does not completely recover, leaving some PTS.

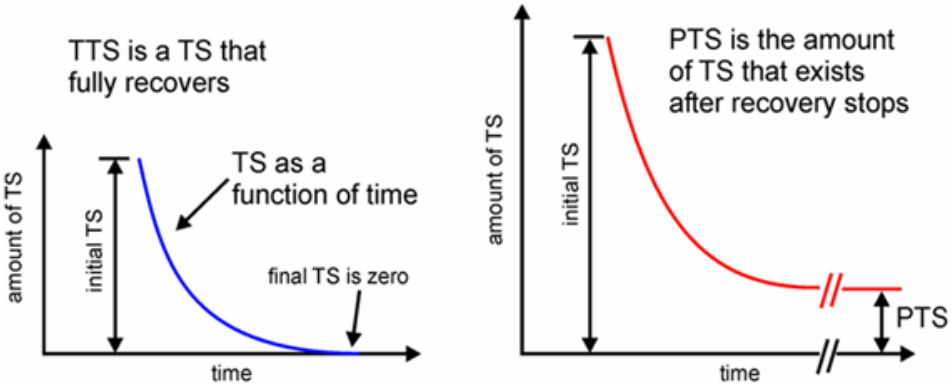

Figure 3.0-23: Two Hypothetical Threshold Shifts
PTS: permanent threshold shift; TS: threshold shift; TTS: temporary threshold shift

The relationship between TTS and PTS is complicated and poorly understood, even in humans and terrestrial mammals, where numerous studies failed to delineate a clear relationship between the two. Relatively small amounts of TTS (e.g., less than 40–50 dB measured 2 minutes after exposure) will recover with no apparent long-term effects; however, terrestrial mammal studies revealed that large amounts of TTS (e.g., approximately 40 dB measured 24 hours after exposure) can result in permanent neural degeneration, despite the hearing thresholds returning to normal (Kujawa and Liberman 2009). The amounts of TTS induced by Kujawa and Liberman were described as being "at the limits of reversibility." It is unknown whether smaller amounts of TTS can result in similar neural degeneration, or if effects would translate to other species such as marine animals.

The amplitude, frequency, duration, and temporal pattern of the sound exposure are important parameters for predicting the potential for auditory fatigue. Duration is particularly important because auditory fatigue is exacerbated with prolonged exposure time. The frequency of the sound also plays an important role in susceptibility to hearing loss. Experiments show that animals are most susceptible to *fatigue* (Box B3) within their most sensitive hearing range. Sounds outside of an animal's audible frequency range do not cause fatigue.

The greater the degree of threshold shift, the smaller the ocean space within which an animal can detect biologically relevant sounds and communicate. This is referred to as reducing an animal's "acoustic space." This reduction can be estimated given the amount of threshold shift incurred by an animal.

Auditory Masking

Auditory masking occurs if the noise from an activity interferes with an animal's ability to detect, understand, or recognize biologically relevant sounds of interest (Box B4). "Noise" refers to unwanted or unimportant sounds that mask an animal's ability to hear "sounds of interest." A sound of interest refers to a sound that is potentially being detected. Sounds of interest include those from conspecifics such as offspring, mates, and competitors; echolocation clicks; sounds from predators; natural, abiotic sounds that may aid in navigation; and reverberation, which can give an animal information about its location and orientation within the ocean.

The frequency, received level, and duty cycle of the noise determine the potential degree of auditory masking. Similar to hearing loss, the greater the degree of masking, the smaller the ocean space within which an animal can detect biologically relevant sounds.

Physiological Stress

If a sound is detected (i.e., heard or sensed) by an animal, a *stress* response can occur (Box B7); or the sound can *cue or alert* the animal (Box B6) without a direct, measurable stress response. If an animal suffers trauma or auditory fatigue, a *physiological stress* response will occur (Box B8). A stress response is a physiological change resulting from a stressor that is meant to help the animal deal with the stressor. The generalized stress response is characterized by a release of hormones (Reeder and Kramer 2005); however, it is now acknowledged that other chemicals produced in a stress response (e.g., stress markers) exist. For example, a release of reactive oxidative compounds, as occurs in noise-induced hearing loss (Henderson et al. 2006), occurs in response to some acoustic stressors. Stress hormones include those produced by the sympathetic nervous system, norepinephrine and epinephrine (i.e., the catecholamines), which produce elevations in the heart and respiration rate, increase awareness, and increase the availability of glucose and lipid for energy. Other stress hormones are the glucocorticoid steroid hormones cortisol and aldosterone, which are produced by the adrenal gland. These hormones are classically used as an indicator of a stress response and to characterize the magnitude of the stress response (Hennessy et al. 1979). Oxidative stress occurs when reactive molecules, called reactive oxygen species, are produced in excess of molecules that counteract their activity (i.e., antioxidants).

An acute stress response is traditionally considered part of the startle response and is hormonally characterized by the release of the catecholamines. Annoyance type reactions may be characterized by the release of either or both catecholamines and glucocorticoid hormones. Regardless of the physiological changes that make up the stress response, the stress response may contribute to an animal's decision to alter its behavior. Alternatively, a stimulus may not cause a measurable stress response but may act as an alert or cue to an animal to change its behavior. This response may occur because of learned associations; the animal may have experienced a stress reaction in the past to similar sounds or activities (Box C4), or it may have learned the response from conspecifics. The severity of the stress response depends on the *received sound level* at the animal (Box A2); the details of the *sound-producing activity* (Box A1); the *animal's life history stage* (e.g., juvenile or adult; breeding or feeding season) (Box B5); and the *animal's past experience* with the stimuli (Box B5). These factors would be subject to individual variation, as well as variation within an individual over time.

An *animal's life history stage* is an important factor to consider when predicting whether a stress response is likely (Box B5). An animal's life history stage includes its level of physical maturity (i.e., larva, infant, juvenile, sexually mature adult) and the primary activity in which it is engaged such as mating, feeding, or rearing/caring for young. Animals engaged in a critical life activity such as mating or feeding may have a lesser stress response than an animal engaged in a more flexible activity such as resting or migrating (i.e., an activity that does not necessarily depend on the availability of resources). The animal's past experiences with the stimuli or similar stimuli are another important consideration. Prior experience with a stressor may be of particular importance because repeated experience with a stressor may dull the stress response via acclimation (St. Aubin and Dierauf 2001) or increase the response via sensitization.

3.0.5.7.1.4 Behavioral Responses

Any number of *Behavioral Responses* can result from a physiological response. An animal responds to the stimulus based on a number of factors in addition to the severity of the physiological response. An

animal's experience with the sound (or similar sounds), the context of the acoustic exposure, and the presence of other stimuli contribute to determining its reaction from a suite of possible behaviors.

Behavioral responses fall into two major categories: alterations in natural behavior patterns and avoidance. These types of reactions are not mutually exclusive, and many overall reactions may be combinations of behaviors or a sequence of behaviors. Severity of behavioral reactions can vary drastically between minor and brief reorientations of the animal to investigate the sound, to severe reactions such as aggression or prolonged flight. The type and severity of the behavioral response will determine the cost to the animal.

Trauma and Auditory Fatigue

Direct trauma and auditory fatigue increases the animal's *physiological stress* (Box B8), which feeds into the *stress* response (Box B7). Direct trauma and auditory fatigue increase the likelihood or severity of a behavioral response and *increase* an animal's overall physiological stress level (Box D10).

Auditory Masking

A behavior decision is made by the animal when the animal detects increased background noise, or possibly when the animal recognizes that biologically relevant sounds are being masked (Box C1). An *animal's past experience* with the sound-producing activity or similar acoustic stimuli can affect its choice of behavior during auditory masking (Box C4). *Competing and reinforcing stimuli* may also affect its decision (Box C5).

An animal may exhibit a passive behavioral response when coping with auditory masking (Box C2). It may simply not respond and keep conducting its current natural behavior. An animal may also stop calling until the background noise decreases. These passive responses do not present a direct energetic cost to the animal; however, auditory masking will continue, depending on the acoustic stimuli.

An animal may actively compensate for auditory masking (Box C3). An animal can vocalize more loudly to make its signal heard over the masking noise. An animal may also shift the frequency of its vocalizations away from the frequency of the masking noise. This shift can actually reduce the masking effect for the animal and other animals that are "listening" in the area. For example, in marine mammals, vocalization changes have been reported from exposure to anthropogenic noise sources such as sonar, vessel noise, and seismic surveying. Changes included mimicry of the sound, cessation of vocalization, increases and decreases in vocalization length, increases and decreases in vocalization rate, and increases in vocalization frequency and level, while other animals showed no significant changes in the presence of anthropogenic sound.

An *animal's past experiences* can be important in determining what behavior decision it may make when dealing with auditory masking (Box C4). Past experience can be with the sound-producing activity itself or with similar acoustic stimuli. For example, an animal may modify its vocalizations to reduce the effects of masking noise.

Other *stimuli* present in the environment can influence an animal's behavior decision (Box C5). These stimuli can be other acoustic stimuli not directly related to the sound-producing activity; they can be visual, olfactory, or tactile stimuli; the stimuli can be conspecifics or predators in the area; or the stimuli can be the strong drive to engage in a natural behavior. In some cases, natural motivations may suppress any behavioral reactions elicited by the acoustic stimulus. For example, an animal involved in mating or foraging may not react with the same degree of severity as it may have otherwise. Reinforcing

stimuli reinforce the behavioral reaction caused by acoustic stimuli. For example, awareness of a predator in the area coupled with the acoustic stimuli may elicit a stronger reaction than the acoustic stimuli itself otherwise would have. The visual stimulus of seeing ships and aircraft, coupled with the acoustic stimuli, may also increase the likelihood or severity of a behavioral response.

Behavioral Reactions and Physiological Stress

A *physiological stress* response (Box B7) such as an annoyance or startle reaction, or a *cueing or alerting* reaction (Box B6) may cause an animal to make a *behavior decision* (Box C6). Any exposure that produces an injury or auditory fatigue is also assumed to produce a *stress* response (Box B7) and increase the severity or likelihood of a behavioral reaction. Both an animal's past experience (Box C4) and *competing and reinforcing stimuli* (Box C5) can affect an animal's behavior decision. The decision can result in three general types of behavioral reactions: *no response* (Box C9), *area avoidance* (Box C8), or *alteration of a natural behavior* (Box C7).

Little data exist that correlate specific behavioral reactions with specific stress responses. Therefore, in practice the likely range of behavioral reactions is estimated from the acoustic stimuli instead of the magnitude of the stress response. It is assumed that a stress response must exist to alter a natural behavior or cause an avoidance reaction. Estimates of the types of behavioral responses that could occur for a given sound exposure can be determined from the literature.

An *animal's past experiences* can be important in determining what behavior decision it may make when dealing with a stress response (Box C4). Past experience can be with the sound-producing activity itself or with similar sound stimuli. Habituation is the process by which an animal learns to ignore or tolerate stimuli over some period of time and return to a normal behavior pattern, perhaps after being exposed to the stimuli with no negative consequences. A habituated animal may have a lesser behavioral response than the first time it encountered the stimuli. Sensitization is when an animal becomes more sensitive to a set of stimuli over time, perhaps as a result of a past, negative experience with the stimuli or similar stimuli. A sensitized animal may have a stronger behavioral response than the first time it encountered the stimuli.

Other *stimuli* (Box C5) present in the environment can influence an animal's *behavior decision* (Box C6). These stimuli may not be directly related to the sound-producing activity, such as visual stimuli; the stimuli can be conspecifics or predators in the area, or the stimuli can be the strong drive to engage or continue in a natural behavior. In some cases, natural motivations (i.e., competing stimuli) may suppress any behavioral reactions elicited by the acoustic stimulus. tend to suppress any potential behavioral reaction. For example, an animal involved in mating or foraging may not react with the same degree of severity as an animal involved in less-critical behavior. Reinforcing stimuli reinforce the behavioral reaction caused by acoustic stimuli. For example, the awareness of a predator in the area coupled with the acoustic stimuli may elicit a stronger reaction than the acoustic stimuli themselves otherwise would have.

The visual stimulus of seeing human activities such as ships and aircraft maneuvering, coupled with the acoustic stimuli, may also increase the likelihood or severity of a behavioral response. It is difficult to separate the stimulus of the sound from the stimulus of the ship or platform creating the sound. The sound may act as a cue, or as one stimulus of many that the animal is considering when deciding how to react. An activity with several platforms (e.g., ships and aircraft) may elicit a different reaction than an activity with a single platform, both with similar acoustic footprints. The total number of vehicles and

platforms involved, the size of the activity area, and the distance between the animal and activity are important considerations when predicting behavioral responses.

An animal may reorient or become more *vigilant* if it detects a sound-producing activity (Box C7). Some animals may *investigate* the sound using other sensory systems (e.g., vision), and perhaps move closer to the sound source. *Reorientation, vigilance, and investigation* all require the animal to divert attention and resources and therefore slow or stop their presumably beneficial natural behavior. This can be a very brief diversion, after which the animal continues its natural behavior, or an animal may not resume its natural behaviors until after a longer period when the animal has habituated to the sound or the activity has concluded. An attentional change via an orienting response represents behaviors that would be considered mild disruption. More severe alterations of natural behavior would include *aggression or panic*.

An animal may choose to *leave or avoid an area* where a sound-producing activity is taking place (Box C8). Avoidance is the displacement of an individual from an area. A more severe form of this comes in the form of flight or evasion. A flight response is a dramatic change in normal movement to a directed and rapid movement away from the detected location of a sound source. Avoidance of an area can help the animal avoid further acoustic effects by avoiding or reducing further exposure.

An animal may choose *not to respond* to a sound-producing activity (Box C9). The physiological stress response may not rise to the level that would cause the animal to modify its behavior. The animal may have habituated to the sound or simply learned through past experience that the sound is not a threat. In this case a behavioral effect would not be predicted. An animal may choose not to respond to a sound-producing activity in spite of a physiological stress response. Some combination of competing stimuli may be present such as a robust food patch or a mating opportunity that overcomes the stress response and suppresses any potential behavioral responses. If the noise-producing activity persists over long periods or reoccurs frequently, the acute stress felt by animals could increase their overall chronic stress levels.

3.0.5.7.1.5 Costs to the Animal

The potential costs to a marine animal from an involuntary or behavioral response include no measurable cost, expended energy reserves, increased stress, reduced social contact, missed opportunities to secure resources or mates, displacement, and stranding or severe evasive behavior (which may potentially lead to secondary trauma or death). Animals suffer costs on a daily basis from a host of natural situations such as dealing with predator or competitor pressure. If the costs to the animal from an acoustic-related effect fall outside of its normal daily variations, then individuals must recover from significant costs to avoid long-term consequences.

Trauma

Trauma or injury to an animal may *reduce its ability to secure food* by *reducing its mobility* or the efficiency of its sensory systems, make the injured individual *less attractive to potential mates*, or increase *an individual's chances of contracting diseases or falling prey to a predator* (Box D2). A severe trauma can lead to the *death* of the individual (Box D1).

Auditory Fatigue and Auditory Masking

Auditory fatigue and masking can impair an animal's ability to hear biologically important sounds (Box D3), especially fainter and distant sounds. Sounds could belong to conspecifics such as other individuals in a social group (i.e., pod, school, etc.), potential mates, potential competitors, or parents/offspring.

Biologically important sounds could also be an animal's own biosonar echoes used to detect prey, sounds from predators, and sounds from the physical environment. Therefore, auditory masking or a hearing loss could reduce an animal's ability to contact social groups, offspring, or parents; and reduce opportunities to detect or attract more distant mates. Animals may also use sounds to gain information about their physical environment by detecting the reverberation of sounds in the underwater space or sensing the sound of crashing waves on a nearby shoreline. These cues could be used by some animals to migrate long distances or navigate their immediate environment. Therefore, an animal's ability to navigate may be impaired if the animal uses acoustic cues from the physical environment to help identify its location. Auditory masking and fatigue both effectively reduce the animal's acoustic space and the ocean volume in which detection and communication are effective.

An animal that modifies its vocalization in response to auditory masking could incur a cost (Box D4). Modifying vocalizations may cost the animal energy from its finite energy budget, interfere with the behavioral function of a call, or reduce a signaler's apparent quality as a mating partner. For example, songbirds that shift their calls up an octave to compensate for increased background noise attract fewer or less-desirable mates, and many terrestrial species advertise body size and quality with low-frequency vocalizations (Slabbekoorn and Ripmeester 2008). Increasing the frequency of these vocalizations could reduce a signaler's attractiveness in the eyes of potential mates even as it improves the overall detectability of the call. Auditory masking or auditory fatigue may also lead to no measurable costs for an animal. Masking could be of short duration or intermittent such that biologically important sounds that are continuous or repeated are received by the animal between masking noise. Auditory fatigue could also be inconsequential for an animal if the frequency range affected is not critical for that animal to hear within, or the auditory fatigue is of such short duration (e.g., a few minutes) that there are no costs to the individual.

Behavioral Reactions and Physiological Stress

An animal that alters its natural behavior in response to stress or an auditory cue may slow or cease its presumably beneficial natural behavior and instead *expend energy* reacting to the sound-producing activity (Box D5). Beneficial natural behaviors include *feeding, breeding, sheltering, and migrating*. The cost of feeding disruptions depends on the energetic requirements of individuals and the potential amount of food missed during the disruption. Alteration in breeding behavior can result in delaying reproduction. The costs of a brief interruption to migrating or sheltering are less clear. Most behavior alterations also require the animal to expend energy for a nonbeneficial behavior. The amount of energy expended depends on the severity of the behavioral response.

An animal that avoids a sound-producing activity may expend additional energy moving around the area, be displaced to poorer resources, miss potential mates, or have social interactions affected (Box D6). Avoidance reactions can cause an animal to expend energy. The amount of energy expended depends on the severity of the behavioral response. Missing potential mates can result in delaying reproduction. Social groups or pairs of animals, such as mates or parent/offspring pairs, could be separated during a severe behavioral response such as flight. Offspring that depend on their parents may die if they are permanently separated. Splitting up an animal group can result in a reduced group size, which can have secondary effects on individual foraging success and susceptibility to predators.

Some severe behavioral reactions can lead to *stranding* (Box D7) or secondary *trauma* (Box D8). Animals that take prolonged flight, a severe avoidance reaction, may injure themselves or strand in an environment for which they are not adapted. Some *trauma* is likely to occur to an animal that strands (Box D8). Trauma can *reduce the animal's ability to secure food and mates*, and *increase the animal's*

susceptibility to predation and disease (Box D2). An animal that strands and does not return to a hospitable environment quickly will likely *die* (Box D9).

Elevated stress levels may occur whether or not an animal exhibits a behavioral response (Box D10). Even while undergoing a stress response, competing stimuli (e.g., food or mating opportunities) may overcome an animal's initial stress response during the behavior decision. Regardless of whether the animal displays a behavioral reaction, this tolerated stress could incur a cost to the animal. Reactive oxygen species produced during normal physiological processes are generally counterbalanced by enzymes and antioxidants; however, excess stress can result in an excess production of reactive oxygen species, leading to damage of lipids, proteins, and nucleic acids at the cellular level (Berlett and Stadtman 1997; Sies 1997; Touyz 2004).

3.0.5.7.1.6 Recovery

The predicted recovery of the animal (Box E1) is based on the cost of any masking or behavioral response and the severity on any involuntary physiological reactions (e.g., direct trauma, hearing loss, or increased chronic stress). Many effects are fully recoverable upon cessation of the sound-producing activity, and the vast majority of effects are completely recoverable over time; whereas a few effects may not be fully recoverable. The availability of resources and the characteristics of the animal play a critical role in determining the speed and completeness of recovery.

Available resources fluctuate by season, location, and year and can play a major role in an animal's rate of recovery (Box E2). Plentiful *food* can aid in a quicker recovery, whereas recovery can take much longer if food resources are limited. If many potential *mates* are available, an animal may recover quickly from missing a single mating opportunity. *Refuge* or shelter is also an important resource that may give an animal an opportunity to recover or repair after an incurred cost or physiological response.

An *animal's health, energy reserves, size, life history stage, and resource gathering strategy* affect its speed and completeness of recovery (Box E3). Animals that are in good health and have abundant energy reserves before an effect will likely recover more quickly. Adult animals with stored energy reserves (e.g., fat reserves) may have an easier time recovering than juveniles that expend their energy growing and developing and have less in reserve. Large individuals and large species may recover more quickly, also due to having more potential for energy reserves. Animals that gather and store resources, perhaps fasting for months during breeding or offspring rearing seasons, may have a more difficult time recovering from being temporarily displaced from a feeding area than an animal that feeds year round.

Damaged tissues from mild to moderate trauma may heal over time. The predicted recovery of direct trauma is based on the severity of the trauma, availability of resources, and characteristics of the animal. After a sustained injury an animal's body attempts to *repair* tissues. The animal may also need to *recover* from any potential costs due to a decrease in resource gathering efficiency and any secondary effects from predators or disease (Box E1). Moderate to severe trauma that does not cause mortality may never fully heal.

Small to moderate amounts of hearing loss may recover over a period of minutes to days, depending on the nature of the exposure and the amount of initial threshold shift. Severe noise-induced hearing loss may not fully recover, resulting in some amount of permanent hearing loss.

Auditory masking only occurs when the sound source is operating; therefore, direct masking effects stop immediately upon cessation of the sound-producing activity (Box E1). Natural behaviors may *resume*

shortly after or even during the acoustic stimulus after an initial assessment period by the animal. Any energetic expenditures and missed opportunities to find and secure resources incurred from masking or a behavior alteration may take some time to *recover*.

Animals displaced from their normal habitat due to an avoidance reaction may *return* over time and *resume* their natural behaviors, depending on the severity of the reaction and how often the activity is repeated in the area. In areas of repeated and frequent acoustic disturbance, some animals may habituate to the new baseline or fluctuations in noise level. More sensitive species, or animals that may have been sensitized to the stimulus over time due to past negative experiences, may not return to an area. Other animals may return but not resume use of the habitat in the same manner as before the acoustic-related effect. For example, an animal may return to an area to feed or navigate through it to get to another area, but that animal may no longer seek that area as refuge or shelter.

Frequent milder physiological responses to an individual may accumulate over time if the time between sound-producing activities is not adequate to give the animal an opportunity to fully recover. An increase in an animal's chronic stress level is also possible if stress caused by a sound-producing activity does not return to baseline between exposures. Each component of the stress response is variable in time, and stress hormones return to baseline levels at different rates. For example, adrenaline is released almost immediately and is used or cleared by the system quickly, whereas glucocorticoid and cortisol levels may take long periods (i.e., hours to days) to return to baseline.

3.0.5.7.1.7 Long-Term Consequences to the Individual and the Population

The magnitude and type of effect and the speed *and completeness of recovery* must be considered in predicting long-term consequences to the individual animal and its population (Box E). Animals that recover quickly and completely from explosive or acoustic-related effects will likely *not suffer reductions in their health or reproductive success, or experience changes in habitat utilization* (Box F2). *No population-level effects* would be expected if individual animals do not suffer reductions in their lifetime reproductive success or change their habitat utilization (Box G2).

Animals that do not recover quickly and fully could suffer *reductions in their health and lifetime reproductive success*; they could be permanently displaced or *change how they utilize the environment*; or they could *die* (Box F1).

Severe injuries can lead to reduced survivorship (longevity), elevated stress levels, and prolonged alterations in behavior that can reduce an animal's lifetime reproductive success. An animal with decreased energy stores or a lingering injury may be less successful at mating for one or more breeding seasons, thereby decreasing the number of offspring produced over its lifetime.

An animal whose hearing does not recover quickly and fully could suffer a reduction in lifetime reproductive success (Box F1). An animal with decreased energy stores or a PTS may be less successful at mating for one or more breeding seasons, thereby decreasing the number of offspring it can produce over its lifetime.

As mentioned above, the direct effects of masking end when the acoustic stimuli conclude. The direct effects of auditory masking could have long-term consequences for individuals if the activity was continuous or occurred frequently enough; however, most of the proposed training and testing activities are normally spread over vast areas and occur infrequently in a specific area.

Missed mating opportunities can have a direct effect on reproductive success. Reducing an animal's energy reserves over longer periods can directly reduce its health and reproductive success. Some species may not enter a breeding cycle without adequate energy stores, and animals that do breed may have a decreased probability of offspring survival. Animals displaced from their preferred habitat, or those who utilize it differently, may no longer have access to the best resources. Some animals that leave or flee an area during a noise-producing activity, especially an activity that is persistent or frequent, may not return quickly or at all. This can further reduce an individual's health and lifetime reproductive success.

Frequent disruptions to natural behavior patterns may not allow an animal to fully recover between exposures, which increase the probability of causing long-term consequences to individuals. Elevated chronic stress levels are usually a result of a prolonged or repeated disturbance. Excess stress produces reactive molecules in an animal's body that can result in cellular damage (Berlett and Stadtman 1997; Sies 1997; Touyz 2004). Chronic elevations in the stress levels (e.g., cortisol levels) may produce long-term health consequences that can reduce lifetime reproductive success.

These long-term consequences to the individual can lead to consequences for the *population* (Box G1). Population *dynamics and abundance* play a role in determining how many individuals would need to suffer long-term consequences before there was an effect on the population (Box G1). Long-term abandonment or a change in the utilization of an area by enough individuals can *change the distribution* of the population. Death has an immediate effect in that no further contribution to the population is possible, which reduces the animal's lifetime reproductive success.

Carrying capacity describes the theoretical maximum number of animals of a particular species that the environment can support. When a population nears its carrying capacity, the lifetime reproductive success in individuals may decrease due to finite resources or predator-prey interactions. *Population growth* is naturally limited by available resources and predator pressure. If one, or a few animals, in a population are removed or gather fewer resources, then other animals in the population can take advantage of the freed resources and potentially increase their health and lifetime reproductive success. Abundant populations that are near their carrying capacity (theoretical maximum abundance) that suffer effects on a few individuals may not be affected overall.

Populations that exist well below their carrying capacity may suffer greater consequences from any lasting effects on even a few individuals. Population-level consequences can include a change in the population dynamics, a decrease in the growth rate, or a change in geographic distribution. Changing the dynamics of a population (the proportion of the population within each age group) or their geographic distribution can also have secondary effects on population growth rates.

3.0.5.7.2 Conceptual Framework for Assessing Effects from Energy-Producing Activities

3.0.5.7.2.1 Stimuli

Magnitude of the Energy Stressor

Regulations do not provide threshold criteria to determine the significance of the potential effects from activities that involve the use of varying electromagnetic frequencies or high energy lasers. Many organisms, primarily marine vertebrates, have been studied to determine their thresholds for detecting electromagnetic fields, as reviewed by Normandeau (2011); however, there are no data on predictable responses to exposure above or below detection thresholds. The type of electromagnetic fields discussed is from mine neutralization activities (magnetic influence minesweeping). The only types of

lasers considered for analysis were weaponized high energy lasers. Since the low to moderate energy lasers (e.g., targeting systems, detection systems, laser light detection and ranging) do not pose a risk to organisms (Swope 2010), they will not be discussed further.

Location of the Energy Stressor

Evaluation of potential energy exposure risks considered the spatial overlap of the resource occurrence and electromagnetic field and high energy laser use. Wherever appropriate, specific geographic areas of potential impact were identified. The greatest potential electromagnetic energy exposure is at the source, where intensity is greatest. The greatest potential for high energy laser exposure is at the ocean's surface, where high energy laser intensity is greatest. As the laser penetrates the water, 96 percent of the beam is absorbed, scattered, or otherwise lost (Swope 2010; Zorn et al. 2000).

Behavior of the Organism

Evaluation of potential energy exposure risk considered the behavior of the organism, especially where the organism lives and feeds (e.g., surface, water column, seafloor). The analysis for electromagnetic devices considered those species with the ability to perceive or detect electromagnetic signals. The analysis for high energy lasers particularly considered those species known to inhabit the surface of the ocean.

3.0.5.7.2.2 Immediate Response and Costs to the Individual

Many different types of organisms (e.g., some invertebrates, fishes, turtles, birds, mammals) are sensitive to electromagnetic fields (Normandeau et al. 2011). An organism that encounters a disturbance in an electromagnetic field could respond by moving toward the source, moving away from it, or not responding at all. The types of electromagnetic devices used in the Proposed Action simulate the electromagnetic signature of a vessel passing through the water column, so the expected response would be similar to that of vessel movement. However, since there would be no actual strike potential, a physiological response would be unlikely in most cases. Recovery of an individual from encountering electromagnetic fields would be variable, but since the physiological response would likely be minimal, as reviewed by Normandeau (2011), any recovery time would also be minimal.

Very little data or information are available to analyze potential impacts on organisms from exposure to high energy lasers. As with humans, the greatest laser-related concern for marine species is damage to an organism's ability to see. High energy lasers may also burn the skin, but the threshold energy level for eye damage is considerably lower, so the analysis considered that lower threshold. Recovery of the individual from eye damage or skin lesion caused by high energy lasers would be based on the severity of the injury and the incidence of secondary infection. Very few studies of this impact are available.

3.0.5.7.2.3 Long-Term Consequences to the Individual and Population

Long-term consequences are considered in terms of a resource's existing population level, growth and mortality rates, other stressors on the resource from the Proposed Action, cumulative impacts on the resource, and the ability of the population to recover from or adapt to impacts. Impacts of multiple or repeated stressors on individuals are cumulative. When stressors are chronic, an organism may experience reduced growth, health, or survival, which could have population-level impacts (Billard et al. 1981), especially in the case of endangered species.

3.0.5.7.3 Conceptual Framework for Assessing Effects from Physical Disturbance or Strike

3.0.5.7.3.1 Stimuli

Size and Weight of the Objects

To determine the likelihood of a strike and the potential impacts on an organism or habitat that would result from a physical strike, the size and weight of the striking object relative to the organism or habitat must be considered. Most small organisms and early life stages would simply be displaced by the movement generated by a large object moving through, or falling into, the water because they are planktonic (floating organisms) and move with the water; however, animals that occur at or near the surface could be struck. A larger nonplanktonic organism could potentially be struck by an object since it may not be displaced by the movement of the water. Sessile (nonmobile) organisms and habitats could be struck by the object, albeit with less force, on the seafloor. The weight of the object is also a factor that would determine the severity of a strike. A strike by a heavy object would be more severe than a strike by a low-weight object (e.g., a parachute, flare end cap, or chaff canister).

Location and Speed of the Objects

Evaluation of potential physical disturbance or strike risk considered the spatial overlap of the resource occurrence and potential striking objects. Analysis of impacts from physical disturbance or strike stressors focuses on proposed activities that may cause an organism or habitat to be struck by an object moving through the air (e.g., aircraft), water (e.g., vessels, in-water devices, towed devices), or dropped into the water (e.g., non-explosive practice munitions and seafloor devices). The area of operation, vertical distribution, and density of these items also play central roles in the likelihood of impact. Wherever appropriate, specific geographic areas of potential impact are identified. Analysis of potential physical disturbance or strike risk also considered the speed of vessels as a measure of intensity. Some vessels move slowly, while others are capable of high speeds.

Buoyancy of the Objects

Evaluation of potential physical disturbance or strike risk in the ocean considered the buoyancy of targets or expended materials during operation, which will determine whether the object will be encountered at the surface, within the water column, or on the seafloor. Once landed on the water surface, buoyant objects have the potential to strike plants and organisms that occur on the sea surface (e.g., drifting into *Sargassum* mats), and negatively buoyant objects may strike plants and organisms within the water column or on the seafloor.

Behavior of the Organism

Evaluation of potential physical disturbance or strike risk considered where organisms occur and if they occur in the same geographic area and vertical distribution as those objects that pose strike risks.

3.0.5.7.3.2 Immediate Response and Costs to the Individual

Before being struck, some organisms would sense a pressure wave through the water and respond by remaining in place, moving away from the object, or moving toward it. An organism displaced a small distance by movements from an object falling into the water nearby would likely continue on with no response. However, others could be disturbed and may exhibit a generalized stress response. If the object actually hit the organism, direct injury in addition to stress may result. The function of the stress response in vertebrates is to rapidly raise the blood sugar level to prepare the organism to flee or fight. This generally adaptive physiological response can become a liability if the stressor persists and the organism cannot return to its baseline physiological state.

Most organisms would respond to sudden physical approach or contact by darting quickly away from the stimulus. Other species may respond by freezing in place or seeking refuge. In any case, the individual must stop whatever it was doing and divert its physiological and cognitive attention to responding to the stressor. The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the individual for other functions such as predator avoidance, reproduction, growth, and metabolism.

The ability of an organism to return to what it was doing following a physical strike (or near miss resulting in a stress response) is a function of fitness, genetic, and environmental factors. Some organisms are more tolerant of environmental or human-caused stressors than others and become acclimated more easily. Within a species, the rate at which an individual recovers from a physical disturbance or strike may be influenced by its age, sex, reproductive state, and general condition. An organism that has reacted to a sudden disturbance by swimming at burst speed would tire after some time; its blood hormone and sugar levels may not return to normal for 24 hours. During the recovery period, the organism may not be able to attain burst speeds and could be more vulnerable to predators. If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer depressed immune function and even death.

3.0.5.7.3.3 Long-Term Consequences to the Population

Long-term consequences are considered in terms of a resource's existing population level, growth and mortality rates, other stressors on the resource from the Proposed Action, cumulative impacts on the resource, and the ability of the population to recover from or adapt to impacts. Impacts of multiple or repeated stressors on individuals are cumulative. When stressors are chronic, an organism may experience reduced growth, health, or survival, which could have population-level impacts (Billard et al. 1981), especially in the case of endangered species.

3.0.5.7.4 Conceptual Framework for Assessing Effects from Entanglement

3.0.5.7.4.1 Stimuli

Physical Properties of the Objects

For an organism to become entangled in military expended materials, the materials must have certain properties, such as the ability to form loops and a high breaking strength. Some items could have a relatively low breaking strength on their own, but that breaking strength could be increased if multiple loops were wrapped around an entangled organism.

Location of the Objects

Evaluation of potential entanglement risk considered the spatial overlap of the resource occurrence and military expended materials. Distribution and density of expended items play a central role in the likelihood of impact. Wherever appropriate, specific geographic areas of potential impact are identified.

Buoyancy of Objects

Evaluation of potential entanglement risk considered the buoyancy of military expended materials to determine whether the object will be encountered within the water column (including the surface) or on the seafloor. Less buoyant materials, such as torpedo guidance wires, sink rapidly to the seafloor. More buoyant materials include less dense items (e.g., parachutes) that are weighted and would sink slowly to the seafloor and could be entrained in currents.

Behavior of the Organism

Evaluation of potential entanglement risk considered the general behavior of the organism, including where the organism typically occurs (e.g., surface, water column, seafloor). The analysis particularly considered those species known to become entangled in nonmilitary expended materials (e.g., "marine debris") such as fishing lines, nets, rope, and other derelict fishing gear that often entangle marine organisms.

3.0.5.7.4.2 Immediate Response and Costs to the Individual

The potential impacts of entanglement on a given organism depend on the species and size of the organism. Species that have protruding snouts, fins, or appendages are more likely to become entangled than smooth-bodied organisms. Also, items could get entangled by an organism's mouth, if caught on teeth or baleen, with the rest of the item trailing alongside the organism. Materials similar to fishing gear, which is designed to entangle an organism, would be expected to have a greater entanglement potential than other materials. An entangled organism would likely try to free itself of the entangling object and in the process may become even more entangled, possibly leading to a stress response. The net result of being entangled by an object could be disruption of the normal behavior, injury due to lacerations, and other sublethal or lethal impacts.

3.0.5.7.4.3 Long-Term Consequences to the Individual and Population

Consequences of entanglement could range from an organism successfully freeing itself from the object or remaining entangled indefinitely, possibly resulting in lacerations and other sublethal or lethal impacts. Stress responses or infection from lacerations could lead to latent mortality. The analysis will focus on reasonably foreseeable long-term consequences of the direct impact, particularly those that could impact the fitness of an individual. Changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success could have population-level impacts if enough individuals are impacted. This population-level impact would vary among species and taxonomic groups.

3.0.5.7.5 Conceptual Framework for Assessing Effects from Ingestion

3.0.5.7.5.1 Stimuli

Size of the Objects

To assess the ingestion risk from military expended materials, this analysis considered the size of the object relative to the animal's ability to swallow it. Some items are too large to be ingested (e.g., non-explosive practice bombs and most targets) and impacts from these items are not discussed further. However, these items may potentially break down into smaller ingestible pieces over time. Items that are of ingestible size when they are introduced into the environment are carried forward for analysis within each resource section where applicable.

Location of the Objects

Evaluation of potential ingestion risk considered the spatial overlap of the resource occurrence and military expended materials. The distribution and density of expended items play a central role in the likelihood of impact. Wherever appropriate, specific geographic areas of potential impact were identified.

Buoyancy of the Objects

Evaluation of potential ingestion risk considered the buoyancy of military expended materials to determine whether the object will be encountered within the water column (including the surface) or on

the seafloor. Less buoyant materials, such as solid metal materials (e.g., projectiles or munition fragments), sink rapidly to the seafloor. More buoyant materials include less dense items (e.g., target fragments and parachutes) that may be caught in currents and gyres or entangled in floating *Sargassum*. These materials can remain in the water column for an indefinite period of time before sinking. However, parachutes are weighted and would generally sink, unless that sinking is suspended, in the scenario described here.

Feeding Behavior

Evaluation of potential ingestion risk considered the feeding behavior of the organism, including where (e.g., surface, water column, seafloor) and how (e.g., filter feeding) the organism feeds and what it feeds on. The analysis particularly considered those species known to ingest nonfood items (e.g., plastic or metal items).

3.0.5.7.5.2 Immediate Response and Costs to the Individual

Potential impacts of ingesting foreign objects on a given organism depend on the species and size of the organism. Species that normally eat spiny hard-bodied invertebrates would be expected to have tougher mouths and guts than those that normally feed on softer prey. Materials similar in size and shape to the normal diet of an organism may be more likely to be ingested without causing harm to the animal; however, some general assumptions were made. Relatively small objects with smooth edges, such as shells or small-caliber projectiles, might pass through the digestive tract without causing harm. A small sharp-edged item may cause the individual immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the individual's mouth and throat), it may block the throat or obstruct digestive processes. An object may even be enclosed by a cyst in the gut lining. The net result of ingesting large foreign objects is disruption of the normal feeding behavior, which could be sublethal or lethal.

3.0.5.7.5.3 Long-Term Consequences to the Individual and Population

Consequences of ingesting nonfood items could be nutrient deficiency, bioaccumulation, uptake of toxic chemicals, compaction, and mortality. The analysis focused on reasonably foreseeable long-term consequences of the direct impact, particularly those that could impact the fitness of an individual. Changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success could have population-level impacts if enough individuals were impacted. This population-level impact would vary among species and taxonomic groups.

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3.1 SEDIMENTS AND WATER QUALITY

SEDIMENTS AND WATER QUALITY SYNOPSIS

The Navy considered all potential stressors and determined that military expended materials containing the following have the potential to impact sediments and water quality:

- Explosives and explosion byproducts
- Metals
- Chemicals other than explosives
- Other materials

Preferred Alternative (Alternative 2)
Impacts from explosion byproducts could be short-term and local; impacts from unconsumed explosives and metals could be long-term and local. In both situations, chemical, physical, or biological changes to sediments or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. Impacts from chemicals other than explosives and from other materials could be both short- and long-term and local. Chemical, physical, or biological changes to sediments or water quality would not be detectable and would be below or within existing conditions or designated uses.

3.1.1 INTRODUCTION AND METHODS

3.1.1.1 Introduction

The following sections provide an overview of the characteristics of sediments and water quality in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area), and describe in general terms the methods used to analyze potential impacts on these resources from the Proposed Action.

3.1.1.1.1 Sediments

The discussion of sediments begins with an overview of sediment sources and characteristics in the Study Area and considers factors that affect sediment quality.

3.1.1.1.1.1 Characteristics of Sediment

Sediment is the solid fragments of organic and inorganic matter created from weathering rock transported by water, wind, and ice (glaciers) and deposited at the bottom of bodies of water. Components of sediment range in size from boulders, cobble, and gravel to sand (particles 0.05 to 2.0 millimeters [mm] in diameter), silt (0.002 to 0.05 mm), and clay (less than or equal to 0.002 mm). Sediment deposited on the continental shelf is delivered mostly by rivers but also by local and regional currents and wind. Most sediment in nearshore areas and on the continental shelf is aluminum silicate derived from rocks on land that is deposited at rates of greater than ten centimeters per 1,000 years. Sediment may also be produced locally as nonliving particulate organic material ("detritus") that travels to the bottom (Hollister 1973; Milliman et al. 1972). Some areas of the deep ocean contain an accumulation of the shells of marine microbes composed of silicon and calcium carbonate, termed biogenic ooze (Chester 2003). Through the downward movement of organic and inorganic particles in the water column, substances that are otherwise scarce in the water column (e.g., metals) are concentrated in bottom sediment (Chapman et al. 2003; Kszos et al. 2003).

3.1.1.1.1.2 Factors Affecting Sediment Quality

The quality of sediment is influenced by its physical, chemical, and biological components, where it is deposited, the properties of seawater, and other inputs and sources of contamination. Because these factors interact to some degree, sediment tends to be dynamic and is not easily generalized. For this discussion, "contaminant" refers to biological, chemical, or physical materials normally absent in sediment but which, when present or when at high concentrations, can impact marine ecosystem processes.

3.1.1.1.1.3 Sediment Physical Characteristics and Processes

At any given site, the texture and composition of sediment are important physical factors that influence the types of substances retained in sediment and subsequent biological and chemical processes that occur. Clay-sized and smaller sediment and similarly sized organic particles tend to bind potential contaminants such as metals, hydrocarbons, and persistent organic pollutants. Through this attraction, these particles efficiently scavenge contaminants from the water column and the water between grains of sediment ("porewater") and may bind them so strongly that their movement in the environment is limited (U.S. Environmental Protection Agency 2008e). Conversely, fine-grained sediment is easily disturbed by currents and bottom-dwelling organisms (Hedges and Oades 1997), dredging (Eggleton and Thomas 2004), storms (Chang et al. 2001), and bottom trawling (Churchill 1989). Disturbance is also possible in some deeper areas where currents are minimal, such as from mass wasting events (e.g., underwater slides, debris flows; Coleman and Prior 1988). If resuspended, fine-grained sediment (and any substances bound to it) can be transported long distances.

3.1.1.1.1.4 Sediment Chemical Characteristics and Processes

The concentration of oxygen in sediment is a major influence on sediment quality by its effect on the binding of materials to sediment particles. At the sediment surface, the level of oxygen is usually the same as that of the overlying water. Deeper sediment layers, however, often have low oxygen levels ("hypoxic") or no oxygen ("anoxic") and a low oxidation-reduction ("redox") state. Certain substances combine in oxygen-rich environments and become less available for other chemical or biological reactions. If these combined substances settle into the low or no-oxygen sediment zone, subsequent reactions may release them into porewater, making them available for other chemical or biological reactions. Conversely, substances that remain in solution in oxygenated environments may combine with organic or inorganic substances under hypoxic or anoxic conditions and be removed from further chemical or biological reactions (Spencer and MacLeod 2002; Wang et al. 2002).

3.1.1.1.1.5 Sediment Biological Characteristics and Processes

Organic matter in sediment provides food for resident microbes. Their metabolism can change the chemical environment in sediment, thereby increasing or decreasing the mobility of various substances and influencing the ability of the sediment to retain and transform those substances (Mitsch and Gosselink 2007; U.S. Environmental Protection Agency 2008e). Bottom-dwelling animals often rework sediment in the process of feeding and burrowing ("bioturbation"). In this way, marine organisms can influence the structure, texture, and composition of sediment as well as the horizontal and vertical distribution of substances in sediment (Boudreau 1998). As noted above, moving substances out of or into low- or no-oxygen zones in sediment may alter the form and availability of various substances. The metabolic processes of bacteria also influence sediment components directly. For example, sediment microbes may alter mercury to methyl mercury, increasing its toxicity (Mitchell and Gilmour 2008).

3.1.1.1.1.6 Location

The quality of coastal and marine sediment is influenced substantially by inputs from adjacent watersheds (Turner and Rabalais 2003). Proximity to watersheds with large cities and intensively farmed areas increases the amount of both inorganic and organic contaminants that often find their way into coastal and marine sediment. Metals enter estuaries through weathering of natural rocks and mineralized deposits carried by rivers and through man-made inputs that often contribute amounts significantly above natural levels. Metals of greatest concern include cadmium, chromium, mercury, lead, selenium, arsenic, and antimony because they bioaccumulate, are toxic at low concentrations to biota, and mostly have no natural functions in biological systems—chromium is the exception (Summers et al. 1996). In addition to metals, a wide variety of organic substances toxic to marine organisms, such as polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and pesticides—often referred together as "persistent organic pollutants"—are discharged into coastal waters from both point and nonpoint urban, agricultural, and industrial sources in a watershed (U.S. Environmental Protection Agency 2008e). It should be noted that PAHs can be both man-made or naturally occurring, produced from forest fires or other natural burning events.

Natural processes that occur in estuaries retain and transform a wide variety of substances (Li et al. 2008; Mitsch and Gosselink 2007). Examples of these processes include the binding of materials to small particles in the water column and the settling of those particles on the bottom in calm areas. Thus, the concentration of various substances decreases with distance from shore. Once in the ocean, the locations of various substances may be a consequence of currents that travel parallel to the shore (Duursma and Gross 1971). Location on the ocean floor also influences the distribution and concentration of various elements through local geology and volcanic activity (Demina and Galkin 2009), as well as mass wasting events such as underwater slides and debris flows (Coleman and Prior 1988).

3.1.1.1.1.7 Other Contributions to Sediment

While the greatest mass of sediment is carried into marine systems by rivers (U.S. Environmental Protection Agency 2008e), wind and rain also deposit materials in coastal waters and contribute to the mass and quality of sediment. For instance, approximately 80 percent of the mercury released from human activities comes from burning of coal, mining and smelting, and solid waste incineration (Agency for Toxic Substances and Disease Registry 1999). These are generally considered the major sources of mercury in marine systems (Fitzgerald et al. 2007). Atmospheric deposition of lead is similar in that human activity is a major source of lead in sediment (Wu and Boyle 1997).

Hydrocarbons are common in sediment. In addition to washing in from land and shipping sources, they are deposited from the combustion of fuels (both wood and petroleum), are produced directly by marine and terrestrial biological sources, and arise from processes in sediment, including microbial activity and natural hydrocarbon seeps (Boehm and Requejo 1986; Geiselbrecht et al. 1998). Means (1995) noted that, because of the high binding capacities of organic-rich, fine-grained sediment found at many coastal and estuarine sites, "hydrocarbons may concentrate to levels far exceeding those observed in the water column of the receiving water body."

Between World War I and 1970, a variety of weapons were disposed off the east coast of the United States and at two known sites in the Mississippi River in Louisiana. Such disposal practices ended in 1970; however, identifying disposal locations, specific weapons, and the quantities involved is not possible in most instances because of incomplete record-keeping and the possibility that items may have been moved by currents (Bearden 2006).

3.1.1.1.2 Water Quality

The discussion of water quality begins with an overview of the characteristics of marine waters, including pH, temperature, oxygen, nutrients, salinity, and other dissolved elements. The discussion then considers how those characteristics of marine waters are influenced by marine physical, chemical, and biological processes.

3.1.1.1.2.1 Characteristics of Marine Waters

The composition of water in the marine environment is determined by complex interactions between physical, chemical, and biological processes. Physical processes include region-wide currents and tidal flows, seasonal weather patterns and temperature, sediment characteristics, and unique local conditions, such as those created by the volume of freshwater delivered by large rivers. Chemical processes involve salinity, pH, dissolved minerals and oxygen, particulates, nutrients, trace minerals, dissolved ions, and pollutants. Biological processes involve the influence of living things on the physical and chemical environment. The two dominant biological processes in the ocean are photosynthesis in upper waters, and respiration, particularly by microorganisms. These processes involve the uptake, conversion, and excretion of waste products during growth, reproduction, and decomposition (Mann and Lazier 1996).

3.1.1.1.2.2 pH

pH is a measure of the degree to which a solution is either acidic (pH less than 7.0) or basic (pH greater than 7.0). Seawater has a relatively stable pH between 7.5 and 8.5 due to the presence of dissolved elements, particularly carbon and hydrogen. Most of the carbon in the sea is present as dissolved inorganic carbon that originates from the complex interaction of dissolved carbon dioxide in seawater. This carbon dioxide-carbonate equilibrium system is the major pH buffering system in seawater. Changes in pH outside the normal range for seawater can make it difficult for specialized marine animals (e.g., molluscs) to maintain their shells (Fabry et al. 2008).

3.1.1.1.2.3 Temperature

Temperature influences the speed at which chemical reactions take place in solution: warmer temperatures increase reaction speed and vice versa. In addition, seasonal changes in weather influence water temperatures that, in turn, influence the degree to which marine waters mix. The increase in surface water temperatures during summer creates three distinct layers in the water column, a process known as stratification. The warmer surface layer is separated from colder water toward the bottom by an intervening layer ("thermocline") across which the temperature changes rapidly. Stratification is important because it can limit the exchange of gases and nutrients as well as the onset and decline of phytoplankton blooms (Howarth et al. 2002). In fall and winter, lower air temperatures and cool surface waters break down this vertical stratification and promote mixing within the water column.

During most of the year, there is a clear north-to-south gradient of increasing temperatures on the sea surface (Figure 3.0-11). Temperatures in winter (February and March) range from 37° Fahrenheit (F); (3° Celsius [C]) off the coast of Maine to 41°F (5°C) off the coast of Delaware to 72°F (22°C) off the coast of Cape Canaveral, Florida. In summer (August), the temperatures range from about 63°F (17°C) to the north to 75°F (24°C) to the south to 82°F (28°C) at Cape Canaveral (National Data Buoy Center 2011). In the Gulf of Mexico, the surface water temperatures range from 64°F (18°C) to 88°F (31°C) during the same months. Currents cause fairly large temperature differences between the eastern and western parts of the Gulf of Mexico with warmer temperatures generally occurring in the eastern Gulf of Mexico (Muller-Karger et al. 1991).

3.1.1.1.2.4 Oxygen

Surface waters in the ocean are usually saturated or supersaturated with dissolved oxygen as a result of photosynthetic activity and wave mixing (4.49 to 5.82 milliliters per liter [ml/L]). As depth from the surface increases, dissolved oxygen content decreases from more than 4.4 ml/L to a minimum of 1.7 ml/L at intermediate depths between 984 and 2,953 ft. (300 and 900 m). Thereafter, dissolved oxygen content increases from 5.4 ml/L to 6.7 ml/L to a depth of approximately 6,562 ft. (2,000 m) and remains relatively constant (Seiwell 1934).

The amount of dissolved oxygen is considered poor if the concentration is less than 2 mg/L; 1 mg/L is approximately 1.3-1.4 ml/L depending on water temperature), a condition referred to as hypoxia (Rabalais et al. 2002; U.S. Environmental Protection Agency 2008e). Such low oxygen levels are natural in marine systems under certain conditions, such as oxygen minimum zones at intermediate depths, upwelling areas, deep ocean basins, and fjords (Helly and Levin 2004). (The term "upwellings" refers to the movement of colder, usually nutrient-rich, waters from deeper areas of the ocean to the surface.) However, the occurrence of hypoxia and anoxia in shallow coastal and estuarine areas can negatively affect fish, bottom-dwelling ("benthic") creatures, and submerged aquatic vegetation. Hypoxia has been increasing in coastal waters and may affect more than half of the estuaries in the United States (Bricker et al. 1999; Diaz and Rosenberg 1995).

3.1.1.1.2.5 Nutrients

Nutrients are elements and compounds necessary to produce organic matter. In marine systems, basic nutrients include dissolved nitrogen, phosphates, silicates, and metals such as iron and copper. Dissolved inorganic nitrogen occurs in ocean water as nitrates, nitrites, and ammonia (Zehr and Ward 2002). Depending on local conditions, the productivity of marine ecosystems may be limited by the amount of phosphorus available or, more often, by the amount of nitrogen available (Anderson et al. 2002; Cloern 2001). Too much of either can lead to a harmful condition known as eutrophication. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption causes dissolved oxygen in the water to decline to the point where creatures that depend on oxygen can no longer survive (Boesch et al. 1997). Sources of excess nutrients include fertilizers applied on land, wastewater, and atmospheric deposition from burning fossil fuels (Turner and Rabalais 2003). Biogeochemical processes in estuaries and on the continental shelf influence the extent to which nitrogen and phosphorus reach the open ocean. Much eventually resides in coastal sediment (Nixon et al. 1996).

3.1.1.1.2.6 Salinity, Ions, and Other Dissolved Substances

The concentration of major ions in seawater determines salinity. Those ions include sodium, chloride, potassium, calcium, magnesium, and sulfate. Salinity over the continental shelf along the east coast ranges from 28 to 36 parts per thousand (ppt) and generally increases from north to south in the Study Area. Salinity of the surface water of the Gulf of Mexico ranges between 36.0 and 36.3 ppt. During summer when the water column is stratified, surface salinities often increase from shore to the continental shelf break. Below 984 ft. (300 m), salinity is more constant (Blanton et al. 2003). Salinity varies seasonally as well, especially in areas influenced by large rivers (Milliman et al. 1972). Table 3.1-1 provides estimates of the concentration of select elements in open ocean waters (Nozaki 1997).

Table 3.1-1: Estimated Average Concentrations of Select Elements in Seawater

Element	Estimated Average Concentration in Seawater (ng/kg)
Magnesium	1,280,000,000
Silicon	2,800,000
Lithium	180,000
Phosphorus	62,000
Molybdenum	10,000
Uranium	3,200
Nickel	480
Zinc	350
Chromium (VI)	210
Copper	150
Cadmium	70
Aluminum	30
Iron	30
Manganese	20
Tungsten	10
Titanium	6.5
Lead	2.7
Chromium (III)	2
Silver	2
Cobalt	1.2
Tin	0.5
Mercury	0.14
Platinum	0.05
Gold	0.02

ng/kg: nanograms per kilogram

The presence of extremely small organic particles (less than 0.63 micrometers [µm]), carbonates, sulfides, phosphates, and metals will influence the dominant form of some substances and determine whether they remain dissolved or form solids.

3.1.1.1.2.7 Influence of Marine Processes on Seawater Characteristics

Ocean currents and tides mix and redistribute seawater. In doing so, they alter surface water temperatures, transport and deposit sediment, and concentrate and dilute substances that are dissolved and suspended in the water. These processes operate to varying degrees from nearshore areas to the deep ocean waters. Salinity also affects the density of seawater and, therefore, its movement relative to the sea surface (Libes 2009). Upwellings, such as those associated with the Gulf Stream, bring cold, nutrient-rich waters from deeper areas, increasing the productivity of local surface waters (Mann and Lazier 1996). Storms and hurricanes also result in strong mixing of marine waters (Li et al. 2006). Additional information on ocean currents in the Study Area is included in Section 3.0.3 (Ecological Characterization of the Study Area).

Temperature and pH influence behavior of trace metals in seawater, such as the extent to which they dissolve in water ("solubility") or their tendency to bind to organic and inorganic particles. However, the degree of influence differs widely among metals (Byrne et al. 1988). The concentration of a given element may change with position in the water column. For instance, some metals have low concentrations in surface waters and higher concentrations at depth, such as cadmium (Bruland 1992), while others decline quickly below the surface (e.g., zinc and iron; Morel and Price 2003; Nozaki 1997). On the other hand, dissolved aluminum exhibits a maximum concentration at the surface, a minimum concentration at mid-depths, and increasing concentrations below 3,300 ft. (1,000 m) (Li et al. 2008). In the northwest Atlantic Ocean, Yeats and Campbell (1983) found that the availability of zinc, cadmium, and nickel were predominantly controlled by biological processes, while copper was predominantly controlled by the extent of surface input and the extent of scavenging by small particles in the water.

Substances like nitrogen, carbon, silicon, and trace metals are extracted from the water by biological processes; others, like oxygen and carbon dioxide, are produced. Metabolic waste products add organic compounds to the water and may also bind to trace metals, removing those metals from the water. Those organic compounds may then be consumed or they may aggregate with other particles and sink toward the bottom (Mann and Lazier 1996; Wallace and Lopez 1997).

Runoff from coastal watersheds influences local and regional coastal water conditions, especially near large rivers like the Hudson and Mississippi. Influences include increased sediment and pollutants, and decreased salinity (Turner and Rabalais 2003; Wiseman and Garvine 1995). Coastal bays and large estuaries, such as Pamlico and Albemarle Sounds on the southeast coast, filter river outflows and reduce total discharge of water to the ocean (Edwards et al. 2006; Mitsch and Gosselink 2007). Depending on their structure and components, estuaries can directly or indirectly affect coastal water quality by recycling various compounds (e.g., excess nutrients), sequestering elements in more inert forms (e.g., trace metals), or altering them, such as the conversion of mercury to methylmercury (Mitchell and Gilmour 2008; Mitsch and Gosselink 2007).

3.1.1.1.2.8 Coastal Water Quality

A recent coastal condition report (U.S. Environmental Protection Agency 2008e) evaluated the condition of U.S. coastal water quality. According to the report, most water quality problems in coastal waters of the United States are associated with degraded water clarity or increased concentrations of phosphates or chlorophyll *a* (a measure of turbidity). Water quality indicators measured included dissolved inorganic nitrogen, dissolved inorganic phosphorus, water clarity and turbidity, dissolved oxygen, and chlorophyll *a*. Chlorophyll *a* is an indicator of microscopic algae (phytoplankton) abundance used to judge nutrient availability (e.g., phosphates and nitrates). Excess phytoplankton or algae can decrease water clarity and lower concentrations of dissolved oxygen. Most sources of these negative impacts arise from onshore point and nonpoint sources.

3.1.1.1.2.9 Hydrocarbons, Trace Metals, and Persistent Organic Pollutants

In addition to the characteristics discussed above, other substances influence seawater quality, including hydrocarbons, metals, and persistent organic pollutants such as pesticides, PCBs, organotins, polycyclic aromatic hydrocarbons, and similar synthetic organic compounds. Sources of these contaminants include commercial and recreational vessels; oil and gas exploration, processing, and spills; industrial and municipal discharges (point source pollution); runoff from urban and agricultural areas (nonpoint source pollution); legal and illegal ocean dumping; poorly or untreated sewage; and atmospheric deposition of combustion residues (U.S. Environmental Protection Agency 2008e).

Various physical, chemical, and biological processes work to remove many of these substances from seawater; thereafter, they become part of nearshore and continental shelf sediment. Additional discussion of contaminants in sediment is provided in Section 3.1.1.1.1 (Sediments).

Hydrocarbons. Hydrocarbons are common in marine ecosystems. They arise from man-made sources, from natural hydrocarbon seeps, and as a result of microbial activity (Boehm and Requejo 1986; Geiselbrecht et al. 1998). According to Kvenvolden and Cooper (2003), during the 1980s, about 10 percent of crude oil entering the marine environment came from natural sources, 27 percent came from oil production, transportation, and refining, and the remaining 63 percent came from atmospheric emissions, municipal and industrial sources, and urban and river runoff. These sources produce many thousands of chemically different hydrocarbon compounds. When hydrocarbons enter the ocean, the lighter-weight components evaporate, degrade by sunlight ("photolysis"), and undergo chemical degradation. A wide range of constituents are consumed by microbes ("biodegradation"). Higher-weight molecular compounds such as asphaltenes are more resistant to degradation and tend to persist after these processes have occurred (Blumer et al. 1973; Mackay and McAuliffe 1988).

Trace metals. The level of dissolved metals in seawater is normally quite low because some are extracted for use by organisms (e.g., iron), many tend to precipitate with various ions already present in the water, and others bind to various metal oxides and small organic and inorganic particles in the water (Turekian 1977). These processes transform the metal from a dissolved state to a solid (particulate) state and substantially decrease the concentration of dissolved metals in seawater (Wallace et al. 1977). The concentration of heavy metals normally decreases with distance from shore (Wurl and Obbard 2004) and varies with depth (Li et al. 2008). A certain amount of trace metals is natural in marine waters due to dissolution of geological formations on land by rain and runoff. However, the additional amounts produced by human activity often have negative consequences for marine ecosystems (Summers et al. 1996), such as the atmospheric deposition of lead in marine systems (Wu and Boyle 1997).

Persistent organic pollutants. Persistent organic pollutants have long half-lives in the environment. They resist degradation, do not readily dissolve in water, and tend to adhere to organic solids and lipids (fats) (Jones and de Voogt 1999). Although they are present in the open ocean and deep ocean waters (Tanabe and Tatsukawa 1983), they are more common and in higher concentrations in nearshore areas and estuaries (Means 1995; Wurl and Obbard 2004). The surface layer of the ocean represents an important microhabitat for a variety of microbes, larvae, and fish eggs. Because of the tendency of hydrocarbons and persistent organic pollutants to float in this surface microlayer, they can be significantly more toxic to those organisms than the adjacent subsurface water (Wurl and Obbard 2004). Sauer et al. (1989) noted that concentrations of PCBs and dichlorodiphenyltrichloroethane (DDT) have been declining in the open ocean for the past several decades.

PCBs are mixtures of up to 209 individual chlorinated compounds known as congeners. They were used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The United States stopped manufacturing PCBs in 1977 (Agency for Toxic Substances and Disease Registry 2000). Marine sources include runoff from agricultural and urban areas and atmospheric deposition from industrialized locations (Kalmaz and Kalmaz 1979). PCBs do not readily degrade in the environment and tend to persist for many years. They can easily move between air, water, and soil, although in aquatic systems, they tend to adhere to fine-grained sediment and organic matter. PCBs have a variety of effects on aquatic organisms. The chemicals persist in the tissues of animals at the bottom of the food chain. Thereafter, consumers of those species tend to accumulate PCBs at levels that may be many

times higher than in water. Microbial breakdown of PCBs (dechlorination) has been documented in estuarine and marine sediments (Agency for Toxic Substances and Disease Registry 2000).

3.1.1.2 Methods

Potential impacts on sediment and water quality are categorized into four stressors: (1) explosives and explosion byproducts; (2) metals; (3) chemicals other than explosives; and (4) a miscellaneous category of other materials. The term "stressor" is used because the military expended materials in these four categories may negatively affect sediment and water quality by altering their physical and chemical characteristics. Potential impacts of these stressors are evaluated based on the extent to which the release of these materials would directly or indirectly impact sediment or water quality. Existing laws, standards, and guidelines are used to evaluate potential impacts. The differences between standards and guidelines are described below.

- **Standards** are established by law or through government regulatory processes that have the force of law. Standards may be numerical or narrative. Numerical standards set allowable concentrations of specific pollutants (e.g., µg/L [ppb]) or levels for other parameters (e.g., pH) to protect the water's designated uses. Narrative standards describe water conditions that are not acceptable, such as nuisance algal blooms.
- **Guidelines** are nonregulatory and generally do not have the force of law. They reflect an agency's preference or suggest conditions that should prevail. Guidelines are often used to assess the condition of a resource to guide subsequent steps, such as the disposal of dredged materials. Terms such as screening criteria, impact levels, and recommendations are also used.

State standards and guidelines. State jurisdiction regarding sediment and water quality extends from the low tide line out 3 nautical miles (nm); jurisdiction for Texas and the west coast of Florida within the Gulf of Mexico extends from the low tide line out 9 nm. Creating state-level sediment and water quality standards and guidelines begins with each state establishing a use for the water, which is referred to as its "designated" use. Examples of such uses of marine waters include fishing, shellfish harvesting, and recreation. For this section, a water body is considered "impaired" if any one of its designated uses is not met. Once this use is designated, standards or guidelines are established to protect the water at the desired level of quality. Applicable state standards and guidelines specific to each stressor are detailed in Section 3.1.3 (Environmental Consequences).

Federal standards and guidelines. Federal jurisdiction regarding sediment and water quality extends from 3 to 200 nm along the east coast of the United States. However, as discussed in the prior paragraph, for Texas and the west coast of Florida within the Gulf of Mexico, federal jurisdiction would begin 9 nm from shore and extend out to 200 nm. These standards and guidelines are mainly the responsibility of the U.S. Environmental Protection Agency (USEPA), specifically ocean discharge provisions of the Clean Water Act (33 United States Code [U.S.C.] § 1343). Ocean discharges may not result in "unreasonable degradation of the marine environment." Specifically, disposal may not result in: (1) unacceptable negative effects on human health; (2) unacceptable negative effects on the marine ecosystem; (3) unacceptable negative persistent or permanent effects due to the particular volumes or concentrations of the dumped materials; and (4) unacceptable negative effects on the ocean for other uses as a result of direct environmental impact (40 Code of Federal Regulations [C.F.R.] § 125.122). Applicable federal standards and guidelines specific to each stressor are detailed in Section 3.1.3 (Environmental Consequences). Proposed training and testing activities also occur beyond 200 nm, but U.S. legal and regulatory authority does not extend beyond 200 nm. In such cases, impacts will be judged against federal standards and guidelines.

The International Convention for the Prevention of Pollution from Ships addresses pollution generated by normal vessel operations. The convention is incorporated into U.S. law as 33 U.S.C. §§ 1901-1915. The convention includes six annexes: Annex I, oil discharge; Annex II, hazardous liquid control; Annex III, hazardous material transport; Annex IV, sewage discharge; Annex V, plastic and garbage disposal; and Annex VI, air pollution. The Navy is required to comply with the convention; however, the United States is not a party to Annex IV, sewage discharge. The convention contains handling requirements and specifies where materials can be discharged at sea, but it does not contain standards and guidelines related to sediment and water quality.

3.1.1.2.1 Intensity and Duration of Impact

The intensity or severity of impact is defined as follows (increasing order of negative impacts):

- Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses.
- Chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses.
- Chemical, physical, or biological changes to sediment or water quality would be measurable and readily apparent but within applicable standards, regulations, and guidelines. Sediment or water quality would be altered compared to historical baseline, desired conditions, or designated uses. Mitigation would be necessary and would likely be successful.
- Chemical, physical, or biological changes to sediment or water quality would be readily measurable, and some standards, regulations, and guidelines would be periodically approached, equaled, or exceeded. Sediment or water quality would be frequently altered from the historical baseline or desired conditions or designated uses. Mitigation would be necessary, but success would not be assured.

Duration is characterized as either short-term or long-term. Short-term is defined as days or months. Long-term is defined as months or years, depending on the type of activity or the materials involved.

3.1.1.2.2 Measurement and Prediction

Because many of the conditions described above often influence each other, measuring and characterizing various substances in the marine environment is often difficult (Byrne 1996; Ho et al. 2007). For instance, sediment contaminants may also change over time. Valette-Silver (1993) reviewed several studies that demonstrated the gradual increase in a variety of contaminants in coastal sediment that began as early as the 1800s, continued into the 1900s, peaked between the 1940s and 1970s, and declined thereafter (e.g., lead, dioxin, PCBs). After initial deposition, normal physical, chemical, and biological processes can resuspend, transport, and redeposit sediment and associated substances in areas far removed from the original source (Hameedi et al. 2002; U.S. Environmental Protection Agency 2008e).

The conditions noted above further complicate predictions of the impact of various substances in the marine environment and on marine organisms; that is, the degree to which they are bioavailable, transfer between trophic levels, and bioaccumulate.

- "Bioavailability" refers to the degree to which a substance is available to be taken in by an organism with the potential for distribution, metabolism, and elimination.

- "Trophic transfer" is the movement of substances up the food chain as predator eats prey. Trophic levels represent different positions in the food chain.
- "Bioaccumulation" is the increase in the concentration of a substance in an organism from a lower trophic level to a higher trophic level (McGeer et al. 2004).

3.1.1.2.3 Sources of Information

A systematic review of relevant literature was conducted to complete this analysis of sediments and water quality, including journals, technical reports published by government agencies, work conducted by private businesses and consulting firms, and U.S. Department of Defense (DoD) reports, operational manuals, natural resource management plans, and current and prior environmental documents for facilities and activities in the Study Area. The literature and other information sources cited are identified at the end of Section 3.1 (Sediments and Water Quality).

Other informative sources for this sediments and water quality analysis include the recent Navy water range assessments developed pursuant to the Navy's Water Range Sustainability Environmental Program Assessment Policy (Chief of Naval Operations 2008). Pursuant to this policy, U.S. Fleet Forces conducted water range assessments for ranges located within state waters with particular emphasis (i.e., operational range site modeling and fate and transport analysis) on those water ranges with specific and distinct operational aim or use points. Four water range assessments were completed:

- Virginia Capes Range Complex Water Range Assessment (U.S. Department of the Navy 2010b),
- Jacksonville Range Complex Water Range Assessment (U.S. Department of the Navy 2010a),
- Key West Range Complex Water Range Assessment (U.S. Department of the Navy 2011), and
- Gulf of Mexico Range Complex Water Range Assessment (U.S. Department of the Navy 2012).

The Water Range Sustainability Environmental Program Assessment Policy establishes procedures to:

- ensure the long-term sustainability of water ranges and operating areas;
- determine whether there has been a release or a substantial threat of a release of munitions constituents of potential concern or military expended material constituents from an operational range to an off-range area;
- determine whether the release or substantial threat of a release of munitions constituents of potential concern or military expended material constituents from an operational range to an off-range area poses an unacceptable risk to human health or the environment;
- assess the potential environmental impacts of the use of military munitions on operational ranges; and
- implement, where appropriate, protective measures for Navy operational ranges that are primarily in water.

Each of the four water range assessments conducted within the AFTT Study Area concluded that no complete exposure pathways to receptors on- or off-range are anticipated. With the projected non-detectable concentrations of munitions constituents and military expended material constituents attenuated in surface waters, using conservative assumptions, it is unlikely that an introduction or accumulation of trace training-related munitions constituents and military expended material constituents pose a risk to human health or the environment. Based on the analysis in each assessment, no further steps are needed to ensure the sustainability of the water ranges.

Because of its importance and proximity to humans, information is readily available regarding the condition of inshore and nearshore sediment and water quality. However, much less is known about deep ocean sediment and open ocean water quality. Because inshore and nearshore sediment and water quality are negatively affected mostly by various human social and economic activities, two general assumptions are used in this discussion: (1) the greater the distance from shore, the higher the quality of sediment and waters; and (2) deeper waters are generally of higher quality than surface waters.

3.1.1.2.4 Areas of Analysis

The locations where specific military expended materials would be used are discussed under each stressor in Section 3.1.3 (Environmental Consequences). Activities at the South Florida Ocean Measurement Facility Testing Range and at pierside locations are not analyzed for impacts on sediment or water quality because no military expended materials are proposed for use at those locations.

3.1.2 AFFECTED ENVIRONMENT

The affected environment includes sediment and water quality within the Study Area, from nearshore areas to the open ocean and deep sea bottom. Existing sediment conditions are discussed first and water quality thereafter. Figures 3.0-1 to 3.0-9 depict the regions and areas discussed below. Figure 3.0-5 provides a general diagram of the continental margin and abyssal (deep ocean) zone.

3.1.2.1 Sediment

The following subsections discuss sediment for each region in the Study Area. Table 3.1-2 provides the sediment quality criteria and index for the U.S. east coast and Gulf of Mexico (U.S. Environmental Protection Agency 2008d).

3.1.2.1.1 Sediment in the North Atlantic

The North Atlantic area consists of the West Greenland Shelf, the Newfoundland-Labrador Shelf, and the Scotian Shelf Large Marine Ecosystems, as well as the Labrador Current Open Ocean Area. The area includes the coasts and offshore marine areas southwest of Greenland, east and northeast of Newfoundland and Labrador, and surrounding Nova Scotia. Note: Although there are no designated range complexes in this region, the area may be used for Navy training and testing activities. See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations.

Because of the low population densities and low levels of development, pollution from land-based sources is limited in the North Atlantic area (Aquarone and Adams 2008a, b; Aquarone et al. 2008). However, pollution is increasing from oil and gas development activities (Aquarone and Adams 2008a, b), and metal pollution exists from prior mineral development activity (Larsen et al. 2001) and atmospheric deposition (Bindler 2001). Natural hydrocarbon seeps are located near Baffin Island to the north (Kvenvolden and Cooper 2003).

Table 3.1-2: Sediment Quality Criteria and Index, U.S. East Coast and Gulf of Mexico

Criterion	Site Criteria			Regional Rating		
	Good	Fair	Poor	Good	Fair	Poor
Sediment Toxicity	Amphipod survival rate ≥ 80%	N/A	Amphipod survival rate < 80%	< 5% of coastal area in poor condition	N/A	≥ 5% of coastal area in poor condition
Sediment Contaminants	No ERM concentration exceeded, and < 5 ERL concentration exceeded	No ERM concentration exceeded and ≥ 5 ERL concentration exceeded	An ERM concentration exceeded for one or more contaminants	< 5% of coastal area in poor condition	5-15% of coastal area in poor condition	> 15% of coastal area in poor condition
Excess Sediment TOC	TOC concentration < 2%	TOC concentration 2% to 5%	TOC concentration > 5%	< 20% of coastal area in poor condition	20-30% of coastal area in poor condition	> 30% of coastal area in poor condition
Sediment Quality Index	No individual criteria rated poor, and sediment contaminants criteria is rated good	No individual criteria rated poor, and sediment contaminants criteria is rated fair	One or more individual criteria rated poor	< 5% of coastal area in poor condition, and > 50% in good condition	5-15% of coastal area in poor condition, and > 50% in combined fair and poor condition	> 15% of coastal area in poor condition

ERM (effects range–median) is the level measured in the sediment below which adverse biological effects were measured 50% of the time.
ERL (effects range–low) is the level measured in the sediment below which adverse biological effects were measured 10% of the time (Long et al. 1995).
N/A: Not Applicable; TOC: (total organic carbon) refers to the amount of carbon contained in organic compounds; %: percent; "≥: equal to or greater than; "<": less than; and ">": greater than.

3.1.2.1.2 Sediment in the Northeast U.S. Large Marine Ecosystem

Almost the entire continental shelf along the eastern United States is covered by medium-sized sand (0.013 to 0.02 in. [0.35 to 0.50 mm]). Sediment north of Cape Hatteras is dominated by quartz and feldspar from Precambrian and Paleozoic rocks that were mechanically weathered and deposited by glaciers and rivers. Silicon- and phosphorus-based sediment is locally abundant (Milliman et al. 1972). Sediment in deep areas beyond the continental break is often dominated by calcium carbonate shells of marine plankton. Nearshore areas of capes and at the mouths of bays, such as Chesapeake Bay and Delaware Bay, are influenced by longshore and cross-shelf currents as well as tidal fluctuations (McBride and Moslow 1991; Murray and Thieler 2004). Extensive estuaries on the east coast tend to trap much of the sediment delivered by rivers. Fine-grained sediment that reaches the ocean is usually transported shoreward by tides or deposited on the continental slope and beyond. Fine sediment occurs in the Gulf of Maine and off the coast of Martha's Vineyard in an area known as the "Mud Patch" (Chang et al. 2001).

Overall, sediment in northeast coastal areas—Maine through Virginia—rates poor in an evaluation of coastal conditions by the USEPA (U.S. Environmental Protection Agency 2008e). Criteria used in the agency's sediment quality index include sediment toxicity, sediment contaminants, and excess sediment carbon contained in organic compounds (total organic carbon).

The poor rating for the northeast coastal areas was due mostly to the areal extent of poor sediment and the degree of contamination adjacent to urbanized areas and areas of past industrial activity, such as Cape Cod Bay, western Long Island Sound, New York-New Jersey Harbor, and tidal freshwater parts of Delaware Bay. However, 76 percent of coastal sediment had low levels of chemical contamination, an absence of acute toxicity, and moderate-to-low levels of sediment total organic carbon (U.S. Environmental Protection Agency 2008e). In a study of sediment in Long Island Sound, Greig et al. (1977) found that concentrations of several metals varied greatly among the 159 sites sampled. Table 3.1-3 compares the range of values found by Greig et al. (1977) with sediment guidelines developed by the National Oceanic and Atmospheric Administration (1999). Greig et al. (1977) commented that the most likely source for these metals was onshore industrial activity.

Table 3.1-3: Comparison of Select Metals in Sediments by Greig et al., with Sediment Guidelines by the National Oceanic and Atmospheric Administration

Metal	Sediment Study by Greig et al. 1977 (ppm)	National Oceanic and Atmospheric Administration	
		Effects Range-Low* (ppm)	Effects Range-Median* (ppm)
Cadmium	2–4	1.2	9.6
Chromium	200-350	81	370
Copper	200-350	34	270
Lead	200-350	46.7	218
Mercury	2–4	0.15	0.71
Nickel	42	20.9	51.6
Silver	2–4	1.0	3.7
Zinc	200–350	150	410

ppm: parts per million, dry weight
* See Table 3.1-2 above for definitions.

Table 3.1-4 provides a range of values for polycyclic aromatic hydrocarbons and PCBs found by various authors in sediments in the northwest Atlantic. The table compares those values with guidelines developed by the National Oceanic and Atmospheric Administration (1999).

Table 3.1-4: Comparison of Polycyclic Aromatic Hydrocarbons and Polychlorinated Biphenyls in Sediment Samples with Sediment Guidelines Developed by the National Oceanic and Atmospheric Administration

Sediment Contaminant	Studies within Northeast Atlantic Region			National Oceanic and Atmospheric Administration	
	Boehm and Gequejo (1986)	Farrington and Trip (1977)	Lamoreaux and Brownawell (1999)	Effects Range-Low*	Effects Range-Median*
PAHs (ppb)	2,000 to 20,000	0.5-3.0	5,600 to 6,100	4,022	44,792
PCBs (ppb)			415 to 500	22.7	180
Location(s)	"Mud Patch," Martha's Vineyard; Gulf of Maine	New York Bight	Governors Island, New York		

ppb: parts per billion, μg/g; PAH refers to polycyclic aromatic hydrocarbons; PCBs refers to polychlorinated biphenyls
* See Table 3.1-2 for definitions.

Boehm and Gequejo (1986) and Farrington and Trip (1977) noted that the source of polycyclic aromatic hydrocarbons was artificial.

Existing Sediment Quality Ratings in the Northeast U.S. Continental Shelf Large Marine Ecosystem

States bordering the Northeast U.S. Continental Shelf Large Marine Ecosystem include Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and northeast North Carolina. See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations. Information regarding the current quality of sediment in nearshore areas of these states is provided below. Figure 3.1-1 depicts those conditions. Except where otherwise indicated, information provided below was drawn from the National Estuary Program Coastal Condition Report (U.S. Environmental Protection Agency 2008c).

Maine. Sediment along the Maine coast was rated 44 percent good, 39 percent fair, and 3 percent poor; 14 percent was missing data. Concerns related to sediment in Maine include PCBs, mercury, and dioxin. As a result, seafood consumption advisories were issued. These concerns involve all the state's estuarine and marine habitats. In much smaller areas, bacteria, low oxygen, copper, and polycyclic aromatic hydrocarbons were also identified (Maine Department of Environmental Protection 2010). Wade and Sweet (2005) reported that sediment from the interior of Casco Bay (Portland, Maine) contains elevated levels of trace metals, PCBs, DDT, and the pesticide chlordane.

New Hampshire. Sediment along the New Hampshire coast were rated 56 percent good, 27 percent fair, and 7 percent poor; 10 percent was missing data. Issues included metals, polycyclic aromatic hydrocarbons, and DDT. These concerns involve all the state's estuarine and marine waters. Marine sediment samples were analyzed for heavy metals (cadmium, chromium, copper, lead, mercury, nickel, and zinc) and organic compounds (PCBs and polycyclic aromatic hydrocarbons). Results indicate that, with few exceptions, the levels of contaminants detected in shellfish and sediment were within the range of contaminants found elsewhere in New England, other regions of the United States, and the world. Two estuarine areas were impaired due to pesticides. Ocean waters are listed as impaired due to

dioxin, mercury, and PCBs. As noted above, concerns are related to seafood consumption (New Hampshire Department of Environmental Services 2008).

Massachusetts. Sediment in the Massachusetts Bay area (from Cape Cod north) was rated 78 percent good, 1 percent fair, and 16 percent poor, with 5 percent missing data. Most poor sediment was concentrated in the Boston Harbor area. No specific issues were indicated. For Buzzards Bay, sediment was rated 85 percent good and 11 percent poor, with 4 percent missing data. No specific issues were indicated.

Rhode Island. Sediment in Narragansett Bay was rated 45 percent good, 37 percent fair, and 15 percent poor; 3 percent was missing data. Issues included high concentrations of metals, DDT, and PCBs. Contaminated sediments were listed as a concern for 1 square mile (mi.^{2}) (2.59 square kilometers [km^2]) of estuarine habitat in Rhode Island. The issue involved "legacy/historical pollutants," such as PCBs in Narragansett Bay (Rhode Island Department of Environmental Management 2008).

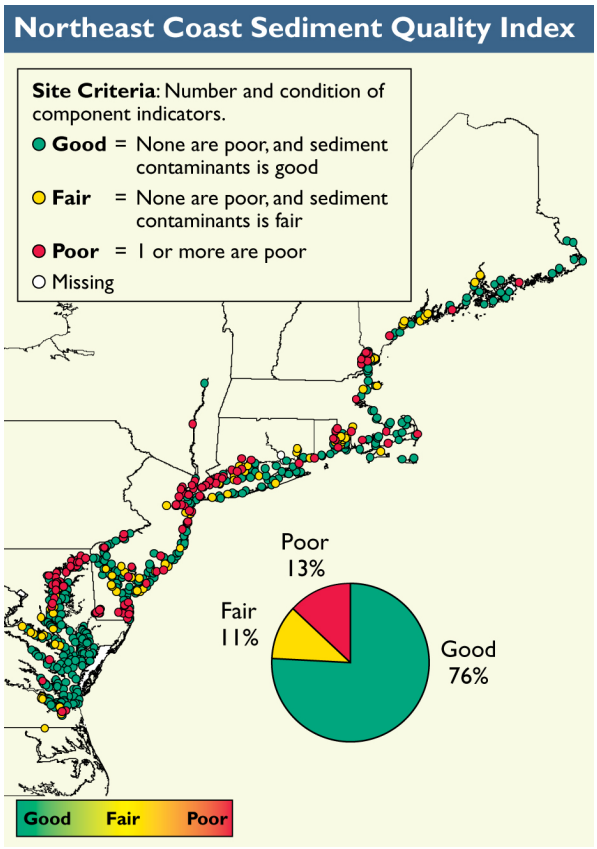

Figure 3.1-1: Sediment Quality Index for the Northeast U.S. Coast
Source: U.S. Environmental Protection Agency (2008b)

Connecticut. Long Island Sound comprises most of the estuarine habitat for Connecticut. In a 2007 study, 45 percent of sediment in the sound was rated good and 32 percent poor. Sampling indicated a trend of decreasing impacts from runoff moving east from New York City. Mecray et al. (2000) found that sediment was enriched two to five times above background levels for silver, calcium, chromium, copper, manganese, lead, and zinc. Compared to a 1977 study, overall trends for silver, cadmium, chromium, copper, and mercury were decreasing, while trends for manganese, nickel, lead, and zinc were increasing.

New York/New Jersey. Sediment in the New York-New Jersey Harbor estuary were rated 30 percent good, 5 percent fair, and 65 percent poor. Issues included elevated concentrations of metals and PCBs. Information for Long Island Sound sediment is presented under Connecticut above. Sediment in Barnegat Bay on the Atlantic coast was rated 81 percent good, 8 percent fair, and 6 percent poor; 5 percent was missing data. No sediment information was collected for Peconic Bay. Information for Delaware Bay is provided below.

Delaware. Sediment in Delaware Bay was rated 65 percent good, 18 percent fair, and 6 percent poor; 11 percent was missing data. The highest levels of sediment contaminants were near Philadelphia and the Maurice River. There may be some point sources for metals, but organic contaminants appear to be primarily from nonpoint sources. Sediment in the inland bays area on the Atlantic coast was rated as 85 percent good and 15 percent poor, mostly due to high levels of total organic carbon. Metals and

organic contaminants in sediment tend to decrease from upper to lower Delaware Bay. Sediment in coastal zones has trace amounts of metals and organic contaminants (Hartwell and Hameedi 2006).

Maryland. Sediment in Maryland's coastal bay area on the Atlantic coast was rated 95 percent good, 4 percent fair, and 1 percent poor. According to the Coastal Bays Report Card (2009), sediment along the Atlantic coast received a grade of C+. Issues of concern are biologically oriented, such as excess nutrients and low dissolved oxygen.

Virginia. Nearly four percent of Virginia's estuaries (87 $mi.^2$ [225 km^2]) are rated as impaired because of contaminated sediment. Several fish consumption advisories were issued because of concerns for mercury and PCBs (Virginia Department of Environmental Quality 2010).

North Carolina. Sediment in the Albemarle-Pamlico Estuarine Complex was rated 93 percent good and 7 percent poor. According to Hackney et al. (1998) "between 37.5 and 75.8 percent of surface sediments in North Carolina's sounds and estuaries were contaminated, and between 19.0 and 36.0 percent were highly contaminated." Contaminants in declining order of frequency were nickel, arsenic, DDT, chromium, PCBs, and mercury. The most contaminated areas were the Neuse and Pamlico Rivers. In general, areas with limited tidal flushing and high river discharge were most contaminated. According to Hyland et al. (2000), 38 percent of the total area of North Carolina estuaries had at least one chemical contaminant present at a concentration in excess of levels at which biological effects can be expected. The most common contaminants in their study were arsenic, mercury, chromium, nickel, pesticides, and PCBs. There were relatively few degraded sites in the open portions of Pamlico Sound and smaller estuaries south of Cape Lookout.

Chesapeake Bay. Major sources of sediment contaminants in Chesapeake Bay are point sources, urban runoff, atmospheric deposition, and spills. The northern portion of the bay, including Baltimore Harbor, Susquehanna Flats, and the Patapsco and Chester Rivers, contain higher levels of contaminants than other areas of the bay farther from development. Sediment samples indicate a decrease in certain polycyclic aromatic hydrocarbons over the past decades, but concentrations are still one to two orders of magnitude above pristine conditions. Sediment in most of the main stem of the bay is relatively uncontaminated; concentrations of PCBs, pesticides, and polycyclic aromatic hydrocarbons are one-tenth lower than sediment in the tributaries. One exception is the Elizabeth River at the southern end of the bay in the more developed areas between Norfolk and Portsmouth (Hartwell and Hameedi 2007).

Note: The Chesapeake Bay watershed includes portions of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia. In order to simplify the discussion and reduce repetition, sediment issues in Chesapeake Bay are not reviewed on a state-by-state basis because: (1) many of the sediment issues are common to most or all of these bordering states; and (2) Navy training and testing activities are limited to the extreme southeast portion of the bay and do not appreciably impact sediment issues in the bay.

3.1.2.1.3 Sediments in the Southeast U.S. Large Marine Ecosystem

Moving south from Cape Hatteras, coastal sediment changes from largely land-based sources to largely marine-based sources. Weathering of sediment in the piedmont and coastal plain provinces in the southeast is mostly chemical; deposition of sediment is mostly by rivers. Sediment farther north was more heavily influenced by mechanical (glacial) processes and glacial deposition. Off the coast of the Carolinas, the calcium carbonate content of sediment is between 5 and 50 percent; this increases to 100 percent on the East Florida Shelf. Sources of calcium carbonate include the shells of molluscs,

echinoderms, barnacles, coralline algae, foraminifera, and ooids, small (0.01 to 0.08 in. [0.25 to 2 mm]) spherical deposits of calcium carbonate (Milliman et al. 1972). Some areas of the continental shelf along the southeast coast have been swept clean of sediment by the Gulf Stream, exposing the underlying bedrock (Riggs et al. 1996). Sediment on the continental shelf off Florida is primarily silt and clay (Milliman et al. 1972).

Hyland et al. (2006) examined the presence of a wide variety of trace metals and persistent organic pollutants in the water and sediment between 1.24 and 47.8 mi. (2 and 77 km) off the Georgia coast. The maximum values found were well below levels of biological effect. Windom et al. (1989) noted that it is not unusual for natural trace metal concentrations in coastal sediment to range over two orders of magnitude, particularly in the southeastern United States. Boehm and Gequejo (1986) noted that sediment hydrocarbons along the southeast coast were less than 10 parts per million in all cases. In a discussion of sediment quality guidelines, MacDonald et al. (1996) noted that Biscayne Bay is contaminated with trace metals, PCBs, polycyclic aromatic hydrocarbons, and pesticides, and that sediment from the St. Johns River had elevated levels of PCBs. Windom et al. (1989) found lead and zinc-contaminated sediment from Biscayne Bay, apparently influenced by discharge from the Miami River.

Existing Sediment Quality Ratings in the Southeast U.S. Continental Shelf Large Marine Ecosystem

States bordering the Southeast U.S. Continental Shelf Large Marine Ecosystem include North Carolina (southeast), South Carolina, Georgia, and Florida (Atlantic coast). See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations. The current quality of sediment in nearshore areas of these states is described below. Figure 3.1-2 depicts those conditions. Overall sediment quality for the coastal areas from North Carolina through the southern tip of Florida rated good. Sediment for 80 percent of this coastal area rated good, 2 percent of coastal areas rated fair, and 12 percent of the area rated poor. No issues related to specific contaminants were noted (U.S. Environmental Protection Agency 2008e). Except where otherwise indicated, information provided below was drawn from the National Estuary Program Coastal Condition Report (U.S. Environmental Protection Agency 2008c).

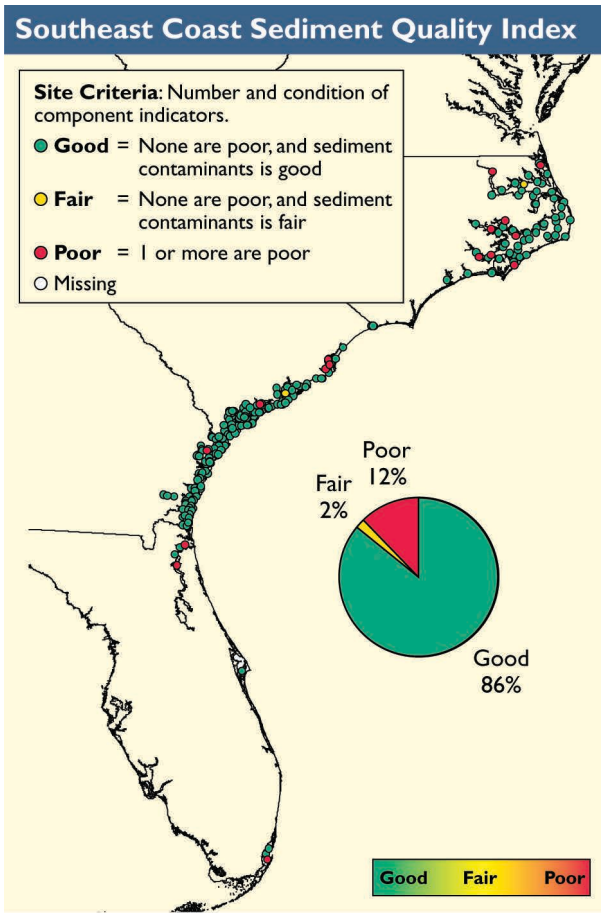

Figure 3.1-2: Sediment Quality Index for the Southeast U.S. Coast
Source: U.S. Environmental Protection Agency (2008b)

North Carolina. Information regarding sediment along the North Carolina coast is provided in Section 3.1.2.1.2 (Sediment in the Northeast United States Large Marine Ecosystem).

South Carolina. Just over four percent of the state's estuarine area (17.3 mi.^{2} [44.8 km^2]) is impaired by metals, mostly by copper, but also nickel and zinc (South Carolina Department of Health and Environmental Control 2008). A recent study found that 33 monitoring points (12 open water, 21 tidal creeks) had at least one contaminant that exceeded concentrations shown to have negative biological effects in 10 percent of published studies. Contaminants included polycylic aromatic hydrocarbons, DDT, and five metals: arsenic, cadmium, copper, lead, and zinc (Van Dolah et al. 2006).

Georgia. Overall, estuarine sediment assessed along the Georgia coast rates 71 percent good, 22 percent fair, and 7 percent poor (Georgia Department of Natural Resources 2010). In terms of toxicity, 97 percent of Georgia's sediment rated good and 2 percent rated poor; 1 percent was missing data. In terms of sediment likely to have negative biological effects, 72 percent rated good, 24 percent rated fair, and 4 percent rated poor. No specific contaminants were indicated. Four mi. (6.4 km) of coastal streams are impaired by mercury and 2 mi. (3.2 km) are impaired by cadmium. Pesticides (in fish tissue) impaired 8 mi. of coastal streams (13 km), and PCBs (in fish tissue) impaired 26 mi. (42 km) of coastal streams (Georgia Department of Natural Resources 2010).

Florida. Sediment in the Indian River Lagoon rated good based on total organic carbon content. Information concerning sediment contaminants and toxicity was not collected. According to the Florida Department of Environmental Protection (2010), estuarine sediment metal concentrations reported above background levels were most often for cadmium, mercury, lead, and zinc. Seventy percent of samples tested for organic chemicals indicated the presence of polycyclic aromatic hydrocarbons. The following metals have impaired estuarine habitat: copper (100 mi.^{2} [259 km^2]), iron (98 mi.^{2} [254 km^2]), nickel (40 mi.^{2} [106.3 km^2]), arsenic (8 mi.^{2} [20.7 km^2]), and lead (7 mi.^{2} [18.1 km^2]). Copper has also impaired 83 mi.^{2} (241 km^2) of coastal waters. A study of sediment in South Florida estuaries by Macauley et al. (2002) also found that elevated concentrations of pesticides were fairly common, but that elevated levels of metals were not.

3.1.2.1.4 Sediment in the Caribbean Sea Large Marine Ecosystem

The Caribbean Sea Large Marine Ecosystem includes offshore marine areas south and southeast of the Florida Keys. Within the Study Area, the majority of the Key West Range Complex is located within this ecosystem. See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations. Sediment in the Straits of Florida consists of 50 to 95 percent carbonate sand, mud, and silt (Cronin 1983). Sediment distribution in shallower areas (less than 1,600 ft. [488 m]) is influenced by tides and the Gulf of Mexico Loop Current; those at intermediate depths are influenced by the eastward-flowing Florida Current; and low-energy, westward-flowing currents dominate in deeper areas (greater than 2,600 ft. [792 m]) (Brooks and Holmes 1990). Western portions of the Straits of Florida are 7,200 ft. [2,190 m] deep. Specific information regarding sediment quality in the Key West Range Complex could not be located. However, contamination of sediment and shellfish by organic and inorganic compounds was low in nearshore areas of Key West (Cantillo et al. 1997).

3.1.2.1.5 Sediment in Gulf of Mexico Large Marine Ecosystem

States bordering the Gulf of Mexico Large Marine Ecosystem include Florida (west coast), Alabama, Mississippi, Louisiana, and Texas. Please see Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations.

The western and central portions of the Gulf of Mexico are dominated by sediment deposition from the Rio Grande and Mississippi River systems, mostly in the form of sandstone and shale (Galloway et al. 2000). DeSoto Canyon, a submarine feature southwest of Pensacola, Florida, marks the transition between the Mississippi River-influenced sediment to the west (Alabama, Mississippi, Louisiana, and Texas) and the carbonate-dominated sediment to the east and south along western Florida (Gearing et al. 1976). The Naval Surface Warfare Center, Panama City Division Testing Range straddles this transition area. Sediment is predominantly carbonate-sand mixture. Carbonate sources include corals, molluscs, and marine microbes. The amount of organic material mixed with the sand generally increases with the distance from shore. Like other deep ocean areas, the central portions of the Gulf of Mexico are dominated by clay-sized particles (less than 0.002 mm).

According to Summers et al. (1996), of the sites in the Gulf of Mexico enriched by three or more metals, 44 percent occur near populated areas and 56 percent occur in agricultural watersheds or the Mississippi River. Many contaminated sites are in watersheds with Superfund sites or are identified by the USEPA National Sediment Inventory as “areas of probable concern” (U.S. Environmental Protection Agency 2008e).

Sediment samples from Pensacola Bay near port facilities were contaminated by lead and zinc (Windom et al. 1989). Lewis et al. (2001) noted that sediment in three bayous of Pensacola Bay contained, on average, as much as 10 times more total heavy metals (e.g., cadmium, copper, and zinc) than sediment collected in Pensacola Bay near the entrance to the bayous. Pesticide concentrations were as much as 45 times greater in the bayou sediment than in those from Pensacola Bay. The authors noted that the bayous were acting as sinks or reservoirs for many contaminants, reducing their transport and availability in Pensacola Bay. The probable source of the contamination was storm water runoff from urbanized watersheds. The authors also indicated that metals and persistent organic pollutant levels in three bayous of Pensacola Bay decreased in a seaward direction.

MacDonald et al. (1996) noted that sediment from Tampa and Pensacola Bays is contaminated with trace metals, PCBs, polycyclic aromatic hydrocarbons, and pesticides; sediment from Choctawhatchee and St. Andrew Bays is contaminated by metals, aromatic hydrocarbons, and pesticides; and sediment from St. Andrew, Apalachicola, Naples, Rookery Bays, and Charlotte Harbor had elevated levels of PCBs. Wade et al. (1988) evaluated coastal sediment at 51 sites in the Gulf of Mexico chosen for their distance from known point sources of polycyclic aromatic hydrocarbons, PCBs, and chlorinated pesticides. The concentrations of the 18 polycyclic aromatic hydrocarbons tested averaged 507 parts per billion (ppb) (range: less than 5 ppb to 36,701 ppb). Eleven percent of all samples had no detectable polycyclic aromatic hydrocarbons. PCB concentrations ranged from less than 5 to 50 ppb, and chlorinated pesticides ranged from less than 0.02 to 5 ppb, with most samples below the limits of detection.

The Gulf of Mexico has several natural hydrocarbon seeps (Kvenvolden and Cooper 2003). In the eastern Gulf of Mexico, Boehm and Gequejo (1986) found that sediment hydrocarbons are mainly marine in origin, although the Gulf Loop Current carries hydrocarbon-laden sediment from the Mississippi River into the area (concentration: 0.4 to 0.5 ppm). West of the Mississippi River, the concentration of hydrocarbons increases in shallow (less than 30 ft. [10 m]) nearshore areas (20 to 70 ppm) and are predominately from man-made sources. Along the Texas coast, sediment hydrocarbon concentrations ranged from 0.5 to 20 ppm; proximity to urban and riverine sources increased the contribution from man-made sources. Farther offshore, hydrocarbons carried on wind as a result of burning fuels were more common.

Existing Sediment Quality Ratings in the Gulf of Mexico Large Marine Ecosystem

Information regarding the current quality of sediment in nearshore areas of the states bordering the Gulf of Mexico Large Marine Ecosystem – Florida, Alabama, Mississippi, Louisiana, and Texas – is provided below. Figure 3.1-3 depicts those conditions. In the Gulf of Mexico – from the southern tip of Florida to the Texas-Mexico border – coastal sediment was generally rated good (79 percent), with 18 percent of the coastal area rated poor because of elevated levels of metals, pesticides, PCBs, and, occasionally, polycyclic aromatic hydrocarbons (U.S. Environmental Protection Agency 2008e). Except where otherwise indicated, information provided below was drawn from the National Estuary Program Coastal Condition Report (U.S. Environmental Protection Agency 2008c).

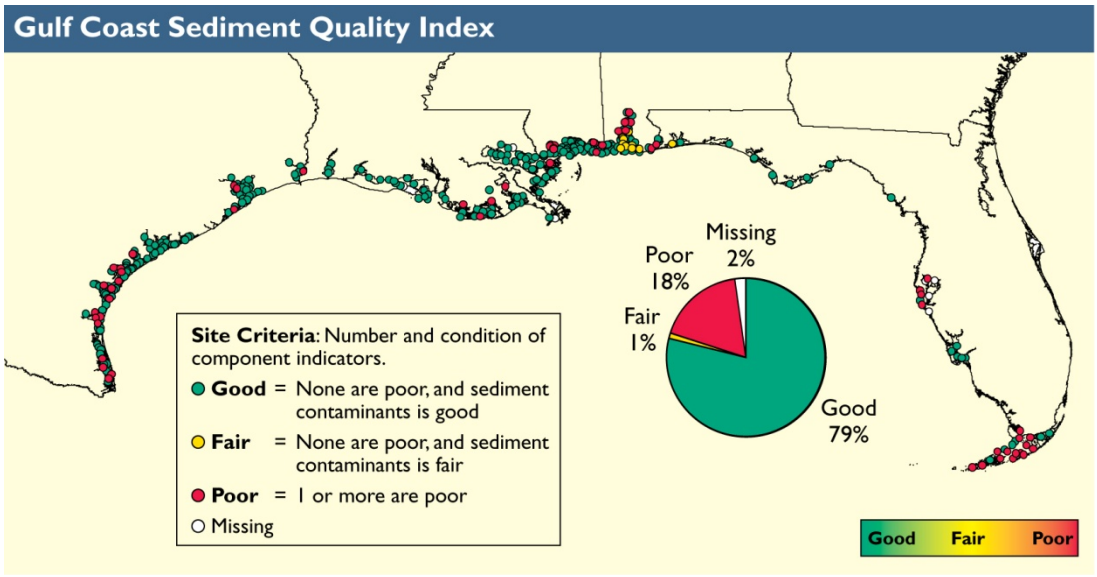

Figure 3.1-3: Sediment Quality Index for the U.S. Gulf Coast
Source: U.S. Environmental Protection Agency (2008b)

Florida. Within the Gulf of Mexico, the National Estuary Program evaluated sediment in Charlotte, Tampa, and Sarasota Bays. Based on low levels of total organic carbon, sediment in each bay rated good. Information concerning sediment contaminants and toxicity was not collected.

Alabama. Mobile Bay, in addition to the sources of polycyclic aromatic hydrocarbons common to a major port, also contains coal burning facilities, natural gas production facilities, and drilling platforms (Peachey 2003). Sediment in Mobile Bay rated 67 percent good, 24 percent fair, and 9 percent poor. No specific contaminants were indicated. Alabama has impaired ocean/estuary habitat due to mercury (201 mi.^{2} [502.6 km^2]) and thallium (94 mi.^{2} [243.5 km^2]) (Alabama Department of Environmental Management 2010). According to Peachey (2003), Mobile Bay and eight related bodies of water were designated as impaired due to high levels of pesticides, persistent organic pollutants, and metals. The Peachey study found that the level of polycyclic aromatic hydrocarbons in bay sediment decreased from the upper bay to the lower bay, and that the main source of the polycyclic aromatic hydrocarbons was burning of fossil fuels.

Mississippi. Most sites sampled along the Mississippi coast indicated good sediment quality. The most recent water quality report for Mississippi did not contain any information regarding marine sediment concerns (Mississippi Department of Environmental Quality 2010).

Louisiana. Sediment in the Terrebonne Estuarine Complex was rated 84 percent good and 12 percent poor; 4 percent was missing data. No specific contaminants were indicated. According to the Louisiana Department of Environmental Quality (2008), mercury impairs 1,657 mi.^{2} (4,291.6 km^2) of estuarine habitat in Louisiana.

Texas. Sediment in Galveston Bay rated 87 percent good and 13 percent poor. For the coastal bend bays areas, 54 percent rated good and 38 percent rated poor; 11 percent was missing data. No specific contaminants were indicated.

***Deepwater Horizon* Oil Spill**

A recent report on the 2010 oil spill in the Gulf of Mexico indicated that 4.9 million barrels of oil were released from the *Deepwater Horizon* well between April and July, 2010 (Lubchenko et al. 2010). Of the oil released, the authors estimated that

- 25 percent was recovered directly at the wellhead or removed by burning and skimming;
- 23 percent naturally evaporated or dissolved;
- 13 percent naturally dispersed;
- 16 percent chemically dispersed; and
- 23 percent "is either on or just below the surface as light sheen and weathered tar balls, has washed ashore or been collected from the shore, or is buried in sand and sediments."

Oil is considered dispersed if it is in droplets less than 100 microns in diameter (about the width of a human hair). Federal agencies, along with academic and independent scientists, continue to monitor and evaluate the fate, transport, and impact of the oil (Lubchenko et al. 2010). Recent visits to deep water habitats indicate oil spill impacts on bottom-dwelling coral communities in the Gulf of Mexico (National Oceanic and Atmospheric Administration 2010).

3.1.2.1.6 Marine Debris, Military Expended Materials, and Sediment

None of the studies of marine debris reviewed for the Atlantic Ocean (i.e., Law et al. 2010; Sheavly 2007; Sheavly 2010) segregated the extent of military expended materials collected, and the studies reviewed reported marine debris, but not their origin. For comparison, Keller et al. (2010) conducted a survey of marine debris collected from the seafloor off the coasts of Washington, Oregon, and California during annual groundfish surveys in 2007 and 2008. This survey focused on marine debris and military expended materials on the ocean floor. Depth of trawling ranged from 180 to 4,200 ft. (55 to 1,280 m), and marine debris was recovered in 469 tows. Categories of marine debris collected included plastic, metal, glass, fabric and fiber, rubber, fishing, and other. Plastic and metallic debris occurred in the greatest number of hauls, followed by fabric and fiber, and glass. The area was within the Navy's west coast training complexes, in which activities occur similar to those in the Proposed Action. Data regarding military expended materials as a component of materials recovered are provided in Table 3.1-5.

Table 3.1-5: Military Expended Materials as Component of All Materials Recovered on the West Coast of the United States, 2007-2008

Category	Count	Percent of Total Count	Weight (kg)	Percent of Total Weight
Plastic	29	7.4	28.3	5.8
Metal	37	6.2	420.3	42.7
Fabric, Fiber	34	13.2	23.3	6.7
Rubber	3	4.7	14.9	6.8

kg: kilogram

Military expended materials with metals included rocket boosters and launchers, and cannon shells. The authors noted that "virtually all" materials identified as military were collected off the coast of Southern California in an area where naval maneuvers are conducted and where permitted military disposal sites are located. No similar study of ocean floor debris and military expended materials was found for the Study Area.

Because they are buoyant, many types of plastic float and may travel thousands of miles in the ocean (U.S. Commission on Ocean Policy 2004). Exceptions include heavy nets and ropes. Because many plastics remain in the water column, additional discussion of marine debris is provided in Section 3.0.5.3.5 (Ingestion Stressors). Although plastics are resistant to degradation, they do gradually break down into smaller particles due to sunlight (photolysis) and mechanical wear (Law et al. 2010). Thompson et al. (2004) found that microscopic particles were common in sediment at 18 beaches around the United Kingdom. They noted that such particles were ingested by small filter and deposit feeders, with unknown effects. The fate of plastics that sink beyond the continental shelf is largely unknown. However, analysis of debris in the center of an area near Bermuda with a high concentration of plastic debris on the surface showed no evidence of plastic as a substantial contributor to debris sinking at depths of 1,650 to 10,500 ft. (500 to 3,200 m) (Law et al. 2010). Marine microbes and fungi are known to degrade biologically produced polyesters, such as polyhydroxyalkanoates, a bacterial carbon and energy source (Doi et al. 1992). Marine microbes also degrade other synthetic polymers, although at slower rates (Shah et al. 2008).

3.1.2.1.7 Climate Change and Sediment

Aspects of climate change that influence sediment include increasing ocean acidity (pH), increasing sea surface water temperatures, and increasing storm activity. Breitbarth et al. (2010) referred to seawater temperature and pH as "master variables for chemical and biological processes," and noted that effects of changes on trace metal biogeochemistry "may be multifaceted and complex." Under more acidic conditions, metals tend to dissociate from particles to which they are bound in sediment, becoming more soluble and potentially more biologically available.

As noted in the beginning of this section, tropical storms can have significant impacts on the resuspension and distribution of bottom sediment (Wren and Leonard 2005). However, no consensus appears to exist on whether climate change will generate more tropical storms or whether those storms will be more intense. If storm frequency and intensity increase, the additional disturbance of sediment may negatively impact water quality in nearshore and coastal areas. A more detailed discussion of this issue is provided in Section 3.1.2.2 (Water Quality).

3.1.2.2 Water Quality

The current state of water quality in the Study Area is discussed below, from nearshore areas to the open ocean and deep sea bottom. Additional information on ocean currents in the Study Area is included in Section 3.0.3 (Ecological Characterization of the Study Area).

3.1.2.2.1 Water Quality in the North Atlantic

The North Atlantic area consists of the West Greenland Shelf, the Newfoundland-Labrador Shelf, and the Scotian Shelf Large Marine Ecosystems, as well as the Labrador Current Open Ocean Area. The area includes the coasts and offshore marine areas southwest of Greenland, east and northeast of Newfoundland and Labrador, and those surrounding Nova Scotia. Although there are no designated range complexes in this region, the area may be used for Navy training and testing activities.

Because of the low population densities and low levels of development, pollution from land-based sources is limited in the North Atlantic area (Aquarone and Adams 2008a, b; Aquarone et al. 2008). However, pollution is increasing from oil and gas development activities (Aquarone and Adams 2008a, b), and concern has been expressed regarding spills, discharges, and contaminants from marine vessels (Aquarone and Adams 2008b).

3.1.2.2.2 Water Quality in the Northeast United States Continental Shelf Large Marine Ecosystem

The Northeast U.S. Continental Shelf Large Marine Ecosystem includes the Northeast and VACAPES Range Complexes and the Naval Undersea Warfare Center Division, Newport Testing Range. The testing range includes waters of Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, and Long Island Sound. See Figure 3.0-2 for the locations of these areas.

Open Ocean Water Quality

Sauer et al. (1989) surveyed the micro-surface layer and subsurface water at five open ocean sites off the Delaware-New Jersey shore for the presence of PCBs and several chlorinated pesticides. Micro-surface layer samples collected contained PCB concentrations between less than 2 and 20 nanograms per liter (ng/L; 2 to 20 parts per trillion [ppt]), and pesticide concentrations between less than 7 and 80 ng/L (7 to 80 ppt). Subsurface water samples contained PCB concentrations between 0.007 and 0.17 ng/L (0.007 to 0.17 ppt), and pesticide concentrations between 0.01 and 0.09 ng/L (0.01 to 0.09 ppt). Wallace et al. (1977) tested surface waters in the northwest Atlantic between Massachusetts and Bermuda. The minimum and maximum ranges of metals found are provided in Table 3.1-6. Units are ng/L, plus or minus the error value.

Table 3.1-6: Particulate Trace Metals Surface Water Concentrations (ng/L) in the Northwest Atlantic Ocean

	Manganese	Iron	Nickel	Chromium	Copper	Zinc	Lead	Cadmium
Minimum	1.2	52	< 0.2	1.4	1.9	1.62	0.84	0.008
Maximum	330	6,800	9.1	21	8.9	75	22	6.0

"<": less than; ng/L: nanograms per liter

In all cases except cadmium, the maximum values were found closest to the shore southeast of Cape Cod. The authors noted that suspended clay minerals and biologically produced particles are important concentrators of trace metals in the marine environment, and that the influence of river-borne suspended sediment extends approximately 1 mi. offshore.

Nearshore Water Quality

States bordering the Northeast U.S. Continental Shelf Large Marine Ecosystem include Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and northeast North Carolina. Information regarding the current quality of marine waters in nearshore areas of these states is provided below. Figure 3.1-4 depicts those conditions.

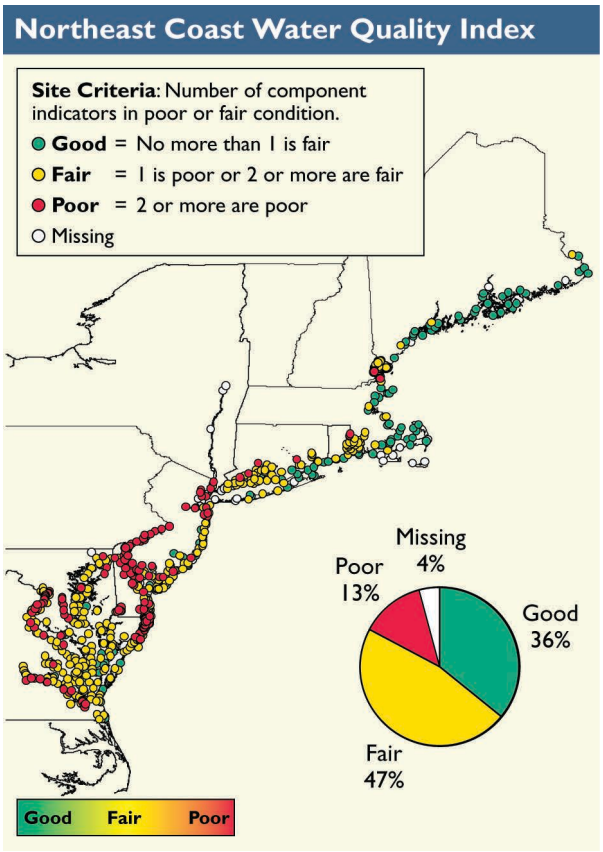

Figure 3.1-4: Water Quality Index for the Northeast United States Coast
Source: U.S. Environmental Protection Agency (2008b)

The USEPA report (2008e) rated the waters along the northeast U.S. coast as fair. Of the sites sampled, 13 percent were in poor condition. Most of these poor sites were concentrated in a few estuarine systems, such as the New York/New Jersey Harbor, Delaware Bay, and Chesapeake Bay. The poor ratings were based on chlorophyll *a* (a measure of turbidity) and low dissolved oxygen. Past and ongoing industrial activities also impact water quality (Aquarone and Adams 2008c). Except where indicated, the following discussion of water quality is drawn from the USEPA (2010).

Maine. Water quality for all the estuaries and bays assessed in Maine is considered impaired, mainly by pathogens (bacteria). All estuarine and marine waters in Maine have an advisory for the consumption of shellfish (lobster tomalley) due to the presence of PCBs and dioxins, presumed to be from atmospheric deposition or prior industrial activity (U.S. Environmental Protection Agency 2008b).

New Hampshire. Water quality for all the estuaries and bays assessed in New Hampshire is considered impaired. Main concerns included dioxin, PCBs, and mercury; nutrients, pathogens, and turbidity were also noted. The entire ocean and nearshore waters assessed were also considered impaired based on similar concerns.

Massachusetts. Water quality for 9.3 percent of estuaries and bays assessed in Massachusetts is considered good and 90.7 percent is considered impaired, mostly by pathogens. Other issues include toxic organics, nutrients, and low dissolved oxygen.

Rhode Island. Water quality for 64.5 percent of estuaries and bays assessed in Rhode Island is considered good and 35.5 percent is considered impaired. The main issues involve low dissolved oxygen, fecal coliform, and excess nutrients (nitrogen).

Connecticut. Water quality for 31.4 percent of estuaries and bays assessed in Connecticut is considered good and 68.6 percent is considered impaired. The main issues involve low dissolved oxygen, eutrophication, and excess nutrients (nitrogen).

New York. Water quality for 42.2 percent of estuaries and bays assessed in New York is considered good and 57.8 percent is considered impaired. The main issues involved PCBs; other issues included total coliform, low dissolved oxygen, cadmium, and excess nutrients (nitrogen).

New Jersey. Water quality for 11.6 percent of estuaries and bays assessed in New Jersey is considered good and 88.4 percent is considered impaired. The main issues involved pesticides, PCBs, low dissolved oxygen, and mercury. The report notes similar concerns for coastal and ocean waters.

Delaware. Water quality for all the estuaries and bays assessed in Delaware is considered impaired. Excess nitrogen, excess phosphorus, and pathogens were issues of almost equal concern.

Maryland. Water quality for 9.8 percent of the state's estuaries and bays is considered good and 90.2 percent is considered impaired. No specific issues were noted. However, (Wazniak et al. 2004) indicate that water quality conditions in Maryland's coastal bays range from generally degraded conditions within or close to tributaries, to better conditions in the bay regions. Most issues are related to excess nutrients. Tributaries generally show poor to very degraded water quality, primarily due to high nutrient inputs, while the open bays have good to excellent water quality. Also, the northern bays are generally in poorer condition than the southern bays due to the extent of development and, to a lesser degree, the extent of flushing that occurs. Areas within the tidal portion of the Potomac River have been placed on the state 303(d) "impaired waters" list because of contamination by PCBs (Interstate Commission on the Potomac River Basin 2008).

Virginia. Water quality for 5.3 percent of estuaries and bays in Virginia is considered good and 94.7 percent is considered impaired. The main issues involve PCBs, noxious aquatic plants, and low dissolved oxygen. Water quality parameters are measured at over 4,000 stations in Virginia's coastal zone. Monitoring data show that 316 coastal water bodies are impaired (Virginia Department of Environmental Quality 2001). Shellfish concerns are related to bacteria, and health advisories have been issued for fish consumption related to PCBs and mercury (Virginia Department of Environmental Quality 2010).

North Carolina. All 322 mi. (518 km) of the North Carolina coastal shoreline are considered impaired. The main issues reported are mercury in fish tissue, as well as selenium at limited locations. Bays and estuaries were not assessed. According to the USEPA (2008c), water quality in the Albemarle-Pamlico Estuarine Complex is rated good. Impairment is primarily the result of runoff from agricultural and urban areas that leads to excess nutrients and increased turbidity from algal blooms.

Chesapeake Bay. Bay water is listed as impaired under Section 303(d) of the federal Clean Water Act due to excess nutrients and sediment (U.S. Geological Society 2005). The most contaminated sites were concentrated at the northern end of the bay, where development is most intensive. Nutrient enrichment in the bay arises from agricultural and other nonpoint source runoff, and municipal and industrial wastewater treatment facilities (U.S. Army Corps of Engineers 2009).

Note: The Chesapeake Bay watershed includes portions of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia. In order to simplify the discussion and reduce repetition, water quality issues in the bay are not reviewed on a state-by-state basis because: (1) many

of the water quality issues are common to most or all of these bordering states; and (2) Navy training and testing activities are limited to the extreme southeast portion of the bay and do not appreciably impact water quality issues in the bay.

3.1.2.2.3 Water Quality in the Southeast U.S. Continental Shelf Large Marine Ecosystem

The Southeast U.S. Continental Shelf Large Marine Ecosystem includes the Navy Cherry Point and JAX Range Complexes, and the South Florida Ocean Measurement Facility Testing Range. See Figure 3.0-3 for the locations of these areas.

Open Ocean Water Quality

Of the large marine ecosystems in the Study Area, the southeast is judged to be in the best ecological condition (Aquarone et al. 2008). Sauer et al. (1989) surveyed the micro-surface layer and subsurface water at five open ocean sites between Cape Hatteras, North Carolina and Florida for the presence of PCBs and several chlorinated pesticides. Micro-surface layer samples collected contained PCB concentrations between less than 0.5 and 1.5 ng/L, and pesticide concentrations between less than 0.5 and 1.0 ng/L. Subsurface water samples contained PCB concentrations between 0.003 and 0.424 ng/L and pesticide concentrations between 0.013 and 0.1 ng/L.

Nearshore Water Quality

States bordering the Southeast U.S. Continental Shelf Large Marine Ecosystem include southeast North Carolina, South Carolina, Georgia, and Florida (Atlantic coast only). Information regarding the current quality of marine waters in the nearshore areas of these states is provided below. Figure 3.1-5 depicts those conditions. The USEPA report (2008e) rated the waters along the southeast coast as fair; 6 percent of the sites sampled rated poor. Except where indicated, the following discussion of water quality is drawn from USEPA (2010).

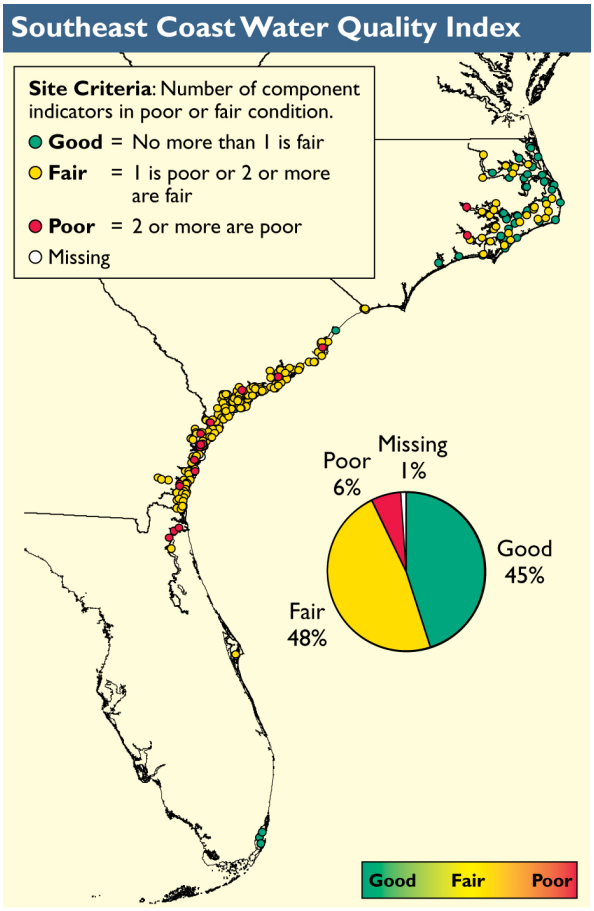

Figure 3.1-5: Water Quality Index for the Southeast U.S. Coast
Source: U.S. Environmental Protection Agency (2008b)

North Carolina. All 322 mi. (518 km) of the North Carolina coastal shoreline are considered impaired. The main issues involved mercury in fish tissue, as well as selenium at limited locations. Bays and estuaries were not assessed. According to Mallin (2000), most estuaries in North Carolina exhibit low-to-moderate eutrophication. However, conditions in three estuaries – the Pamlico River, Neuse River, and New River – were rated as highly eutrophic based on frequency and extent of algal blooms, bottom-water hypoxia and anoxia, fish kills, and loss of submerged aquatic vegetation. According to the USEPA (2008c), water quality in the Albemarle-Pamlico estuarine complex is

rated good. Impairment is primarily the result of runoff from agricultural and urban areas that leads to excess nutrients and increased turbidity from algal blooms.

South Carolina. For South Carolina, water quality for 57.9 percent of estuaries and bays is considered good and 42.1 percent is considered impaired (U.S. Environmental Protection Agency 2008c). Estuaries in South Carolina exhibit low or moderate eutrophication (Mallin et al. 2000). Ocean and near-coastal waters were rated good.

Georgia. Water quality along Georgia's coast is rated fair based on five indicators: dissolved oxygen, dissolved inorganic nitrogen, dissolved inorganic phosphorus, turbidity as measured by chlorophyll *a*, and water clarity. Eighty percent of the state's estuaries rated fair, 18 percent rated poor, and 1 percent rated good. Increasing eutrophication and decreasing water clarity were noted as concerns (Georgia Department of Natural Resources 2005).

Florida. Most of the state's estuaries and all of its coastal waters are considered impaired because of mercury in fish tissue, low dissolved oxygen, turbidity as measured by chlorophyll *a*, fecal coliform, and bacteria in shellfish. Harmful algal blooms and nutrient enrichment are of increasing concern (Florida Department of Environmental Protection 2010). Because Florida is included in both the Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, Florida's gulf coast is discussed below.

3.1.2.2.4 Water Quality in the Caribbean Sea Large Marine Ecosystem

The Caribbean Sea Large Marine Ecosystem includes offshore marine areas south and southeast of the Florida Keys. Within the Study Area, the majority of the Key West Range Complex is located within this ecosystem. See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations. These marine waters are clear and poor in nutrients (Heileman and Mahon 2008). Specific information regarding water quality in the Key West Range Complex could not be located. As with other coastal areas, nearshore water quality is mostly influenced by onshore activities and development, plus the discharge of solid waste and wastewater from commercial and cruise vessels (Heileman and Mahon 2008; Lapointe et al. 1994).

3.1.2.2.5 Water Quality in the Gulf of Mexico Large Marine Ecosystem

The Gulf of Mexico Large Marine Ecosystem includes the GOMEX Range Complex, which consists of four OPAREAs: Panama City, Pensacola, New Orleans, and Corpus Christi. Also within the Gulf of Mexico Large Marine Ecosystem are the Naval Surface Warfare Center, Panama City Division Testing Range (Florida) and a portion of the Key West Range Complex. See Table 3.0-2 for a list of range complexes within each large marine ecosystem, and Figure 3.0-2 for their locations.

Open Ocean Water Quality

Unlike the other areas, no open ocean areas are specifically designated for the Gulf of Mexico. However, Sauer et al. (1989) surveyed the micro-surface layer and subsurface water at six sites in the west central part of the Gulf of Mexico for the presence of PCBs and several chlorinated pesticides. Micro-surface layer samples collected contained PCB concentrations between less than 0.2 and 1.0 ng/L and pesticide concentrations between less than 0.1 and 0.5 ng/L. Subsurface water samples contained PCB concentrations between 0.0006 and 0.0024 ng/L and pesticide concentrations between 0.0002 and 1.46 ng/L.

Nearshore Water Quality

States bordering the Gulf of Mexico Large Marine Ecosystem include Florida (gulf coast only), Alabama, Mississippi, Louisiana, and Texas. Information regarding the current quality of marine waters in the nearshore areas of these states is provided below. Figure 3.1-6 depicts those conditions. The USEPA (2008e) rated the gulf waters as fair. Of the sites sampled, 14 percent rated poor. Various combinations of all the water quality indicators were responsible for poor site conditions. Onshore development, oil and gas extraction, and excess nutrients are the main sources of stress on the Gulf of Mexico (Heileman and Rabalais 2008). Except where indicated, the following discussion of water quality is drawn from USEPA (2010).

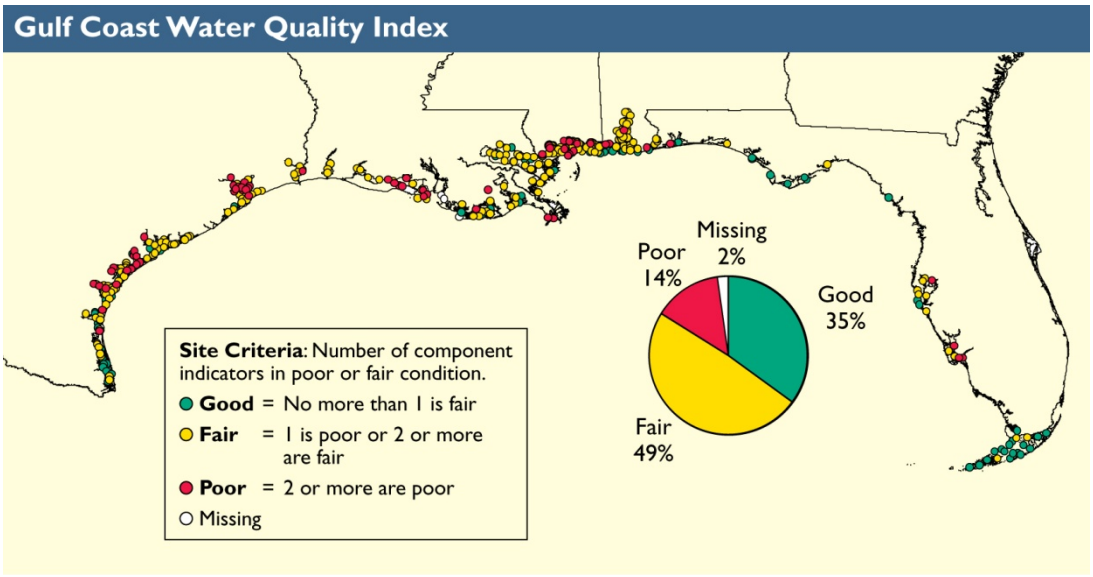

Figure 3.1-6: Water Quality Index for the U.S. Gulf Coast
Source: U.S. Environmental Protection Agency (2008b)

Florida. Most of the state's estuaries and all of its coastal waters are considered impaired because of mercury in fish tissue, bacteria in shellfish, low dissolved oxygen, turbidity as measured by chlorophyll *a*, and fecal coliform. Harmful algal blooms and nutrient enrichment are of increasing concern (Florida Department of Environmental Protection 2010).

Lewis et al. (2001) studied the impacts of urbanization on three areas in Pensacola Bay. Although total metal concentrations varied widely, copper and zinc were most commonly detected in surface waters. Average levels for copper exceeded both the chronic (3.1 µg/L) and acute (4.8 µg/L) exposure levels established to protect marine life. Cadmium, chromium, and nickel were detected in fewer samples but, where detected, concentrations exceeded chronic exposure levels. Concentrations of most chlorinated pesticides, polycyclic aromatic hydrocarbons, and all PCBs were below the limits of detection. The most commonly detected pesticides were diazinon (0.03 to 0.22 µg/L) and atrazine (0.03 to 0.30 µg/L). The authors noted that some pesticides occasionally exceeded the recommended maximum surface water concentration of 0.004 µg/L and that total polycylic aromatic hydrocarbons concentrations at some sites exceeded the recommended annual average of less than or equal to 0.031 µg/L, but these occasions were "uncommon." Petroleum hydrocarbons were detected in surface water collected from several sites, but most commonly in Bayou Grande, where the average concentrations ranged from 1.1 to 8.9 µg/L.

Alabama. Water quality for the estuaries and bays assessed for Alabama rated 15.6 percent as good and 84.4 percent as impaired, mainly by pathogens (fecal bacteria). Ocean and near coastal water quality was rated impaired. The main issue was mercury.

Mississippi. Of the 23 mi. (37 km) of coastal Mississippi shoreline assessed, 62.5 percent rated good and 37.5 percent rated impaired. The main issue was pathogens (fecal bacteria). No information was provided for bays and estuaries. Sampling along the coast indicated degraded water clarity and high phosphorus levels contributed to poor water quality (U.S. Environmental Protection Agency 2008c; 4% missing data).

Louisiana. Clark and Goolsby (2000) studied herbicide concentrations in the Mississippi River at Baton Rouge between 1991 and 1997. Peak herbicide concentrations generally followed peak discharges in late winter or early spring. Herbicides and their metabolites were detected in more than half of the samples (e.g., alachlor, atrazine, metolachlor, deethylatrazine, and cyanazine). No compound exceeded 5 µg/L, and the total herbicide concentration did not exceed 10 µg/L. None of the average annual concentrations of the herbicides examined in that study exceeded maximum contaminant levels or the health advisory levels established at that time.

Water quality for the estuaries and bays in Louisiana was rated as 51.8 percent good and 48.2 percent impaired. The main issues were mercury and fecal coliform.

Texas. Water quality for the estuaries and bays in Texas were rated as 69.2 percent good and 30.8 percent impaired. The main issues were bacteria (in oyster waters) and low dissolved oxygen. Of the coastal shoreline assessed, the issue was bacteria; for ocean and nearshore waters, the issue was mercury in fish.

***Deepwater Horizon* Oil Spill**

An overview of the 2010 oil spill in the Gulf of Mexico from the *Deepwater Horizon* well is provided in Section 3.1.2.1.5 (Sediment in Gulf of Mexico Large Marine Ecosystem).

3.1.2.2.6 Marine Debris and Water Quality

The National Marine Debris Monitoring Program developed three categories of marine debris for its study of the extent of man-made materials in the oceans: land-based, ocean-based, and general, i.e., origin unspecified (Sheavly 2007). Land-based debris may blow in on the wind, be washed in with storm water, arise from recreational use of coastal areas, and be generated by extreme weather such as hurricanes. Ocean-based sources of marine debris include commercial shipping and fishing, private boating, offshore mining and extraction, and legal and illegal dumping at sea. Ocean current patterns, weather and tides, and proximity to urban centers, industrial and recreational areas, shipping lanes, and fishing grounds influence the types and amount of debris found (Sheavly 2010). These materials are concentrated at the surface and in the water column.

According to Sheavly (2010), land-based sources account for about half of marine debris, and ocean/waterway-based sources contribute another 18 percent. Land-based debris included syringes, condoms, metal beverage cans, motor oil containers, balloons, six-pack rings, straws, tampon applicators, and cotton swabs. Ocean-based debris included gloves, plastic sheets, light bulbs and tubes, oil and gas containers, pipe-thread protectors, nets, traps and pots, fishing line, light sticks, rope, salt bags, fish baskets, cruise line logo items, and floats and buoys. General debris included plastic bags, strapping bands, and plastic bottles for beverages, food, cleaners, and other products (Sheavly 2007).

Microscopic plastic fragments enter the marine environment from use as scrubbers in hand cleaning products, abrasive beads for cleaning ships, and deterioration of macroscopic plastics (Teuten et al. 2007). Recent marine debris findings in the Study Area (Sheavly 2007) are provided in Table 3.1-7 below.

Table 3.1-7: Percent Marine Debris by Source in Atlantic Fleet Training and Testing Study Area

Sheavly Study Area	Locations within Study Area	Land-Based (%)	Ocean-Based (%)	General (%)
Region 1 (Provincetown, Massachusetts, to Canadian border)	Northeast Range Complexes	28	42	30
Region 2 (Cape Cod, Massachusetts, to Beaufort, North Carolina)	Northeast and Virginia Capes Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range	63	7	30
Region 3 (Morehead City, North Carolina, to Port Everglades, Florida)	Navy Cherry Point and Jacksonville Range Complexes; Undersea Warfare Training Range	41	14	44
Regions 4 & 5 (Port Everglades, Florida, to Mexican border)	Gulf of Mexico and Key West Range Complexes; Naval Surface Warfare Center, Panama City Division Testing Range	48	16	36

%: percent
Numbers may not sum due to rounding.

In a recent survey of marine debris in the North Atlantic, 62 percent of all net tows contained detectable amounts of plastic debris (Law et al. 2010). The highest concentrations were observed between 22° and 38°N latitude (roughly south of Florida to Maine). Tows closest to land, such as along the Florida coast and in the Gulf of Maine, found relatively small amounts of plastic.

Because of their buoyancy, many types of plastic float and may travel thousands of miles in the ocean (U.S. Commission on Ocean Policy 2004). Exceptions include heavy nets and ropes. Although plastics are resistant to degradation, they do gradually breakdown into smaller particles due to sunlight ("photolysis") and mechanical wear (Law et al. 2010). A study by Teuten et al. (2007) indicated that the water-borne phenanthrene (a type of polycyclic aromatic hydrocarbon) adhered preferentially to small pieces of plastic ingested by a bottom-dwelling marine lugworm and incorporated into its tissue. Marine microbes and fungi are known to degrade biologically produced polyesters, such as polyhydroxyalkanoates, a bacterial carbon and energy source (Doi et al. 1992). Marine microbes also degrade other synthetic polymers, although at slower rates (Shah et al. 2008).

Plastics may serve as vehicles for transport of various pollutants, whether by binding them from seawater or from the constituents of the plastics themselves. Mato et al. (2001) noted that polypropylene resin pellets (precursors to certain manufactured plastics) collected from sites in Japan contained PCBs, dichlorodiphenyldichloroethylene (a breakdown product of DDT), and the persistent organic pollutant nonylphenol (a precursor to certain detergents). PCBs and dichlorodiphenyldichloro-ethylene were adsorbed from seawater. The original source of nonylphenol was less clear; it may have originated from the pellets themselves or may have been adsorbed from the seawater.

3.1.2.2.7 Climate Change and Water Quality

Aspects of climate change that influence water quality include decreasing ocean pH (i.e., more acidic), increasing water temperatures, and increasing storm activity. Changes in pH outside the normal range

can make it difficult for marine animals with shells to maintain those shells (Fabry et al. 2008). Since many creatures are at the base of the marine food chain, such as diatoms and phytoplankton, changes may reverberate through the ecosystem. Warming waters can be detrimental to coastal ecosystems. For example, in waters that are warmer than normal, coral colonies appear to turn white (bleaching) because they expel symbiotic microbes (zooxanthellae) that give them some of their colors. These microbes are important for coral survival because they provide the coral with food and oxygen, while the coral provides shelter, nutrients, and carbon dioxide. Especially when combined with acidification, warmer waters can be detrimental to corals (Anthony et al. 2008). Major coral bleaching events occurred during increased sea water temperatures in 2005–2006 that caused extensive bleaching of corals in Florida and the Caribbean. Water pollution and natural disturbances (e.g., hurricanes) often inflict additional stress on coral ecosystems (Hughes and Connell 1999).

According to the Intergovernmental Panel on Climate Change, there is no clear global trend in the annual numbers of tropical hurricanes (Intergovernmental Panel on Climate Change 2007). However, according to the Pew Center on Global Climate Change, there has been an increase in the frequency of tropical storms and major hurricanes in the North Atlantic. The intensity of tropical storms has also increased, with the strongest trends in the North Atlantic and Indian Oceans (Pew Center on Global Climate Change 2010). The Intergovernmental Panel on Climate Change (2007) and the U.S. Climate Change Science Program (2008) rate as "likely" that future storms will be more intense, with higher peak wind speeds and heavier precipitation. Others disagree with these conclusions. For example, Knutson (2010) contends that, although there is a recent trend of more tropical storms, there is a declining trend for land-falling hurricanes. From 1850 to 1990, the long-term average number of tropical storms per year in the North Atlantic and Gulf of Mexico was about 10, about half of which were hurricanes. For the period 1998–2007, the average is about 15 tropical storms per year (Blake et al. 2007). These authors noted that "this increase in frequency correlates strongly with the rise in North Atlantic sea surface temperature," a rise that is linked to climate change. If storm frequency and intensity increase, there would be a resulting increase in marine sediment disturbance (Wren and Leonard 2005) resulting in a decline in nearshore and coastal area water quality.

3.1.3 Environmental Consequences

This section evaluates how and to what degree the training and testing activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially could impact sediment and water quality in the Study Area. Tables 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Each sediments and water quality stressor is introduced, analyzed by alternative, and analyzed for training and testing activities. Potential impacts could be associated with

- the release of materials into the water that subsequently disperse, react with seawater, or may dissolve over time;
- the deposition of materials on the ocean bottom and any subsequent interactions with sediment or the accumulation of such materials over time;
- the deposition of materials or substances on the ocean bottom and any subsequent interaction with the water column; and
- the deposition of materials on the ocean bottom and any subsequent disturbance of that sediment or the creation of turbidity.

These potential impacts are categorized into four stressors: (1) explosives and explosion byproducts; (2) metals; (3) chemicals other than explosives; and (4) a miscellaneous category of other materials. The

term “stressor” is used because materials in these four categories may directly impact sediment and water quality by altering their physical and chemical characteristics.

The area of analysis for sediment and water quality includes the estuaries, nearshore areas, and the open ocean (including the sea bottom) in the western Atlantic Ocean and Gulf of Mexico. Sediment and marine waters within territorial and nonterritorial waters along the east coast and Gulf of Mexico would be similar in terms of their reactions to military expended materials. For instance, extremely small sediment size is a major determinant of how metals behave in sediment, and sediment size would be similar at a given distance from shore. Thus, potential impacts on sediment and water quality from military expended materials that come to rest in sediment at a given distance from shore are assumed to be similar whether off the east coast or the Gulf of Mexico.

3.1.3.1 Explosives and Explosion Byproducts

3.1.3.1.1 Introduction

Explosives are complex chemical mixtures that may negatively impact sediment and water quality through the byproducts of their detonation in water and the distribution of unconsumed explosives in sediment and the water column. The use of explosives may also disturb sediment, increasing turbidity. Underwater explosions resuspend sediment into the water column, creating a turbidity plume. However, these turbidity impacts are not considered substantial because, depending on specific site conditions of wind and tidal currents, the turbidity plume eventually dissipates as particles return to the bottom or are dispersed. Therefore, this issue is not considered further.

The proposed alternatives involve the use of three main categories of explosives:

- Nitroaromatics such as trinitrotoluene (TNT), ammonium picrate, and tetryl (methyl-2,4,6-trinitrophenyl-nitramine);
- Nitramines such as royal demolition explosive (RDX or hexahydro-1,3,5-trinitro-1,3,5-triazine) and high melting explosive (HMX or octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine); and
- Nitrate esters, such as pentaerythritol tetranitrate.

The explosives TNT, royal demolition explosive, and high melting explosive are components of bombs, missile and rocket fuels, warheads, torpedoes, sonobuoys, medium- and large-caliber munitions, and charges used in a variety of activities, such as mine countermeasure and mine neutralization activities (Clausen et al. 2007). Pentaerythritol tetranitrate (PETN) is most commonly used in blasting caps, detonation cord, and other initiators of explosions. Chemical stressors other than explosives are discussed in Section 3.1.3.3 (Chemicals Other than Explosives).

During their detonation, energetic compounds may undergo high-order detonation, low-order detonation, or may fail to detonate. High-order (complete) detonations consume 98 to 99 percent of the explosive, with the remainder released into the environment as discrete particles. Low-order (incomplete) detonations consume a lower percentage of the explosive and release larger amounts of explosives into the environment. If the ordnance fails to detonate, the energetic compound may be released to the environment over time if corrosion of the shell occurs. For the remainder of this discussion, the term “explosives” is used to refer to unconsumed explosives remaining after low-order detonations and detonation failures. The term “explosion byproducts” is used to refer to the liquids and gases that remain after detonation of explosives. The remainder of Section 3.1.3.1 discusses explosives and explosion byproducts.

- Sections 3.1.3.1.2 and 3.1.3.1.3 provide more detail concerning explosives and explosion byproducts as well as the estimated rates at which munitions do not perform as expected;
- Section 3.1.3.1.4 describes how explosives and explosion byproducts will be evaluated under each alternative;
- Section 3.1.3.1.5 reviews information regarding the behavior and potential negative impacts of explosives and explosion byproducts on sediment and water quality; and
- Section 3.1.3.1.6 evaluates each alternative in terms of the information provided in Sections 3.1.3.1.4 and 3.1.3.1.5.

Explosions that occur above or at the surface are assumed to distribute nearly all explosion byproducts into the air, rather than into the water. These impacts are discussed in Section 3.2 (Air Quality). This analysis concerns only those explosions that occur underwater. It should also be noted that military expended materials that explode in the air or at the water surface may deposit particles of unconsumed explosives in the marine environment. These materials are addressed in Section 3.1.3.3.5 (Other Chemicals Associated with Ordnance) which deals with unconsumed explosives.

3.1.3.1.2 Background

Under the Proposed Action, explosions would occur: (1) above the surface of the water, at the water surface, or just beneath the water surface in those warfare areas that use bombs, medium- and large-caliber projectiles, missiles, and rockets; and (2) underwater during mine countermeasure and mine neutralization activities, ship shock trials, explosives testing, and use of torpedoes, explosive sonobuoys and percussion grenades. Mine countermeasure and neutralization activities occur beneath the surface and on or near the bottom, typically in fairly shallow areas. Charges range in size from 2 to 60 lb. (0.9 to 27.2 kg) net explosive weight. Ship shock trials occur in deeper waters (at least 600 ft. [183 m]) and involve charges ranging from 1,000 to 58,000 lb. (454 to 26,310 kg) net explosive weight. Detonations occur about 200 ft. (61 m) below the surface and at varying distances from the vessel (U.S. Department of the Navy 2008a).

Mine countermeasure and mine neutralization activities most often involve the explosive composition 4 (C-4). C-4 is composed of about 95 percent royal demolition explosive mixed with polyisobutylene, a plastic binding material. When functioning properly (i.e., complete detonation), 99.997 percent of the explosive is converted to inorganic compounds (Renner and Short 1980; U.S. Army Corps of Engineers 2003). Table 3.1-8 below details the byproducts of underwater detonation of C-4 (95 percent RDX).

Table 3.1-8: Byproducts of Underwater Detonation of C-4

Byproduct	Percent of Total, by Weight	Byproducts	Percent of Total, by Weight
Nitrogen	37.0	Propane	0.2
Carbon dioxide	24.9	Methane	0.2
Water	16.4	Hydrogen cyanide	< 0.01
Carbon monoxide	18.4	Methyl alcohol	< 0.01
Ethane	1.6	Formaldehyde	< 0.01
Ammonia	0.9	Other compounds	< 0.01
Hydrogen	0.3		

"<": less than.

From Table 3.1-8, nitrogen, carbon dioxide, water, carbon monoxide, ammonia, and hydrogen are natural components of seawater and represent 98 percent of all byproducts produced from the detonation of royal demolition explosive.

Ship shock trial charges use high blast explosive (HBX-1), which consists of the following components (by weight): cyclotrimethylene trinitramine (39.3 percent), TNT (37.8 percent), aluminum powder (17.1 percent), wax (4.6 percent), and miscellaneous fillers (1.3 percent). Table 3.1-9 below details the byproducts of underwater detonation of a high blast explosive (U.S. Department of the Navy 2008a). No explosion byproducts exceeded permissible concentrations (U.S. Environmental Protection Agency 1986).

Table 3.1-9: Byproducts of Underwater Detonation of High Blast Explosive

Byproduct	Predicted Concentration (mg/L)	Permissible Concentration (mg/L)
Aluminum oxide	0.434	N/A
Carbon	0.143	N/A
Carbon monoxide	0.0293	0.552
Ethane	0.00469	120
Carbon dioxide	0.00262	1.0
Ammonia	0.00230	0.092
Propane	0.00135	120
Hydrogen cyanide	0.000298	0.001
Methane	0.000126	120
Other compounds*	< 0.0001	—

Source: U.S. Environmental Protection Agency 1986
* Other compounds include methyl alcohol, formaldehyde, acetylene, and phosphine. Predicted concentrations were well below permissible concentrations.
"<": less than; mg/L: milligrams per liter.

3.1.3.1.3 Ordnance Failure and Low-Order Detonations

Table 3.1-10 provides information about the rates of failure and low-order detonations for high-explosives and other munitions (Rand Corporation 2005; U.S. Army Corps of Engineers 2007).

Table 3.1-10: Failure Rates and Low-Order Detonation Rates of Military Ordnance

Ordnance	Failure Rate (Percent)	Low-Order Detonation Rate (Percent)
Guns/artillery	4.68	0.16
Hand grenades	1.78	—
High explosive ordnance	3.37	0.09
Rockets	3.84	—
Submunitions*	8.23	—

* Submunitions are munitions contained within and distributed by another device such as a rocket.

3.1.3.1.4 Approach to Analysis

Most activities involving explosives and explosion byproducts would be conducted more than 3 nm off shore in each range complex and testing range. Activities in these areas (3 nm to 200 nm) would be subject to federal sediment and water quality standards and guidelines. This includes mine countermeasure and mine neutralization activities conducted in Warning Area 50 (W-50) in the VACAPES Range Complex (Virginia). (Note: Proposed training and testing activities also occur beyond 200 nm, but U.S. legal and regulatory authority does not extend beyond 200 nm. In such cases, impacts will be judged against federal standards and guidelines.)

Explosives are also used in nearshore areas (low tide line to 3 nm) specifically designated for mine countermeasure and mine neutralization activities. Such activities are conducted in the following areas: Joint Expeditionary Base Little Creek-Fort Story, VACAPES (Virginia, North Carolina); Onslow Bay in the Navy Cherry Point Range Complex (North Carolina); the Charleston OPAREA in the JAX Range Complex (North and South Carolina); and the Naval Surface Warfare Center, Panama City Division Testing Range (Florida). These activities would be subject to state sediment and water quality standards and guidelines.

For explosion byproducts, "local" refers to the water column in the vicinity of the underwater detonation. For unconsumed explosives, "local" refers to the area of potential impact from explosives in a zone of sediment about 66 inches (2 m) in diameter around the unconsumed explosive where it comes to rest on the sea floor.

State standards and guidelines. Table 3.1-11 below summarizes existing state standards and guidelines for sediment and water quality related to explosives and explosion byproducts.

Table 3.1-11: State Water Quality Criteria for Explosives and Explosion Byproducts

State	Explosives, Explosion Byproducts	Criteria (µg/L)	Source
Florida	Cyanide	≤ 1.0	Florida 1994, 2010b
Georgia	Cyanide	1.0	Georgia 2010
	2,4-dinitrotoluene	3.4	
North Carolina	Cyanide	1.0	North Carolina 2007
Virginia*	Cyanide	1.0 (chronic/acute)	Virginia 2011
	2,4-dinitrotoluene	≤ 9.1 annual average	

* "Acute" criteria reflect a one-hour average concentration not to be exceeded more than once every three years on average. "Chronic" criteria reflect a four-day average concentration not to be exceeded more than once every three years on average. "≤" means less than or equal to. µg/L: micrograms per liter.

Federal standards and guidelines. Table 3.1-12 summarizes the USEPA (U.S. Environmental Protection Agency 2009) criteria for explosives and explosion byproducts in saltwater.

Table 3.1-12: Federal Criteria for Explosives and Explosion Byproducts in Saltwater

Explosives, Explosion Byproducts	Criterion Maximum Concentration (µg/L)	Criterion Continuous Concentration (µg/L)
Cyanide	1	1

"Criteria maximum concentration" is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. "Criterion continuous concentration" is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. µg/L: micrograms per liter.

3.1.3.1.5 Impacts from Explosives and Explosion Byproducts

As recently as 2004, Zhao et al. (2004) reported that little data are available on the fate and degradation of unconsumed explosives in sediment. In 2007, Cruz-Uribe et al. (2007) noted that "contamination of the marine environment by munitions constituents is not well documented," and Montgomery et al. (2008) noted that there is "little published information on TNT degradation in seawater or sediments aside from the work of Carr and Nipper (2003)." Still, Zhao et al. (2004) noted that leaching of unconsumed explosives is considered a major source of sediment contamination in seas and waterways, and that contaminants can subsequently move from the sediment and accumulate in aquatic organisms. According to Nipper et al. (2002), their studies of Puget Sound sediment demonstrate "that the studied ordnance compounds were not a cause for environmental concern in the levels previously measured in sediments." The studied compounds included 2,6-dinitrotoluene, tetryl, and picric acid. They remarked that the "levels of ordnance compounds that would be of concern in sediments have not yet been identified."

The behavior of explosives and explosion byproducts in marine environments—and the extent to which those constituents have negative impacts—is influenced by various processes, including the ease with which the explosive dissolves in water (solubility), the degree to which explosives are attracted to other materials in the water (e.g., clay-sized particles and organic matter; sorption), and the tendency of the explosives to evaporate (volatilization). These characteristics, in turn, influence the extent to which the material is subject to biotic (biological) and abiotic (physical and chemical) transformation, degradation, and bioaccumulation (Pennington and Brannon 2002). The solubility of various explosives is provided in Table 3.1-13. In the table, higher numbers mean that the substance is more soluble in water. For instance, high melting explosive is virtually insoluble in water. Table salt, which dissolves easily in water, is provided for comparison.

Table 3.1-13: Water Solubility of Common Explosives and Explosive Degradation Products

Compound[1]	Water Solubility[2]
Table salt (sodium chloride)	357,000
Ammonium perchlorate (D)	249,000
Picric acid (E)	12,820
Nitrobenzene (D)	1,900
Dinitrobenzene (E)	500
Trinitrobenzene (E)	335
Dinitrotoluene (D)	160–161
TNT (E)	130
Tetryl (E)	51
Pentaerythritol tetranitrate (E)	43
Royal demolition explosive (E)	38
High melting explosive (E)	7

Source: U.S. Department of the Navy (2008a)

[1] "E" refers to explosive; "D" refers to explosive degradation product.

[2] Units are milligrams per liter (mg/L) at 20°C.

TNT: trinitrotoluene

Solubility rates were not affected by pH, but they increase as temperature increases (Lynch et al. 2002). Explosives proposed for use under the alternatives have low solubilities as shown in Table 3.1-13 and would dissolve slowly over time. Thus they are not very mobile within marine environments (Juhasz and Naidu 2007). Nitroaromatics such as TNT do not bind to metal hydroxides but may bind to clays, depending on the type (more so with potassium or ammonia ions but "negligibly small" for clays with ions of sodium, calcium, magnesium, and aluminum). Sorption by nitroamines such as royal demolition explosive is "very low" (Haderlein et al. 1996).

According to Walker et al. (2006), TNT, royal demolition explosive, and high melting explosive experience rapid biological and photochemical degradation in marine systems. The authors noted that productivity in marine and estuarine systems is largely controlled by the limited availability of nitrogen. Because nitrogen is a key component of explosives, explosives are attractive as substrates for marine bacteria that metabolize other naturally occurring organic matter, such as polycyclic aromatic hydrocarbons. Juhasz and Naidu (2007) also noted that microbes use explosives as sources of carbon and energy.

Carr and Nipper (2003) indicated that conversion of TNT to carbon dioxide, methane, and nitrates in coastal sediment (a process referred to as "mineralization") occurred at rates typical for naturally occurring compounds such as phenanthrene, fluoranthene, toluene, and naphthalene. They noted that transformation of 2,6-dinitrotoluene and picric acid by organisms in sediment is dependent on temperature and type of sediment (i.e., finer-grained). Pavlostathis and Jackson (2002) reported the uptake and metabolism of TNT by the marine microalgae *Anabaena* sp. Nipper et al. (2002) noted that enhanced degradation of 2,6-dinitrotoluene, tetryl, and picric acid occurred in fine-grained sediment high in organic carbon. Cruz-Uribe et al. (2007) noted that three species of marine macroalgae metabolize TNT to 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene, and they speculate that "the ability of marine macroalgae to metabolize…TNT is widespread, if not generic."

Singh et al. (2009) indicated that biodegradation of royal demolition explosive and high melting explosive occurs with oxygen (aerobic) and without (anoxic or anaerobic), but that they more easily degraded under the latter conditions. Crocker et al. (2006) indicated that the mechanism of high melting explosive and royal demolition explosive biodegradation are similar, but degradation of high melting explosive occurs more slowly. Singh et al. (2009) noted that royal demolition explosive and high melting explosive are biodegraded under a variety of anaerobic conditions by specific microbial species and by mixtures ("consortia") of such species. Work by Zhao et al. (2004) indicated that biodegradation of royal demolition explosive and high melting explosive occurs in cold marine sediment.

According to Singh et al. (2009), typical end products of royal demolition explosive degradation include nitrite , nitrous oxide, nitrogen, ammonia, formaldehyde, formic acid , and carbon dioxide. Crocker et al. (2006) stated that many of the primary and secondary intermediate compounds from biodegradation of royal demolition explosive and high melting explosive are unstable in water and spontaneously decompose. Thus, these explosives are degraded by a combination of biotic and abiotic reactions. Formaldehyde is subsequently metabolized to formic acid, methanol, carbon dioxide, or methane by various microorganisms (Crocker et al. 2006).

According to Juhasz and Naidu (2007), TNT, royal demolition explosive, and high melting explosive also degrade from photolysis (exposure to light) and hydrolysis (exposure to water). The byproducts of TNT photolysis include nitrobenzenes, benzaldehydes, azoxydicarboxylic acids, and nitrophenols. The byproducts of royal demolition explosive and high melting explosive photolysis include azoxy

compounds, ammonia, formaldehyde, nitrate, nitrite, nitrous oxide, and *N*-nitroso-methylenediamine (Juhasz and Naidu 2007). Walker et al. (2006) speculated that degradation of TNT "below the photic (light) zone in coastal waters and sediments may be largely controlled by metabolism by heterotrophic bacteria." According to Monteil-Rivera et al. (2008), at the pH common in marine environments (i.e., 8), there should be a "slow but significant removal" of royal demolition explosive and high melting explosive due to alkaline hydrolysis. Under such conditions, and absent biodegradation, royal demolition explosive would take over 100 years to hydrolyze, while high melting explosive would require more than 2,100 years (Monteil-Rivera et al. 2008).

Detection and Fate of Unexploded Ordnance in Marine Environments

Most studies of unexploded ordnance in marine environments have not detected explosives or have detected them in the range of parts per billion. Studies examining the impact of ordnance on marine organisms have produced mixed results. More information regarding these studies is provided below. The amount and concentration of ordnance deposited in the areas studied were far in excess of those that would occur under the Proposed Action.

Several authors studied the impact of unexploded ordnance in Halifax Harbor, Nova Scotia, Canada. Rodacy et al. (2000) noted that munitions explosions in 1917 and 1946 scattered ordnance across an area known as the Bedford Basin. Resulting ordnance was both fully exposed on and partially buried in the sea floor. They reported that 34 of 59 water samples (58 percent) "produced detectable signatures" of ordnance, as did 26 of 27 sediment samples (96 percent). They also noted that marine growth was observed on most of the exposed ordnance, and that TNT metabolites were present and suspected as the result of biological decomposition. In a prior study (Durrach et al. 1998), sediment collected near unexploded, but broken, ordnance did not indicate the presence of TNT, but samples near ordnance targets that appeared intact showed trace explosives in the range of low parts per billion or high parts per trillion. The sampling distance was 6 to 12 inches (0.15 to 0.3 m) from the munitions. The authors expressed the opinion that, after 50 years, the contents of broken munitions had dissolved, reacted, biodegraded, or photodegraded, and that intact munitions appear to be slowly releasing their contents through corrosion pinholes or screw threads.

A study was conducted on chemical and conventional munitions disposed on the ocean floor approximately 5 mi. (8 km) south of Pearl Harbor, Hawaii (Hawaii Undersea Military Munitions Assessment 2010). Documents indicate that, following World War II (October-November 1944), sixteen thousand 100 lb. (45 kg), mustard-filled bombs may have been disposed in this area. The state of deterioration of the munitions ranged from "nearly intact to almost completely disintegrated." The authors collected 94 sediment samples and 30 water samples from 27 stations at five locations. These were analyzed for chemical agents, explosives, metals (arsenic, copper, lead, and zinc), polycyclic aromatic hydrocarbons, pesticides, PCBs, phenols, and organic tin. There were no confirmed detections of chemical agents or explosives, and comparisons between the disposal site and reference sites showed no statistically significant differences in levels of munitions constituents, chemical agents, and metals. However, the sampling distance for this project was 3 to 6 ft. (1 to 2 m). The authors compared their sampling distance to that used by Durrach et al. (1998), that is, 6 to 12 inches (0.15 to 0.3 m). Regarding that difference, they indicated the project sampling distance may be too far to detect any chemical agents or explosives and that sampling distance may be a significant factor determining whether munitions constituents can be detected near discarded munitions. Samples with elevated metals relative to typical deep-sea sediment were "most likely" the result of dumping sediment dredged from Oahu harbors.

Hoffsommer et al. (1972) analyzed seawater and ocean floor sediment and fauna at known ocean dumping sites for military ordnance. The sites were 85 mi. (137 km) west of Cape Flattery, Washington, and 172 mi. (277 km) south-southeast of Charleston, South Carolina. Samples were tested for TNT, royal demolition explosive, tetryl, and ammonium perchlorate. None of these materials were detected in any of the samples. Detection limits were in parts per trillion. Walker et al. (2006) sampled seawater and sediment at two offshore sites where underwater demolition had been performed using 10-lb. (4.5-kg) charges of TNT and royal demolition explosive. Both explosives were below the detection limit in seawater, including samples collected in the detonation plume within five minutes of detonation.

According to Fisheries Research Services Report (1996), over one million tons of chemical and conventional munitions were disposed of at Beaufort's Dyke, a trench in the North Channel between Scotland and Ireland. The trench is more than 30 mi. (50 km) long and 2 mi. (3.5 km) wide. The average density of munitions is about 2,225 tons per $mi.^2$ (5,700 tons per km^2). Seabed sediment samples were obtained from 105 sites. Sampling distance from the munitions was not noted. Sediment sampling results did not find detectable concentrations of the explosives nitroglycerine, TNT, royal demolition explosive, or tetryl, and analysis of metals indicated that levels within the survey area were within the ranges reported from other Scottish coastal areas.

Nipper et al. (2002) studied the impact of the explosives 2,6-dinitrotoluene, tetryl, and picric acid in sediment in Puget Sound. They noted that the levels measured did not account for the sediment's toxicity. Test subjects and processes included small marine crustaceans (amphipods), marine segmented worms (polychaetes), macro-algae germination and growth, and sea urchin embryo development. The authors suggested that the degradation products of the explosives rather than the explosives themselves may be responsible. They acknowledged that the "persistence of such degradation compounds in marine environments is not known."

An underwater explosion deposits a fraction of the chemical products of the reaction in the water in a roughly circular surface pool that moves with the current (Young and Willey 1977). In a land-based study, Pennington et al. (2006) noted that data demonstrate that high explosives in the main charge of howitzer rounds, mortar rounds, and hand grenades are efficiently consumed (on average 99.997 percent or more) during live-fire operations that result in high-order detonations. The explosives not consumed during these detonations are spread over an area that would, on average, contribute 10 µg/kg per detonation or less to the ground surface. However, the applicability of the study by Pennington et al. (2006) to underwater marine systems remains uncertain.

Table 3.1-14 provides: (1) the amount of explosive remaining after underwater detonation of 5-lb. (2.26-kg) and 20-lb. (9-kg) charges of C-4; and (2) the volume of water required to meet the Department of Defense Range and Munitions Use working group marine screening value for the amount of C-4 remaining after detonation. A 5-lb. block of C-4 contains 4.6 lb. (2.06 kg) of royal demolition explosive; a 20-lb. block contains 18.2 lb. (8.24 kg) of royal demolition explosive (U.S. Department of the Navy 2010b).

Pennington et al. (2006) assumed that 0.02 percent of royal demolition explosive residue remained after detonation. The failure rate is zero for C-4 because, during mine countermeasure and mine neutralization activities, personnel do not leave any undetonated C-4 on range at the end of training.

Table 3.1-14: Volume of Water Needed to Meet Marine Screening Value for Royal Demolition Explosive

Screening Value for Ecological Marine Surface Water	5-Pound (2.26 kg) Charge		20-Pound (9 kg) Charge	
	Amount of Royal Demolition Explosive Remaining after Detonation	Attenuation Needed to Meet Screening Value	Amount of Royal Demolition Explosive Remaining after Detonation	Attenuation Needed to Meet Screening Value
5,000 µg/L	0.01 ounce (0.41 gram)	22 gallons (82.6 liters)	0.06 ounce (1.65 grams)	87 gallons (330 liters)

kg: kilogram; µg/L: micrograms per liter

The amount of pentaerythritol tetranitrate in detonation cord associated with any underwater detonation event is low (approximately 13.4 ounces [381 grams]). Assuming five percent is not consumed in the detonation, 0.7 ounce (19 grams) of pentaerythritol tetranitrate would be present. This amount would attenuate to a level below the Department of Defense Range and Munitions Use working group benchmark risk screening value for marine surface water in 60 gallons (227 liters) of water (U.S. Department of the Navy 2010b).

3.1.3.1.6 Evaluation of Alternatives

Table 3.1-15 summarizes the types and amounts of high-explosive military expended materials proposed under all alternatives. Numbers represent amounts expended annually, except for ship shock trials. Explosives used for ship shock trials reflect use over a five-year period. The types and amounts of expended materials in the table were drawn from the tables in Chapter 2 (Description of Proposed Action and Alternatives).

In most instances, explosive bombs, projectiles, missiles, and rockets detonate above the surface of the water, at the water surface, or just beneath the surface. Underwater detonations always occur during ship shock trials, mine countermeasure and mine neutralization training and testing, explosives testing, and during the use of explosive torpedoes, percussion grenades, and explosive sonobuoys.

The following sections evaluate each alternative in terms of the information provided in Sections 3.1.3.1.4 (Approach to Analysis) and 3.1.3.1.5 (Impacts from Explosives and Explosion Byproducts). Potential impacts on sediment and water quality from explosives and explosion byproducts should be viewed in the following context: (1) nearshore sediment and water quality in many areas are negatively impacted, both by historical and ongoing activities; and (2) the majority of those impacts are from human-generated, land-based activities.

3.1.3.1.6.1 No Action Alternative

Under the No Action Alternative, training and testing with explosives would involve 1,691 events. Numerically, large-caliber explosive projectiles and explosive sonobuoys represent 84 percent of the high-explosive items expended during those events. Charge sizes for these projectiles range from 0.6 to 10 lb. (0.3 to 4.5 kg). For comparison, charges in sonobuoys range from 2.6 to 5 lb. (1.2 to 2.3 kg), charges in missiles proposed for use range from 2.5 to 488 lb. (1.1 to 221 kg), charges in mine neutralization range from 0.25 to 20 lb. (0.1 to 9 kg) and may include the use of an explosive mine (650 lb., 295 kg), and charges in bombs range from 250 to 1,000 lb. (113 to 454 kg).

Table 3.1-15: High-Explosive Military Expended Materials – All Alternatives Annually

Type of Military Expended Material	No Action Alternative	Alternative 1	Alternative 2
Torpedoes			
Training	1	1	1
Testing	8	8	8
Total	9	9	9
Sonobuoys			
Training	1,770	1,978	1,978
Testing	956	2,988	3,996
Total	2,726	4,966	5,974
Neutralizers			
Training	30	92	92
Testing	130	323	362
Total	160	415	454
Anti-Swimmer Grenades			
Training	100	206	206
Testing	0	0	0
Total	100	206	206
Bombs			
Training	25	133	133
Testing	0	0	0
Total	25	133	133
Rockets			
Training	0	7,980	7,980
Testing	0	368	404
Total	0	8,348	8,384
Missiles			
Training	321	490	490
Testing	10	141	148
Total	331	631	638
Large-Caliber Projectiles			
Training	2,026	13,038	13,038
Testing	0	6,435	7,425
Total	2,026	19,473	20,463
Medium-Caliber Projectiles			
Training	0	123,954	123,954
Testing	0	23,400	26,100
Total	0	147,354	150,054

Table 3.1-15: High-Explosive Military Expended Materials – All Alternatives Annually (Continued)

Type of Military Expended Material	No Action Alternative	Alternative 1	Alternative 2
Shock Trial Charges			
Training	0	0	0
Testing	0	16	16
Total	0	16	16
Surface and Underwater Detonations[1]			
Training	86	2,190	2,190
Testing	215	397	439
Total	301	2,587	2,629

[1] Mine neutralization, mine countermeasures, and ordnance testing activities

Training Activities. Under the No Action Alternative, numerically, training activities represent 80 percent of activities that use explosives (1,347 events); sonobuoys and large-caliber projectiles would comprise 84 percent of activities that use explosives. The majority of that activity (52 percent) would occur in two range complexes: VACAPES (32 percent) and JAX (20 percent), with another 18 percent occurring in Other AFTT Areas. Training activities are further described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Table 2.8-1.

Comparison of Training Materials by Net Explosive Weight. A review of training materials based on net explosive weight provides a different perspective on the relative contribution of various items under the No Action Alternative. Table 3.1-16 depicts those categories of training materials that contribute nearly all (97 percent) of the total net explosive weight under the No Action Alternative. The estimated total net explosive weight for these categories used during training under the No Action Alternative is 61,876 lb. (28,092 kg). For purposes of estimating explosive weight, within each type of military expended material, ordnance near the median value was chosen to represent that category.

Table 3.1-16: High-Explosive Training and Testing Materials under the No Action Alternative – Comparison of Number of Items versus Net Explosive Weight

Type of Military Expended Material (ordnance used for estimating)	Percent of Total HE by Number	Percent of Total HE by Net Explosive Weight
Training		
Missiles	7.4	52
Large-Caliber Projectiles	46.5	31
Bombs	0.6	8
Sonobuoys	40.6	8
Underwater Detonations	2.0	1
Testing		
Sonobuoys	72.5	14
Underwater Detonations	16.3	86

HE: high explosive

Under the No Action Alternative, the distribution of the training materials based on net explosive weight would be as follows:

- Missiles – VACAPES (55 percent), JAX (27 percent), Cherry Point (14 percent) Range Complexes, and Other AFTT Areas (3 percent).
- Large-Caliber Projectiles – VACAPES (42 percent), JAX (19 percent), and Cherry Point (4 percent) Range Complexes, and Other AFTT Areas (35 percent).
- Bombs –VACAPES (80 percent) and GOMEX (16 percent) Range Complexes, and Other AFTT Areas (4 percent).
- Sonobuoys –VACAPES, JAX, Cherry Point, and GOMEX Range Complexes (20 percent each); and Northeast Range Complexes (19 percent).
- Underwater Detonations – VACAPES (72 percent) and Cherry Point (17 percent) Range Complexes.

Testing Activities. Under the No Action Alternative, numerically, testing activities represent 20 percent of activities that use explosives (344 events). Most of that activity (72.5 percent) would involve sonobuoys (Table 3.1-16). Use of sonobuoys is split fairly evenly between the Northeast Range Complexes, VACAPES Range Complex, Navy Cherry Point Range Complex, JAX Range Complex, GOMEX Range Complex, and Other AFTT Areas. Testing activities are further described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Comparison of Testing Materials by Net Explosive Weight. The total net explosive weight used during testing (Table 3.1-16) under the No Action Alternative is 19,951 lb. (9,951 kg). The number of underwater detonations at the Naval Surface Warfare Center, Panama City Division Testing Range account for 58 percent of the total number of underwater detonations for testing and 42 percent occur in the VACAPES Range Complex. The underwater detonations account for 86 percent of the net explosive weight under the No Action Alternative.

Subsurface high-order explosions and their byproducts. Under the No Action Alternative, training and testing activities would involve 3,108 subsurface detonations. Numerically, 88 percent of those detonations involve explosive sonobuoys. Mine neutralization and countermeasure activities would represent 12 percent of subsurface detonations. See the previous paragraphs for the net explosive weight and distribution of explosive sonobuoy and underwater detonations used during training and testing. Most of the mine countermeasure and neutralization activities would occur in two locations: the Naval Surface Warfare Center, Panama City Division Testing Range and the VACAPES Range Complex.

Unconsumed explosives. Under the No Action Alternative, there would be 1,691 training and testing events involving high explosives. Based on estimates of unconsumed explosive, low-order detonations, and ordnance failure, a total of 2,907 lb. (1,320 kg) of unconsumed explosives would be released into sediment and the surrounding water column.

Summary of Impacts from Explosives and Explosion Byproducts

Under the No Action Alternative, the impacts on sediment and water quality from explosives and explosion byproducts associated with training and testing activities would be short- and long-term and local. Short-term impacts could arise from explosion byproducts; long-term impacts could arise from unconsumed explosives. The majority of high-order explosions occur at or above the surface of the ocean and would have minimal impacts on sediment and water quality. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing

conditions or designated uses. Reasons for this level of impact include: (1) the number of explosives used is small relative to the area across which they would be distributed; (2) most explosion byproducts are benign or are natural constituents of seawater; and (3) explosion byproducts would dissipate, evaporate, or be quickly diluted to undetectable levels. Neither state nor federal standards or guidelines would be exceeded.

The impacts of unconsumed explosives associated with training and testing activities would be long-term and local. Chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. This level of impact is based on the following: (1) the majority of explosives are consumed during detonation; (2) the frequency of low-order detonations is low, and therefore the frequency of unconsumed explosives is low; (3) the number of explosives used is small relative to the area across which they would be distributed; and (4) the constituents of unconsumed explosives are subject to several physical, chemical, and biological processes that render the materials harmless or would otherwise dissipate them to undetectable levels. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.1.6.2 Alternative 1

Under Alternative 1, training and testing with explosives would increase from 1,691 to 8,054 events compared to the No Action Alternative. Numerically, medium- and large-caliber explosive projectiles are accounted for in 41 percent of events involving explosives, but represent 91 percent of the explosive items expended under Alternative 1.

Training Activities. Under Alternative 1, training activities that use explosives would increase from 1,347 to 5,891 events compared to the No Action Alternative. Numerically, training activities would represent 73 percent of activities that use explosives under Alternative 1 (80 percent under the No Action Alternative), with medium- and large-caliber explosive projectiles representing 91 percent of those explosives events (47 percent under the No Action Alternative). Most such training would occur in three range complexes: VACAPES (41 percent; 42 percent under the No Action Alternative), JAX (37 percent; 19 percent under the No Action Alternative), and Navy Cherry Point (16 percent; 4 percent under the No Action Alternative).

Comparison of Training Materials by Net Explosive Weight. Like the No Action Alternative, a review of training materials based on net explosive weight under Alternative 1 provides a different perspective on the relative contribution of various items. Table 3.1-17 depicts those categories of training materials that contribute nearly all (99 percent) of the total net explosive weight under Alternative 1. Total net explosive weight used during training would increase from an estimated 61,876 to an estimated 441,959 lb. (28,092 to 200,650 kg) compared to the No Action Alternative. Most (98 percent) of the explosions would occur at or above the surface of the water.

Table 3.1-17: High-Explosive Training Materials under Alternative 1 – Comparison of Number of Items versus Net Explosive Weight

Type of Military Expended Material (ordnance used for estimating)	Percent of Total HE by Number	Percent of Total HE by Net Explosive Weight
Training		
Missiles	0.33	11
Large- and Medium-Caliber Projectiles	91.3	70
Bombs	0.1	6
Sonobuoys	1.3	1
Underwater Detonations	1.5	3
Rockets	5.3	9
Testing		
Missiles	0.41	10
Large- and Medium-Caliber Projectiles	87.6	70
Bombs	0.0	0
Sonobuoys	8.8	6
Underwater Detonations	1.2	12
Rockets	1.1	1

HE: high explosives

Under Alternative 1, the distribution of the training materials based on net explosive weight would be as follows:

- Missiles – VACAPES (39 percent; 55 percent under the No Action Alternative), JAX (36 percent; 27 percent under the No Action Alternative), and Navy Cherry Point (19 percent; 14 percent under the No Action Alternative) Range Complexes.
- Large- and medium-caliber projectiles – VACAPES (45 percent; 42 percent under the No Action Alternative), JAX (36 percent; 19 percent under the No Action Alternative), and Navy Cherry Point (13 percent; 4 percent under the No Action Alternative) Range Complexes.
- Bombs – VACAPES (48 percent; 80 percent under the No Action Alternative), JAX (24 percent; 0 percent under the No Action Alternative), and Navy Cherry Point (24 percent; 0 percent under the No Action Alternative) Range Complexes.
- Sonobuoys – VACAPES (22 percent; 20 percent under the No Action Alternative), JAX (56 percent; 20 percent under the No Action Alternative), and Navy Cherry Point (9 percent; 20 percent under the No Action Alternative) Range Complexes.
- Underwater Detonations – VACAPES (97 percent; 72 percent under the No Action Alternative).
- Rockets – VACAPES (48 percent; 0 percent under the No Action Alternative) and JAX (48 percent; 0 percent under the No Action Alternative) Range Complexes.

Testing Activities. Under Alternative 1, testing activities that use explosives would increase from 344 to 2,163 events compared to the No Action Alternative. Numerically, these testing activities represent 27 percent of activities that use explosives under Alternative 1 (20 percent under the No Action Alternative). Medium- and large-caliber explosive projectiles represent 89 percent of all testing-related

explosions under Alternative 1. Most testing with explosives (92 percent) would occur in two range complexes: VACAPES (43 percent) and JAX (35 percent), and the AFTT Study Area (14 percent).

Comparison of Testing Materials by Net Explosive Weight. The total net explosive weight used during testing (Table 3.1-17) would increase from an estimated 19,951 to 136,681 lb. (9,058 to 62,053 kg) compared to the No Action Alternative. Large- and medium-caliber projectiles would account for 70 percent of the total net explosive weight, underwater detonations would account for 12 percent, and explosive sonobuoys would account for 6 percent. Under Alternative 1, the distribution of the majority of testing materials based on net explosive weight would be as follows:

- Large- and medium-caliber projectiles – VACAPES Range Complex (33 percent), JAX (19 percent) Range Complex, and AFTT Study Area (39 percent); 0 percent under the No Action Alternative.
- Sonobuoys – Northeast (11 percent; 23 percent under the No Action Alternative), VACAPES (27 percent; 18 percent under the No Action Alternative), JAX (5 percent; 16 percent under the No Action Alternative), and Key West (44 percent; 0 percent under the No Action Alternative) Range Complexes, and Other AFTT Areas (6 percent; 19 percent under the No Action Alternative).
- Underwater Detonations – VACAPES Range Complex (34 percent; 42 under the No Action Alternative) and Naval Surface Warfare Center, Panama City Division Testing Range (44 percent; 58 under the No Action Alternative).

Direct comparisons with explosives testing between Alternative 1 and the No Action Alternative are difficult. Under the No Action Alternative, the majority of expended explosives are sonobuoys or large-caliber projectiles (80 percent of explosive items, 40 events). Under Alternative 1, the majority of expended explosives are medium- and large-caliber explosive projectiles (91 percent of explosive items, 812 events). Last, although the alternatives would have two range complexes in common (VACAPES and JAX), most explosives testing under the No Action Alternative would occur below the surface, while most would occur at or above the surface of the water under Alternative 1.

Subsurface High-order Explosions and Their Byproducts. Under Alternative 1, subsurface detonations associated with training and testing activities would increase from 3,108 to 7,490 compared to the No Action Alternative. Numerically, 94 percent of the detonations involve explosive sonobuoys (3 percent of the net explosive weight) and mine countermeasure and neutralization activities (5 percent of the net explosive weight). This compares to 88 percent involving sonobuoys and 12 percent involving mine neutralization and mine countermeasures activities under the No Action Alternative. See the previous paragraphs for the net explosive weight and distribution of training and testing.

Unconsumed Explosives. Under Alternative 1, training and testing activities involving explosives would increase from 1,691 to 8,054 events compared to the No Action Alternative. Based on estimates of unconsumed explosive, low-order detonations, and ordnance failure, a total of 25,322 lb. (11,496 kg) of unconsumed explosives would be released into sediment and into the surrounding water column.

Summary of Impacts from Explosives and Explosion Byproducts

Although the amount of explosive material under Alternative 1 represents an increase over the No Action Alternative, impacts would be similar to the No Action Alternative, i.e., no impacts on sediments and minimal impacts on water quality. Impacts on sediment and water quality from explosion byproducts under Alternative 1 would be short-term and local. The majority of high-order explosions occur at or above the surface of the ocean and would have no impacts on sediments and minimal

impacts on water quality. The impacts of unconsumed explosives associated with training and testing activities under Alternative 1 would be long-term and local. Although the number of activities that use explosives increases over the No Action Alternative, the level of impact is similar to the No Action Alternative based on the following: (1) the majority of explosives are consumed during detonation; (2) the frequency of low-order detonations is low, and therefore the frequency of unconsumed explosives is low; (3) the number of explosives used is small relative to the area across which they would be distributed; and (4) the constituents of unconsumed explosives are subject to several physical, chemical, and biological processes that render the materials harmless or would otherwise dissipate them to undetectable levels. Neither state nor federal standards or guidelines would be exceeded. Some unconsumed explosives would be expected in sediment, but they are not anticipated to accumulate. Chemical, physical, or biological changes to sediment or water quality would be measurable, but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses.

3.1.3.1.6.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, training and testing activities involving explosives would increase from 1,691 to 8,269 events compared to the No Action Alternative. Numerically, medium- and large-caliber explosive projectiles are accounted for in 41 percent of events involving explosives, but represent 91 percent of the explosive items expended under Alternative 2.

Training Activities. Under Alternative 2, the use of explosives for training would increase from 1,347 to 5,903 events compared to the No Action Alternative. Numerically, training activities represent 71 percent of activities that use explosives under Alternative 2 (80 percent under the No Action Alternative). Medium- and large-caliber explosive projectiles represent 91 percent of all explosives items expended under Alternative 2 (37 percent under the No Action Alternative). The distribution of activities that use explosives would be the same as Alternative 1.

Comparison of Training Materials by Net Explosive Weight. Similar to Alternative 1, a review of training materials based on net explosive weight under Alternative 2 provides a different perspective on the relative contribution of various items. Table 3.1-18 depicts those categories of training materials that contribute nearly all (99 percent) the total net explosive weight under Alternative 2. Total net explosive weight used during training would increase from an estimated 61,876 to an estimated 441,959 lb. (28,092 to 200,650 kg) compared to the No Action Alternative.

Table 3.1-18: High-Explosive Training Materials under Alternative 2 – Comparison of Number of Items versus Net Explosive Weight

Type of Military Expended Material (ordnance used for estimating)	Percent of Total HE by Number	Percent of Total HE by Net Explosive Weight
Training		
Missiles	0.3	11
Large- and Medium-Caliber Projectiles	91.3	70
Bombs	0.1	6
Sonobuoy	1.3	1
Underwater Detonations	1.5	3
Rockets	5.3	9
Testing		
Missiles	0.4	10
Large- and Medium-Caliber Projectiles	86.2	70
Bombs	0.0	0
Sonobuoy	10.3	8
Underwater Detonations	1.1	11
Rockets	1.0	1

HE: high explosive

Under Alternative 2, the distribution of the training materials based on net explosive weight would be the same as described under Alternative 1.

Testing Activities. Under Alternative 2, the use of explosives for testing would increase from 344 to 2,366 events compared to the No Action Alternative. Numerically, explosive testing activities represent 29 percent of explosive use under Alternative 2. Medium- and large-caliber explosive projectiles represent 86 percent of all explosive testing under Alternative 2 (Table 3.1-18). Explosive sonobuoys would be involved in 10 percent of events and 1 percent would involve mine neutralization and mine countermeasures activities. Distribution of explosive testing materials would be the same as under Alternative 1. Direct comparisons with testing between Alternative 2 and the No Action Alternative are difficult for the reasons discussed under Alternative 1.

Subsurface High-Order Explosions and Their Byproducts. Under Alternative 2, subsurface detonations associated with training and testing activities would increase from 3,108 to 8,540 compared to the No Action Alternative. Numerically, 90 percent of the detonations involve explosive sonobuoys (3 percent of the net explosive weight) and mine countermeasure and neutralization activities (5 percent of the net explosive weight). This compares to 88 percent under the No Action Alternative. The relative contribution and distribution of subsurface detonations would be the same as under Alternative 1. Impacts on sediment and water quality from explosion byproducts associated with training and testing activities under Alternative 2 would be short-term and local. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Although use of explosives increases over the No Action Alternative, the reasons for a level of impact similar to the No Action Alternative are the same as those enumerated under the No Action Alternative. Specifically, this level of impact is based on the following: (1) the majority of explosives are consumed during detonation; (2) the frequency of low-order detonations is low, and

therefore the frequency of unconsumed explosives is low; (3) the number of explosives used is small relative to the area across which they would be distributed; and (4) the constituents of unconsumed explosives are subject to several physical, chemical, and biological processes that render the materials harmless or would otherwise dissipate them to undetectable levels. Neither state nor federal standards or guidelines would be exceeded.

Charge sizes in ship shock trials range from 2,000 to 58,000 lb. (908 to 26,310 kg) net explosive weight. The percent of the total net explosive weight used for ship shock trials under Alternative 2 would be approximately 5 percent, the same as under Alternative 1.

Unconsumed Explosives. Under Alternative 2, training and testing activities associated with explosives would increase from 1,691 to 8,269 events compared to the No Action Alternative. Based on estimates of unconsumed explosives, low-order detonations, and ordnance failure, a total of 26,168 lb. (11,880 kg) of unconsumed explosives would be released into sediment and into the surrounding water column.

Summary of Impacts from Explosives and Explosion Byproducts

Although the amount of explosive material under Alternative 2 represents an increase over the No Action Alternative, impacts would be similar to the No Action Alternative, i.e., no impacts on sediments and minimal impacts on water quality. Impacts on sediment and water quality from explosion byproducts under Alternative 2 would be short-term and local. The majority of high-order explosions occur at or above the surface of the ocean and would have no impacts on sediments and minimal impacts on water quality. The impacts of unconsumed explosives associated with training and testing activities under Alternative 2 would be long-term and local. Although the number of activities that use explosives increases over the No Action Alternative, the level of impact similar to the No Action Alternative based on the following: (1) the majority of explosives are consumed during detonation; (2) the frequency of low-order detonations is low, and therefore the frequency of unconsumed explosives is low; (3) the number of explosives used is small relative to the area across which they would be distributed; and (4) the constituents of unconsumed explosives are subject to several physical, chemical, and biological processes that render the materials harmless or would otherwise dissipate them to undetectable levels. Neither state nor federal standards or guidelines would be exceeded. Some unconsumed explosives would be expected in sediment, but they are not anticipated to accumulate. Chemical, physical, or biological changes to sediment or water quality would be measurable, but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses.

3.1.3.2 Metals

3.1.3.2.1 Introduction

Many metals occur naturally in seawater, and several are necessary for marine organisms and ecosystems to function properly, such as iron, zinc, copper, and manganese. Zinc, copper, and manganese may also be harmful to plants and animals at high concentrations. Other metals have negative impacts on sediment and water quality (e.g., cadmium, chromium, lead, and mercury).

Metals are introduced into sediment and seawater through training and testing activities. Metals represent parts or the whole of vessels, manned and unmanned aircraft, ordnance (bombs, projectiles, missiles, and torpedoes), sonobuoys, chaff cartridges, batteries, electronic components, and as anti-corrosion compounds coating exterior surfaces of some munitions. In most instances, because of the physical and chemical reactions that occur with metals in marine systems (e.g., precipitation), metals

often concentrate in sediment. Thus, metal contaminants in sediment are more of an issue than metals in the water column.

Military expended materials such as steel bomb bodies or fins, missile casings, small arms projectiles, and naval gun projectiles may contain small percentages (less than 1 percent by weight) of lead, manganese, phosphorus, sulfur, copper, nickel, tungsten, chromium, molybdenum, vanadium, boron, selenium, columbium, or titanium. Smaller caliber rounds are composed of steel with small amounts of aluminum and copper, and brass casings that are 70 percent copper and 30 percent zinc. Naval gun shells are composed of steel, brass, copper, tungsten, and other metals. The 20-mm cannon shells used in close-in weapons systems are composed mostly of tungsten alloy. Some projectiles have lead cores (U.S. Department of the Navy 2008b). Torpedo guidance wire is composed of copper and cadmium coated with plastic (U.S. Department of the Navy 2008a). Sonobuoy components include metal housing, batteries and battery electrodes, lead solder, copper wire, and lead used for ballast. Thermal batteries in sonobuoys are contained in a hermetically sealed and welded stainless steel case that is 0.03 to 0.1 in. (0.1 to 0.25 cm) thick and resistant to the battery electrolytes (Naval Facilities Engineering Command 1993). Rockets are usually composed of steel and steel alloys, although composite cases made of glass, carbon, or Kevlar® fiber are also used (Missile Technology Control Regime 1996).

Non-explosive practice munitions refers to ammunition and components that contain no explosive material and may include: (1) ammunition and components that have had all explosive material removed and replaced with inert material; (2) empty ammunition or components; and (3) ammunition or components manufactured with inert material in place of all explosive material. These practice munitions vary in size from 25 lb. (11 kg) to 500 lb. (227 kg) and can be built to simulate different explosive capabilities. Some non-explosive practice munitions may also contain unburned propellant (e.g., rockets) and may contain spotting charges or signal cartridges for locating the point of impact (e.g., smoke charges for daylight spotting or flash charges for night spotting) (U.S. Department of the Navy 2010b). Non-explosive practice munitions are composed mainly of iron and steel casings that are filled with sand, concrete, or vermiculite. These materials are similar to those used to construct artificial reefs. Non-explosive practice munitions are configured to have the same weight, size, center of gravity, and ballistics as live bombs (U.S. Department of the Navy 2006). Practice bombs entering the water do not contain combustion chemicals found in the warheads of live bombs.

Decommissioned vessels used as targets during vessel-sinking exercises are selected from a list of U.S. Navy-approved vessels that have been cleaned or remediated in accordance with USEPA guidelines. By rule, vessel-sinking exercises must be conducted at least 50 nm offshore and in water at least 6,000 ft. (1,830 m) deep (40 C.F.R. § 229.2). The USEPA considers the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection, Research, and Sanctuaries Act (33 U.S.C. §§ 1401-1445).

The next sections provide the following overview:

- Section 3.1.3.2.2 discusses how metals will be evaluated under each alternative;
- Section 3.1.3.2.3 reviews information regarding the behavior and potential negative impacts of metals on sediment and water quality; and
- Section 3.1.3.2.4 evaluates each alternative in terms of the information provided in Sections 3.1.3.2.2 and 3.1.3.2.3.

3.1.3.2.2 Approach to Analysis

Most activities involving military expended materials with metal components would be conducted more than 3 nm offshore in each range complex or test range. Activities in these areas would be subject to federal sediment and water quality standards and guidelines. Military expended materials with metal components are also used in nearshore areas specifically designated for mine countermeasure and mine neutralization activities in the Navy Cherry Point (Onslow Bay) and JAX (Charleston OPAREA) Range Complexes and in the Naval Surface Warfare Center, Panama City Division Testing Range. These activities would be subject to state sediment and water quality standards and guidelines. Standard operating procedures require that materials be removed after training is complete, including metal fragments on the bottom. Therefore, potential impacts from metals are assumed to be negligible in these areas. For metals, "local" refers to the zone of sediment about 0.4 in. (1 cm) surrounding the metal where it comes to rest.

State standards and guidelines. Table 3.1-19 summarizes the state standards and guidelines for metals in sediment in Florida, the only state for which sediment criteria could be located.

Table 3.1-19: Florida – Sediment Screening Guidelines for Metals

Metal	Threshold Effects Level (µg/L)	Probable Effects Level (µg/L)
Chromium	52.3	160
Lead	30.2	112
Mercury	0.13	0.696

µg/L: micrograms per liter. The threshold effects level is the concentration of a contaminant above which adverse biological effects are expected to rarely occur. The probable effects level is the concentration of a contaminant above which adverse biological effects are expected to occur frequently (MacDonald et al. 1996).

Table 3.1-20 summarizes the state standards and guidelines for water quality related to metals for Virginia, North Carolina, South Carolina, Georgia, and Florida.

Table 3.1-20: Water Quality Criteria for Metals – Virginia, North Carolina, South Carolina, Georgia, and Florida (µg/L)

	Virginia[1]		North Carolina[2]	South Carolina[3]		Georgia[4]		Florida[5]
Metal	Acute	Chronic	Criteria	CMC	CCC	Acute	Chronic	Criteria
Chromium VI	1,100	50	20	1,100	50	1,100	50	≤ 50
Lead	240	9.3	25	220	8.5	210	8.1	≤ 8.5
Mercury	1.8	0.94	0.025	1.1	1.1	1.8	0.025	0.025

[1] "Acute" criteria reflect a one-hour average concentration not to be exceeded more than once every three years on average. "Chronic" criteria reflect a four-day average concentration not to be exceeded more than once every three years on average. Source: (Table 3.1-8; Virginia Department of Environmental Quality 2011).
[2] Source: North Carolina Department of Environment and Natural Resources (2007).
[3] "CMC" refers to criterion maximum concentration, the highest in-stream concentration of a substance to which the organisms can be exposed for a brief period of time without causing an acute effect (analogous to "acute"). "CCC" refers to criterion continuous concentration, the highest in-stream concentration of a substance to which the organisms can be exposed to protect against long-term effects (analogous to "chronic"). Source: South Carolina Department of Health and Environmental Control (2008).
[4] Source: Georgia Department of Natural Resources (2010).
[5] (Table 3.1-10 and Table 3.1-11; Florida Department of Environmental Protection 2010)).
"≤": less than or equal to; µg/L: micrograms per liter.

Federal standards and guidelines. Table 3.1-21 summarizes the USEPA "threshold values" for metals in marine waters (U.S. Environmental Protection Agency 2009).

Table 3.1-21: U.S. Environmental Protection Agency Threshold Values for Exposure to Select Metals in Saltwater

Metal	Criteria (µg/L)	
	Acute Toxicity (1-hour exposure)	Chronic Toxicity (4-day average exposure)
Cadmium	40	8.8
Chromium	1,000	50
Copper	4.8	3.1
Lead	210	8.1
Lithium*	6,000	n/a
Mercury	1.8	0.94
Nickel	74	8.2
Silver	1.9	n/a
Zinc	90	81

*No threshold value established by USEPA. Value shown is from Kszos et al.(2003).
n/a: no chronic value is available; µg/L: micrograms per liter

"Acute toxicity" means a negative response to a substance observed in 96 hours or less (e.g., mortality, disorientation, or immobilization). "Chronic toxicity" means the lowest concentration of a substance that causes an observable effect (e.g., reduced growth, lower reproduction, or mortality). This effect occurs over a relatively long period of time, such as one-tenth of the life span of the species. A 28-day test period is used for small fish test species (U.S. Environmental Protection Agency 1991).

3.1.3.2.3 Impacts from Metals

The discussion below summarizes studies that investigated the impacts of sampled metal in military expended materials introduced into the marine environment.

In general, three things happen to military expended materials that come to rest on the ocean floor: (1) they lodge in sediment where there is little or no oxygen, usually below 4 in. (10 cm); (2) they remain on the ocean floor and begin to react with seawater; or (3) they remain on the ocean floor and become encrusted by marine organisms. As a result, rates of deterioration depend on the metal or metal alloy and the conditions in the immediate marine and benthic environment. If buried deep in ocean sediments, materials tend to decompose at much lower rates than when exposed to seawater (Ankley 1996). With the exception of torpedo guidance wires and sonobuoy parts, sediment burial appears to be the fate of most ordnance used in marine warfare (Canadian Forces Maritime Experimental and Test Ranges 2005).

In those situations where metals are exposed to seawater, they begin to slowly corrode, a process that creates a layer of corroded material between the seawater and uncorroded metal. This layer of corrosion removes the metal from direct exposure to the corrosiveness of seawater, a process that further slows movement of the metals into the adjacent sediment and water column. This is particularly true of aluminum. Any elevated levels of metals in sediment would be restricted to a small zone around the metal, and any release to the overlying water column would be diluted. In a similar fashion, as materials become covered by marine life, the direct exposure of the material to seawater decreases and the rate of corrosion decreases. Dispersal of these materials in the water column is controlled by

physical mixing and diffusion, both of which tend to vary with time and location. The analysis of metals in marine systems begins with a review of studies involving metals used in proposed activities that may be introduced into the marine environment.

In one study, water quality sampling for lead, manganese, nickel, vanadium, and zinc was conducted at a shallow bombing range in Pamlico Sound (state waters of North Carolina) immediately following a bomb training event with non-explosive practice munitions. All water quality parameters tested, except nickel, were within the state limits. The nickel concentration was significantly higher than the state criterion, although the concentration did not differ significantly from the control site located outside the bombing range. This suggests that bombing activities were not responsible for the elevated nickel concentrations (U.S. Department of the Navy 2010b). A recent study conducted by the U.S. Marine Corps sampled sediment and water quality for 26 different constituents related to munitions at several U.S. Marine Corps water-based training ranges. Metals included lead and magnesium. This area was also used for bombing practice. No levels were detected above screening values used at the U.S. Marine Corps water ranges (U.S. Department of the Navy 2010b).

A study by Pait et al. (2010) of previous Navy training areas at Vieques, Puerto Rico, found generally low concentrations of metals in sediment. Areas in which live ammunition were used (live-fire areas) were included in the analysis. Table 3.1-22 compares the sediment concentrations of several metals from those naval training areas with sediment screening levels established by the National Oceanic and Atmospheric Administration (Buchman 2008).

Table 3.1-22: Concentrations and National Oceanic and Atmospheric Administration Screening Levels for Select Metals in Sediments, Vieques, Puerto Rico

Metal	Sediment Concentration (µg/g)			Sediment Guidelines – National Oceanic and Atmospheric Administration (µg/g)	
	Minimum	Maximum	Average	Threshold Effect Level	Probable Effect Level
Cadmium	0	1.92	0.15	0.68	4.21
Chromium	0	178	22.58	52.3	160
Copper	0	103	25.9	18.7	390
Lead	0	17.6	5.42	30.24	112
Mercury	N/R	0.112	0.019	130	700
Nickel	N/R	38.3	7.80	15.9	42.8
Zinc	N/R	130	34.4	124	271

N/R: not reported; µg/g: micrograms per gram

The "threshold effect level" is the concentration of a contaminant above which adverse biological effects are expected to rarely occur. The "probable effect level" is the concentration of a contaminant above which adverse biological effects are expected to occur frequently (MacDonald et al. 1996).

As reflected in Table 3.1-22, with the exception of copper, average sediment concentrations of the metals evaluated were below both the threshold and probable effects levels. Copper's average concentration (25.9 µg/g) was above the threshold effect level but below the probable effect level.

For other elements, (1) the average sediment concentration of arsenic at Vieques was 4.37 µg/g, and the highest concentration was 15.4 µg/g—both values were below the sediment quality guidelines examined; and (2) the average sediment concentration of manganese in sediment was 301 µg/g, and the

highest concentration was 967 µg/g (Pait et al. 2010). The National Oceanic and Atmospheric Administration did not report threshold or probable effects levels for manganese.

A study of the impacts of lead and lithium was conducted at the Canadian Forces Maritime Experimental and Test Ranges near Nanoose Bay, British Columbia, Canada (Canadian Forces Maritime Experimental and Test Ranges 2005). These materials are common to expendable mobile anti-submarine warfare training targets, acoustic device countermeasures, sonobuoys, and torpedoes. The study noted that lead is a naturally occurring metal in the environment and that typical concentrations of lead in the test range were between 0.01 and 0.06 ppm in seawater, and from 4 to 16 ppm in sediment. Cores taken of sediment in the test range show a steady increase in lead concentration from the bottom of the core to a depth of approximately 8 in. (20 cm). This depth corresponds to the late 1970s and early 1980s and was attributed to atmospheric deposition from lead as a gasoline additive. The sediment cores showed a general reduction in concentration to the present time, coincident with the phasing out of lead in gasoline by the mid-1980s. The study also noted that other training ranges show minimal impacts of lead ballasts because they are usually buried deep in sediment, where they are not biologically available. The study concluded there would be no negative impacts on marine organisms from the lead ballasts due to the low probability of mobilization of lead.

A study by the U.S. Department of the Navy examined the impact of materials from activated seawater batteries in sonobuoys that freely dissolve in the water column (e.g., lead, silver, and copper ions), as well as nickel-plated steel housing, lead solder, copper wire, and lead shot used for sonobuoy ballast (Naval Facilities Engineering Command 1993). The study concluded that constituents released from saltwater batteries as well as the decomposition of other sonobuoy components did not exceed state or federal standards and that the reaction products are short-lived in seawater.

Lead. Lead is used as ballast in torpedoes, in batteries in torpedoes and sonobuoys, and various munitions. Lead is nearly insoluble in water, particularly at the near-neutral pH levels of seawater. While it is reasonable to assume some dissolution of lead could occur, such releases into the water column would be small and would be diluted (U.S. Department of the Navy 2006).

Several studies have evaluated the potential impacts of batteries expended in seawater (Borener and Maugham 1998; Canadian Forces Maritime Experimental and Test Ranges 2005; Naval Facilities Engineering Command 1993; U.S. Coast Guard 1994). Sediment samples were taken adjacent to and near fixed navigation sites where these batteries are used and analyzed for all metal constituents in the batteries. Results indicated that metals were either below or consistent with background levels or were below National Oceanic and Atmospheric Administration sediment screening levels (Buchman 2008), "reportable quantities" under the Comprehensive Environmental Response, Compensation, and Liability Act §103(a), or USEPA toxicity criteria (U.S. Environmental Protection Agency 2008f).

A sonobuoy battery experiment employed lead (II) chloride batteries in a 17-gallon (64-liter) seawater bath for eight hours (Naval Facilities Engineering Command 1993). Under these conditions, the dilution assumptions are conservative relative to normal ocean bottom conditions. The concentration released from the battery was diluted to 200 µg/L (200 ppb) in two seconds, which is less than the acute criteria of 210 µg/L (210 ppb). Considering each milliliter as a discrete parcel, dilution by a current traveling at two inches per second (5 cm per second) would dilute the lead released from the battery to 200 µg/L (200 ppb) in two seconds, which is less than the acute criteria of 210 µg/L (210 ppb). Assuming the exponential factor of two dilutions, the concentration is less than the chronic limit of 8.1 µg/L (8.1 ppb)

in seven seconds. The calculated rate of leaching will decrease as the concentration of lead within the battery decreases.

Since lead (II) chloride tends to dissolve more readily than either silver chloride or copper thiocyanate, this assures that the potential impacts from batteries employing silver chloride or copper thiocyanate are substantially lower than those for the lead (II) chloride battery. The copper thiocyanate battery also has the potential to release cyanide, a material often toxic to the marine environment. However, thiocyanate is tightly bound and can form a salt or bind to bottom sediment. Therefore, the risk associated with thiocyanate is low (U.S. Department of the Navy 2008a). The peak concentration of copper released from a copper thiocyanate seawater battery was calculated to be 0.015 µg/L (0.015 ppb) (Naval Facilities Engineering Command 1993), which is substantially lower than USEPA acute and chronic toxicity criteria.

Tungsten and tungsten alloys. Because of environmental concerns related to lead in munitions, tungsten has been used as a replacement (Defense Science Board 2003). Tungsten was initially chosen because it was considered nonreactive in the environment under normal circumstances. However, concerns have risen lately regarding that assessment. Adverse health consequences arise with inhalation, and movement of tungsten into groundwater is an issue (Agency for Toxic Substances and Disease Registry 2005). However, no drinking water standard exists for tungsten, and it is not listed as a carcinogen (U.S. Environmental Protection Agency 2008f), and neither inhalation nor groundwater is an issue relative to sediment and water quality in the AFTT Study Area.

The natural concentration of tungsten reported in seawater is about 0.1 µg/L (0.1 ppb) (Agency for Toxic Substances and Disease Registry 2005). It arises naturally from weathering of tungsten-rich deposits and from underwater hydrothermal vents; elevated levels in sediment from natural sources have been reported. Industrial processes also contribute tungsten to the environment (Koutsospyros et al. 2006). In water, tungsten can exist in several different forms depending on pH, and it has a strong tendency to form complexes with various oxides and with organic matter. The rate at which tungsten dissolves or dissociates increases as pH decreases below 7.0. (The pH of seawater is normally between 7.5 and 8.4.) The speed of the process also depends on the metal with which tungsten is alloyed. For instance, iron tends to enhance the dissolution of tungsten, while cobalt slows the process (Agency for Toxic Substances and Disease Registry 2005). Tungsten is a component of metabolic enzymes in various microbes (Kletzin and Adams 1996). Although much is known about the physical and chemical properties of tungsten, less is known about the behavior of the various complexes that tungsten forms, making predictions about its behavior in the environment difficult. For instance, it is not known whether the organic complexes that tungsten forms affect its bioavailability (Koutsospyros et al. 2006).

Lithium. Silver chloride, lithium, or lithium iron disulfide thermal batteries are used to power subsurface units of sonobuoys. The lithium-sulfur batteries used typically contain lithium sulfur dioxide and lithium bromide, but may also contain lithium carbon monofluoroxide, lithium manganese dioxide, sulfur dioxide, and acenitrile (a cyanide compound). During battery operation, the lithium reacts with the sulfur dioxide to form lithium dithionite. Thermal batteries are contained in a hermetically sealed and welded stainless steel case that is 0.03 to 0.1 in. (0.1 to 0.25 cm) thick and resistant to the battery electrolytes.

Lithium always occurs as a stable mineral or salt, such as lithium chloride or lithium bromide (Kszos et al. 2003). Lithium is naturally present in seawater at 180 µg/L (180 ppb). Its incorporation into clay minerals is a major process in its removal from solution (Stoffyn-Egli and Machenzie 1984).

Kszos et al. (2003) demonstrated that sodium ions in saltwater mitigate the toxicity of lithium to sensitive aquatic species. Fathead minnows (*Pimephales promelas*) and the water flea (*Ceriodaphnia dubia*) were unaffected by lithium concentrations as high as 6 mg/L (6 ppm) in the presence of tolerated concentrations of sodium. Therefore, it is expected that in the marine environment, where sodium concentrations are at least an order of magnitude higher than tolerance limits for the tested freshwater species, lithium would be essentially nontoxic.

Canadian Forces Maritime Experimental and Test Ranges (2005) reported that 99 percent of the lithium in a sonobuoy battery would be released to the environment over 55 years. The release will result in a dissolved lithium concentration of 83 mg/L (83 parts ppm) in the immediate area of the breach in the sonobuoy housing. At a distance of 0.2 in. (5.5 mm) from the breach, the concentration of lithium will be about 15 mg/L (15 ppm), or 10 percent of typical seawater lithium values (150 ppm). Thus, it would be difficult to discern the additional concentration due to the lithium leakage from the background concentration (Canadian Forces Maritime Experimental and Test Ranges 2005). Cores taken of sediment in the Canadian Forces Maritime Experimental and Test Ranges near Nanoose Bay, British Columbia, Canada, showed fairly consistent lithium concentrations with depth, indicating little change in lithium deposition with time. Given ambient lithium concentrations taken outside the range, the report concluded that "it is difficult to demonstrate an environmental impact of lithium caused by (test range activities)" (Canadian Forces Maritime Experimental and Test Ranges 2005).

3.1.3.2.3.1 Metals in Non-Explosive Practice Munitions

On the bottom, non-explosive practice munitions and fragments are exposed to seawater or lodge in sediment. Once settled, metal components slowly corrode in seawater. Over time, natural encrustation of exposed surfaces occurs and reduces the rate of corrosion. Elemental aluminum in seawater tends to be converted by hydrolysis to aluminum hydroxide, which is relatively insoluble, and scavenged by particulates and transported to the bottom sediment (Monterey Bay Research Institute 2010). Practice bombs are made of materials similar to those used to construct artificial reefs. The steel and iron, though durable, corrode over time, with no noticeable environmental impacts (U.S. Department of the Navy 2006).

3.1.3.2.4 Evaluation of Alternatives

Table 3.1-23 summarizes the types and amounts of military expended materials with metal components for all alternatives. The numbers represent amounts expended annually for each type of material under each alternative. The types and amounts of expended materials in the table were drawn from the tables in Section 3.0 (Introduction to the Affected Environment and Environmental Consequences).

The following sections evaluate each alternative in terms of the information provided in Sections 3.1.3.2.3 (Impacts from Metals) and 3.1.3.2.4 (Evaluation of Alternatives). Potential impacts on sediment and water quality from military expended materials with metal components should be viewed in the following context: (1) nearshore sediment and water quality in many areas have been negatively impacted by metals from other sources, especially those near major river systems and industrial facilities; and (2) the majority of those impacts are from human-generated, land-based activities. The numbers of military expended materials discussed below reflect amounts expended annually for each type of material under each alternative.

3.1.3.2.4.1 No Action Alternative

Under the No Action Alternative, approximately 2.6 million military expended materials with metal components would be distributed throughout the Study Area during training and testing. Numerically, small-, medium-, and large-caliber projectiles comprise 96 percent of the total.

Table 3.1-23: Military Expended Materials with Metal Components – All Alternatives Annually

Type of Military Expended Material	No Action Alternative	Alternative 1	Alternative 2
Small-Caliber Projectiles			
Training	2,040,880	6,264,040	6,264,040
Testing	8,800	45,000	51,800
Total	2,049,680	6,309,040	6,315,840
Medium-Caliber Projectiles[1]			
Training	405,530	1,676,596	1,676,596
Testing	63,482	293,500	310,508
Total	469,012	1,970,096	1,987,104
Large-Caliber Projectiles[1]			
Training	10,874	19,421	19,421
Testing	596	19,760	21,390
Total	11,470	39,181	40,811
Bombs[1]			
Training	2,379	3,502	3,502
Testing	655	1,063	1,145
Total	3,034	4,565	4,647
Missiles[1]			
Training	456	494	494
Testing	151	800	881
Total	607	1,294	1,375
Rockets[1]			
Training	3,700	7,980	7,980
Testing	377	2,761	3,037
Total	4,077	10,741	11,017
Expendable Subsurface Targets[2]			
Training	1,621	2,306	2,306
Testing	133	766	862
Total	1,754	3,072	3,168
Vessels as Targets			
Training	6	1	1
Testing	0	0	0
Total	6	1	1
Other Surface Targets[3]			
Training	1,440	3,116	3,116
Testing	406	1,140	1,242
Total	1,846	4,256	4,358

Table 3.1-23: Military Expended Materials with Metal Components – All Alternatives Annually (Continued)

Type of Military Expended Material	No Action Alternative	Alternative 1	Alternative 2
Airborne Targets			
Training	0	0	0
Testing	110	110	121
Total	110	110	121
Chaff Cartridges			
Training	64,590	45,612	45,612
Testing	2,984	10,660	11,650
Total	67,574	56,272	57,262
Sonobuoys			
Training	30,151	30,945	30,945
Testing	4,068	16,246	19,791
Total	34,219	47,191	50,736
Mines, Mine Shapes			
Training	0	84	84
Testing	204	607	674
Total	204	691	758
Torpedoes			
Training	1	1	1
Testing	12	42	45
Total	13	43	46
Torpedo Accessories[4]			
Training	127	116	116
Testing	127	1,009	1,112
Total	254	1,125	1,228
Grenades			
Training	100	206	206
Testing	0	0	0
Total	100	206	206

[1] Includes non-explosive practice munitions.
[2] Includes expendable torpedo targets.
[3] High-speed jet skis and motorboats.
[4] Includes guidance wires, flex hoses, ballast, protective nose covers, suspension bands, air stabilizers, and propeller baffles used with air-launched torpedoes.

Training Activities. Under the No Action Alternative, numerically, training activities represent 97 percent of all materials with metal components, of which 96 percent are small- and medium-caliber projectiles. Most of those projectiles (85 percent) would be used in two range complexes: VACAPES (62 percent) and JAX (23 percent).

Comparison of Training Materials by Weight. A review of training materials based on metal weight provides a different perspective on the relative contribution of various items under the No Action Alternative. For instance, although small-caliber projectiles comprise 77 percent of the total number of items, by weight they represent less than 6 percent of the total. The total metal weight of training

materials under the No Action Alternative would be an estimated 1,747 tons (1.58 million kg). Table 3.1-24 depicts those categories of materials that contribute most (89 percent) of the total metal weight of training items under the No Action Alternative.

Table 3.1-24: Training Materials with Metal Components under the No Action Alternative – Comparison of Number of Items versus Weight

Type of Military Expended Material	Percent of Total by Number	Percent of Total by Weight
Bombs	0.09	33.9
Large- and Medium-Caliber Projectiles	16.25	26.8
Sonobuoys	1.18	17.0
Missiles	0.02	11.0

"<": less than.
Percent of Total by Weight shows the contribution of metal weight

Under the No Action Alternative, the distribution of the training materials based on weight would be as follows:

- Bombs – Cherry Point (34 percent), JAX (29 percent), and VACAPES (24 percent) Range Complexes.
- Large- and medium-caliber projectiles – JAX (16 percent), Navy Cherry Point (9 percent), and VACAPES (50 percent) Range Complexes.
- Sonobuoys – JAX (68 percent), VACAPES (16 percent), and Navy Cherry Point (6 percent) Range Complexes.
- Missiles – VACAPES (63 percent), JAX (23 percent), and Navy Cherry Point (11 percent) Range Complexes.

Note: Because the contribution of testing materials to the total amount of materials with metal components is relatively small – by number and by weight, only training materials were used for the comparisons in Table 3.1-24. Surface vessels used as targets also contribute a large amount of metal weight. Under the No Action Alternative, six surface vessels are proposed for vessel sinking exercises. However, the types of vessels used as targets depend on their availability and, therefore, cannot be specified. For comparison, the total weight of training materials with metal components under the No Action Alternative is estimated to be 1,747 tons (1.58 million kg). A Navy vessel used as a target would weigh between 5,000 and 10,000 tons (4.5 to 9.1 million kg).

Testing Activities. Under the No Action Alternative, testing activities represent 3 percent of all materials with metal components. Of those materials, 89 percent are small-, medium-, and large-caliber projectiles, all of which (100 percent) would be used in four range complexes or testing ranges: VACAPES (59 percent), JAX (22 percent); Naval Surface Warfare Center, Panama City Division Testing Range (16 percent); and GOMEX (3 percent). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Metals

Under the No Action Alternative, potential impacts on sediment and water quality from training and testing activities involving materials with metal components would be long-term and local. Metal

components would come to rest on the sea floor exposed to seawater when resting on the bottom or, more likely, buried in sea floor sediment. These metals would slowly corrode over years or decades and release small amounts of metals and metal compounds to adjacent sediment and waters. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. This conclusion is based on the following: (1) most of the metals are benign, and those of potential concern make up a small percentage of munitions; (2) metals released through corrosion would be diluted by currents or bound up and sequestered in adjacent sediment; (3) impacts would be limited to the immediate area around the expended material; and (4) the areas across which metal components would be distributed are large. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.2.4.2 Alternative 1

Under Alternative 1, use of training and testing materials with metal components would increase 324 percent compared to the No Action Alternative. Numerically, small- and medium-caliber projectiles would comprise 98 percent of the total (96 percent under the No Action Alternative). Materials expended at the Undersea Warfare Training Range will include torpedo accessories (e.g., guidance wires, air launch accessories, and ballast), sonobuoys, acoustic countermeasures, and expendable mobile anti-submarine warfare training targets. Because of the concentration of this training, these items are expected to increase on the sea floor within the training range. Items used in the training range are included in the tally of materials in Table 3.1-25.

Training Activities. Under Alternative 1, training activities would represent 95 percent of all materials with metal components, similar to the No Action Alternative. Those training materials would increase 314 percent compared to the No Action Alternative. Numerically, 99 percent are small-, medium and large-caliber projectiles (96 percent under the No Action Alternative), most of which (84 percent) would be used in two range complexes: VACAPES (59 percent; 62 percent under the No Action Alternative) and JAX (25 percent; 23 percent under the No Action Alternative).

Table 3.1-25: Training Materials with Metal Components under Alternative 1 – Comparison of Number of Items versus Weight

Type of Military Expended Material	Percent of Total by Number	Percent of Total by Weight
Large- and Medium-Caliber Projectiles	21.0	35.9
Bombs	< 0.1	30.6
Small-Caliber Projectiles	77.6	11.0
Sonobuoys	0.4	10.9

"<": less than.

Comparison of Training Materials by Weight. As with the No Action Alternative, a review of training materials based on weight provides a different perspective on the relative contribution of various items under Alternative 1. Under Alternative 1, the total weight of training materials with metal components would be an estimated 2,844 tons (2.58M kg), compared to an estimated 1,747 tons (1.58M kg) under the No Action Alternative, an increase of 163 percent. Table 3.1-25 depicts those categories of materials that contribute most (88 percent) of the total weight of training items with metal components under Alternative 1.

Under Alternative 1, the distribution of the training materials based on weight would be as follows:

- Large- and medium-caliber projectiles – JAX (28 percent; 17 percent under the No Action Alternative), Navy Cherry Point (14 percent; 10 percent under the No Action Alternative), and VACAPES (51 percent; 56 percent under the No Action Alternative) Range Complexes.
- Bombs – Navy Cherry Point (34 percent; same under the No Action Alternative), JAX (37 percent; 29 percent under the No Action Alternative), and VACAPES (19 percent; 24 percent under the No Action Alternative) Range Complexes.
- Small-caliber projectiles – JAX (24 percent; 25 percent under the No Action Alternative), Navy Cherry Point (9 percent; 10 percent under the No Action Alternative), and VACAPES (62 percent; 64 percent under the No Action Alternative) Range Complexes.
- Sonobuoys – JAX (70 percent; 68 percent under the No Action Alternative), VACAPES (16 percent; same under the No Action Alternative), and Navy Cherry Point (5 percent; 6 percent under the No Action Alternative) Range Complexes.

Note: Because the contribution of testing materials to the total amount of materials with metal components is relatively small – by number and to some degree by weight, only training materials were used for the comparisons in Table 3.1-25. Surface vessels used as targets also contribute a large amount of metal weight. Under Alternative 1, one surface vessel is proposed for vessel sinking exercises (six under the No Action Alternative). However, the types of vessels used as targets depend on their availability and, therefore, cannot be specified. For comparison, the total weight of materials with metal components under Alternative 1 is estimated to be 4,167 tons (3.78 million kg). A Navy vessel used as a target would weigh between 5,000 and 10,000 tons (4.5 to 9.1 million kg).

Testing Activities. Testing activities would represent 5 percent of all materials with metal components under Alternative 1 (3 percent under the No Action Alternative). Testing materials with metal components would increase 479 percent compared to the No Action Alternative. Of those materials, 91 percent are medium- and large-caliber projectiles, most of which (87 percent; 91 percent under the No Action Alternative) would be used in two range complexes: VACAPES (60 percent; 66 percent under the No Action Alternative), and JAX (27 percent; 25 percent under the No Action Alternative). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Metals

Although the amount of expended materials associated with training and testing under Alternative 1 would represent an increase over the No Action Alternative, impacts would be similar to the No Action Alternative. Even though the total weight of metals increases under Alternative 1 over the No Action Alternative, the conclusions regarding potential impacts do not change for the following reasons: (1) most of the metals are benign, and those of potential concern make up a small percentage of munitions; (2) metals released through corrosion would be diluted by currents or bound up and sequestered in adjacent sediment; (3) impacts would be limited to the immediate area around the expended material; and (4) the areas across which metal components would be distributed are large. Metal components would come to rest on the sea floor exposed to seawater when resting on the bottom or, more likely, buried in sea floor sediment. These metals would slowly corrode over years or decades and release small amounts of metals and metal compounds to adjacent sediment and waters. Potential impacts on sediment and water quality would be long-term and local. Chemical, physical, or biological changes to sediment or water quality would be measurable, but below applicable standards,

regulations, and guidelines, and would be within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.2.4.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, training and testing activities involving materials with metal components would increase 324 percent compared to the No Action Alternative. Numerically, small-, medium-, and large-caliber projectiles make up 98 percent of the total (96 percent under the No Action Alternative). Materials expended at the Undersea Warfare Training Range will include torpedo accessories (e.g., guidance wires, air launch accessories, and ballast), sonobuoys, acoustic countermeasures, and expendable mobile anti-submarine warfare training targets. Because of the concentration of this training, these items are expected to increase on the sea floor within the training range. Items used in the training range are included in the tally of materials in Table 3.1-26.

Training Activities. Under Alternative 2, training activities involving materials with metal components would increase 314 percent compared to the No Action Alternative. Such activities would represent 95 percent of materials with metal components, similar to the No Action Alternative. Numerically, 99 percent are small-, medium-, and large-caliber projectiles (95 percent under the No Action Alternative), most of which (84 percent) would be used in two range complexes: VACAPES (59 percent; 62 percent under the No Action Alternative) and JAX (25 percent; 23 percent under the No Action Alternative).

Comparison of Training Materials by Weight. Similar to Alternative 1, a review of training materials based on weight provides a different perspective on the relative contribution of various items under Alternative 2. Under Alternative 2, the total weight of training materials with metal components would be an estimated 2,844 tons (2.58 million kg), compared to an estimated 1,747 tons (1.58 million kg) under the No Action Alternative, an increase of 63 percent. Table 3.1-26 depicts those categories of materials that contribute most (88 percent) of the total weight of training items with metal components under Alternative 2.

Table 3.1-26: Training Materials with Metal Components under Alternative 2 – Comparison of Number of Items versus Weight

Type of Military Expended Material	Percent of Total by Number	Percent of Total by Weight
Large- and Medium-Caliber Projectiles	21.0	35.9
Bombs	< 0.1	30.6
Small-Caliber Projectiles	77.6	11.0
Sonobuoys	0.4	10.9

"<": less than.

Under Alternative 2, the distribution of the training materials based on weight would be the same as described under Alternative 1.

Note: Because the contribution of testing materials to the total amount of materials with metal components is relatively small by number and to some degree by weight, only training materials were used for the comparisons in Table 3.1-26. Surface vessels used as targets also contribute a large amount of metal weight. Under Alternative 2, one surface vessel is proposed for vessel sinking exercises (six

under the No Action Alternative). However, the types of vessels used as targets depend on their availability and, therefore, cannot be specified. For comparison, the total weight of military expended materials with metal components under Alternative 2 is estimated to be 4,405 tons. A Navy vessel used as a target would weigh between 5,000 and 10,000 tons.

Testing Activities. Under Alternative 2, testing activities would represent 5 percent of all materials with metal components, the same as the No Action Alternative. Use of these materials would increase 517 percent compared to the No Action Alternative. Of those materials, 90 percent are small-, medium-, and large-caliber projectiles, most of which (87 percent; 91 percent under the No Action Alternative) would be used in two range complexes: VACAPES (60 percent; 66 percent under the No Action Alternative), and JAX (27 percent; 25 percent under the No Action Alternative). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Metals

Although the amount of materials with metal components associated with training and testing activities under Alternative 2 would represent an increase, similar to Alternative 1 and the impacts would be similar to the No Action Alternative. Even though the total weight of metals increases under Alternative 2 over the No Action Alternative, the conclusions regarding potential impacts do not change for the following reasons: (1) most of the metals are benign, and those of potential concern make up a small percentage of munitions; (2) metals released through corrosion would be diluted by currents or bound up and sequestered in adjacent sediment; (3) impacts would be limited to the immediate area around the expended material; and (4) the areas across which metal components would be distributed are large. Metal components would come to rest on the sea floor exposed to seawater when resting on the bottom or, more likely, buried in sea floor sediment. These metals would slowly corrode over years or decades and release small amounts of metals and metal compounds to adjacent sediment and waters. Potential impacts on sediment and water quality would be long-term and local. Chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.3 Chemicals Other than Explosives

3.1.3.3.1 Introduction

Under the Proposed Action, chemicals other than explosives are associated with the following military expended materials: (1) solid-fuel propellants in missiles, rockets, and unmanned aerial vehicles (targets); (2) Otto Fuel II torpedo propellant and combustion byproducts; (3) PCBs in target vessels used during sinking exercises; (4) other chemicals associated with ordnance; and (5) chemicals and biological materials that simulate chemical and biological warfare agents, referred to as “chemical simulants” and “biological simulants.”

The next sections provide the following overview:

- Sections 3.1.3.3.2, 3.1.3.3.3, and 3.1.3.3.4 provide more detail concerning the solid-fuel propellants, Otto Fuel II, and PCBs;
- Sections 3.1.3.3.5 and 3.1.3.3.6 provide a summary of other chemicals associated with ordnance and additional detail related to chemical and biological simulants;

- Section 3.1.3.3.7 discusses how chemicals other than explosives will be evaluated under each alternative;
- Section 3.1.3.3.8 reviews information about the behavior and potential impacts of chemicals other than explosives on sediment and water quality; and
- Section 3.1.3.3.9 evaluates each alternative in terms of the information provided in Sections 3.1.3.3.7 and 3.1.3.3.8.

Hazardous air pollutants associated with explosives and explosion byproducts are discussed in Section 3.2.3.2 (Hazardous Air Pollutants). Fuels onboard manned aircraft and vessels are not reviewed, nor are fuel-loading activities or onboard operations and maintenance activities.

3.1.3.3.2 Missile and Rocket Propellant – Solid Fuel

The largest chemical constituent of missiles is solid propellant. Solid propellant contains both the fuel and the oxidizer (a source of oxygen needed for combustion). A Standard Missile-1 typically contains 150 lb. (68 kg) of solid propellant (U.S. Department of the Navy 2008b). Ammonium perchlorate is an oxidizing agent used in most modern solid-propellant formulas. It normally accounts for 50 to 85 percent of the propellant by weight. Ammonium dinitramide may also be used as an oxidizing agent. Aluminum powder as a fuel additive makes up 5 to 21 percent by weight of solid propellant; it is added to increase missile range and payload capacity. Two high explosives—high melting explosive (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, also known as HMX) and royal demolition explosive (hexahydro-1,3,5-trinitro-1,3,5-triazine, also known as RDX)—may be added, although they usually compose less than 30 percent of the propellant weight (Missile Technology Control Regime 1996).

The most common substance used as binding material for solid propellants is hydroxyl-terminated polybutadiene. Other binding materials include carboxyl-terminated polybutadiene and polybutadiene-acrylic acid-acrylonitrile. These materials also burn as fuels and contribute to missile thrust. Other materials found in solid-fuel propellants include curing agents and catalysts such as triphenyl bismuth; nitrate esters and nitrated plasticizers are liquid explosives added to increase the engine burn rate, and n-hexyl carborane and carboranylmethyl propionate are also used to increase propellant performance.

Double-base propellant is a solid fuel that is a mixture of fuels and small particulate oxidizers. Like other solid propellants, the most commonly used fuel component of these propellants is ammonium perchlorate. High melting explosive and royal demolition explosive may be added to improve performance, and the most common binder is hydroxyl-terminated polybutadiene. In addition to the binders listed in the preceding paragraph, polybutadiene-acrylic acid polymer, elastomeric polyesters, polyethers, and nitrocellulose plasticized with nitroglycerine or other nitrate esters may be used. To reduce decomposition of propellant, 2-nitrodiphenylamine and N-methyl-4-nitroaniline may be added (Missile Technology Control Regime 1996).

3.1.3.3.3 Torpedo Propellant – Otto Fuel II and Combustion Byproducts

The MK 48 torpedo weighs roughly 3,700 lb. (1,680 kg) and uses Otto Fuel II as a liquid propellant. Otto Fuel II is composed of propylene glycol dinitrate and nitro-diphenylamine (76 percent), dibutyl sebacate (23 percent and 2-nitrodiphenylamine as a stabilizer (2 percent). Combustion byproducts of Otto Fuel II include nitrous oxides, carbon monoxide, carbon dioxide, hydrogen, nitrogen, methane, ammonia, and hydrogen cyanide. During normal venting of excess pressure or upon failure of the torpedo's buoyancy bag, the following are discharged: carbon dioxide, water, hydrogen, nitrogen, carbon monoxide, methane, ammonia, hydrochloric acid, hydrogen cyanide, formaldehyde, potassium chloride, ferrous oxide, potassium hydroxide, and potassium carbonate (U.S. Department of the Navy 1996a, b).

3.1.3.3.4 Polychlorinated Biphenyls in Target Vessels Used During Sinking Exercises

In the past, PCBs were raised as an issue because they were found in certain solid materials on vessels used as targets during vessel-sinking exercises (e.g., insulation, wires, felts, and rubber gaskets). Currently, vessels used for sinking exercises are selected from a list of U.S. Navy-approved vessels that have been cleaned in accordance with USEPA guidelines. By rule, a sinking exercise must be conducted at least 50 nm offshore and in water at least 6,000 ft. (1,830 m) deep (40 C.F.R. § 229.2). Six sinking exercises per year are proposed under the No Action Alternative. Under Alternatives 1 and 2, one sinking exercise is planned per year. In the Study Area, these exercises occur in an area that straddles the Gulf Stream and North Atlantic Gyre Open Ocean Areas.

The USEPA estimates that as much as 100 lb. (45 kg) of PCBs remain onboard sunken vessels. The agency considers the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection, Research, and Sanctuaries Act (33 U.S.C. §§ 1401-1445) (U.S. Environmental Protection Agency 1999). Based on the foregoing considerations, PCBs will not be considered further.

3.1.3.3.5 Other Chemicals Associated with Ordnance

Table 3.1-27 provides a list of ordnance constituents remaining after low-order detonations and with unconsumed explosives. These constituents are in addition to the high explosives contained in the ordnance.

Lead azide, titanium compounds, perchlorates, barium chromate, and fulminate of mercury are not natural constituents of seawater. Lead oxide is a rare, naturally occurring mineral. It is one of several lead compounds that form films on lead objects in the marine environment (Agency for Toxic Substances and Disease Registry 2007). Metals are discussed in more detail in Section 3.1.3.2.

Table 3.1-27: Constituents Remaining after Low-Order Detonations and from Unconsumed Explosives

Ordnance Component	Constituent
Pyrotechnics Tracers Spotting Charges	Barium chromate ($BaCrO_4$) Potassium perchlorate Chlorides Phosphorus Titanium compounds
Oxidizers	Lead (II) oxide (PbO)
Delay Elements	Barium chromate ($BaCrO_4$) Potassium perchlorate Lead chromate
Fuses	Potassium perchlorate
Detonators	Fulminate of mercury [$Hg(CNO)_2$] Potassium perchlorate
Primers	Lead azide [$Pb(N_3)_2$]

3.1.3.3.6 Chemical and Biological Simulants

Chemical and biological agent detectors are used to monitor the presence of chemical and biological warfare agents and to protect military personnel and civilians from the threat of exposure to these agents. The exposure of military personnel or the public to even small amounts of real warfare agents, such as nerve or blistering agents, or harmful biological organisms, such as anthrax, is potentially

harmful and not legal in most countries in the world, including the United States. Furthermore, their use, including the testing of detection equipment, is banned by international agreement. The 1993 Chemical Weapons Convention banned the use of chemical weapons, their development, production, stockpiling, and transfer. It also required that all existing stocks of chemical weapons be destroyed within 10 years, with the exception of trace amounts of live agents used for lab testing. The United States signed the Chemical Weapons Convention on 13 January 1993 and ratified it on 25 April 1997. Nevertheless, because chemical and biological warfare agents remain a security threat, the DoD searches for and utilizes relatively harmless compounds (simulants) as substitutes for chemical and biological warfare agents to test equipment intended to detect their presence. The simulants trigger a physical or chemical interaction by the detection equipment without irritating or injuring personnel involved in testing detectors and without harming the environment.

Simulants must have one or more characteristics – size, density, or aerosol behavior – similar to those of real chemical or biological agents so they can effectively mimic them. Simulants are selected using the following criteria: (1) safety to humans and the environment and (2) the ability to trigger a response by the infrared sensors used in the detection equipment.

Safety to humans and the environment. Simulants must be relatively benign (e.g., low toxicity or effects potential) from a human health, safety, and environmental perspective. Exposure levels during testing activities should be well below concentrations associated with any adverse human health or environmental effects. The degradation products of simulants must also be harmless.

Infrared absorbance. The spectral absorbance peaks for simulant vapors should be within a certain range of the spectral absorbance peaks of the warfare agents they are intended to mimic in order to assess the capacity of detection equipment to see the vapors of simulants or agents.

Both chemical and biological simulants may be used for testing purposes. Under Alternatives 1 and 2, chemical and biological simulant testing could occur anywhere within the Northeast, VACAPES, Cherry Point, and JAX Range Complexes. Under the No Action Alternative this testing would only occur in the VACAPES Range Complex. Vapor releases would take place in these areas allowing vapor clouds to disperse as predicted by modeling and by monitoring weather conditions just prior to the test. Because of the need for early detection of chemical and biological agents, testing is designed to detect simulants at very low levels – levels well below quantities that could present risks to human health and the environment.

The types of chemical simulants proposed for use in testing exercises include Navy Chemical Agent Simulant 82 (NCAS-82), glacial acetic acid, triethyl phosphate, sulfur hexaflouride, 1,1,1,2-tetraflouroethane (refrigerant – 134 or “R-134”) and 1,1-difluoroethane (refrigerant -152a or “R-152a”). Sulfur hexafluoride and the proposed refrigerant simulants (refrigerant-134 and refrigerant-152a) are also referred to as gaseous simulants and can be released in smaller quantities in conjunction with glacial acetic acid or triethyl phosphate releases. The types of biological simulants that may be used include spore-forming bacteria, non-spore-forming bacteria, ovalbumin, bacteriophage MS2, and *Aspergillus niger*.

3.1.3.3.6.1 Chemical Simulants

Navy Chemical Agent Simulant 82. NCAS-82 is a mixture of 90 percent polyethylene glycol and 10 percent methyl salicylate. This simulant is used to test the detection of liquid agents deposited on ship surfaces or aerosolized agents carried into ship spaces. In addition, ships’ decontamination,

filtration, and collective protection systems and procedures can be evaluated for their ability to remove this simulant. NCAS-82 is dispersed by aircraft or watercraft to deliver relatively coarse droplets from above to targeted ships and can also be dispersed by hand sprayer. Up to 20 gallons of simulant is released per aircraft pass with most of the liquid intended to reach the surface of the target area on the ship. Tests are typically planned for the possibility of up to three releases — in the event a release does not sufficiently coat the target area due to wind conditions or other targeting complications. This simulant is also used in hand-held sprayers in quantities less than 5 gallons per sprayer, and up to 20 gallons would be applied per day by hand sprayer. This simulant is delivered essentially undiluted to ship surfaces (Neil 2013).

Polyethylene glycol. Polyethylene glycol occurs as a clear liquid or as a white semi-solid to solid with a slightly sweet (mild) odor, depending on its molecular weight and the ambient temperature. The form used for NCAS-82 is referred to as PEG-200 and occurs as a liquid. It can be used as one of the components of a chemical simulant for a G-agent (nerve agent) or H-agent (blistering agent) due to its physicochemical properties (U.S. Patent Office 2003).

Methyl salicylate. Methyl salicylate is a colorless or pale yellow liquid with a strong characteristic wintergreen odor. It is used as a simulant for blistering agents such as sulfur mustard agents (Seitzinger et al. 1990). It occurs naturally in plants, where it probably developed as an anti-herbivore defense. Methyl salicylate has a half-life of about 1.4 days due to its reaction with photochemically produced hydroxyl radicals (Meylan and Howard 1993). It is slightly soluble in water, with lowest solubility of 0.11 percent at an acid concentration of 62 percent acid and increasing in solubility at concentrations both above and below this value (Rubel 1989).

Glacial Acetic Acid. Glacial acetic acid is used to simulate airborne chemical agents because its appearance to infrared standoff detectors is similar to that of blister agent vapor. It is used as a simulant for persistent nerve agents, the V-agents. Glacial acetic acid is dispersed by spraying a fine mist into a high speed airflow so the simulant forms a vapor cloud approximately 100 feet above the sea surface. Up to 10 gallons is released per aircraft or vessel pass to produce a cloud of vapor. Glacial acetic acid could be released up to 20 times per day.

Glacial acetic acid is a concentrated form of acetic acid, which is a colorless liquid that gives vinegar its sour taste and pungent smell. Acetic acid is highly soluble in water and has many industrial and household uses. Acetic acid-producing bacteria are ubiquitous throughout the world and have been widely used for fermentation processes throughout history. Acetic acid occurs throughout the environment and is a normal metabolite in animals, hence people are continually exposed to low concentrations of it through the ingestion of food and the inhalation of air (Hazardous Substances Data Bank 2008b). Although acetic acid commonly occurs in the environment in dilute form, in concentrated form such as glacial acetic acid, it is harmful to the skin, eyes, and respiratory system.

Triethyl phosphate. Triethyl phosphate is a colorless liquid with a slight pleasant or sweetish odor (Lewis et al. 2001) that is soluble in most organic solvents, alcohol, and ether, and is capable of being fully mixed into water (Lewis 1999). For testing purposes triethyl phosphate is applied in a manner similar to glacial acetic acid, dispersed by spraying a fine mist into a high speed airflow so the simulant forms a vapor cloud approximately 100 feet above the sea surface. Up to 10 gallons is released per aircraft or vessel pass to produce a cloud of vapor. Triethyl phosphate could be released up to 20 times per day.

Triethyl phosphate is used primarily in industry, but is also used as a flame retardant. Consumer exposure to triethyl phosphate via inhalation during its use as a flame retardant in plastic materials was

calculated to be approximately 0.001 mg/m^3 (National Institute for Occupational Safety and Health 1983). Triethyl phosphate is considered for use as a G-agent (e.g., sarin) simulant due to its physicochemical properties (Bartelt-Hunt et al. 2008). In aquatic systems, lethal doses (LD50, single doses required to kill 50 percent of a test population) ranged from more than 100 to 2,140 mg/kg for fish and from more than 100 to 2,705 mg/L for invertebrates in tests ranging from 48 to 96 hours (United Nations Environmental Program 1998). In a subchronic 21-day test, the concentration at which half the test individuals showed effects, known as the Effective Concentration 50 or EC50, for the water flea Daphnia magna was 729 mg/L (Verschueren 2001). The bioconcentration potential of triethyl phosphate in aquatic organisms is considered to be low (Hazardous Substances Data Bank 2008c). Triethyl phosphate is considered to be moderately toxic, with a probable oral lethal dose to humans of between 500 to 5,000 mg/kg, which equates to between 1 ounce (oz.) and 16 oz. for a 150-lb. (68-kg) individual (Gosselin et al. 1984).

3.1.3.3.6.1.1 Gaseous Simulants

For testing purposes the three gaseous simulants (sulfur hexafluoride, refrigerant-134, and refrigerant-152a) discussed below are released in small quantities in conjunction with releases of glacial acetic acid or triethyl phosphate because they are detectible by standoff infrared detectors (Neil 2013).

Sulfur hexafluoride. Sulfur hexafluoride is a colorless, odorless gas. It is soluble in potassium hydroxide and alcohol, but has a low solubility in water. It is primarily used in industry as a gaseous electrical insulating material and for the production of semiconductors (dry/plasma etching).

As with other gases, direct exposure to large concentrations could cause asphyxiation as a result of the displacement of oxygen (American Conference of Governmental Industrial Hygienists 1994-1995). However, ordinarily sulfur hexafluoride does not exist in a pure state (Sittig 2002). The degeneration products of sulfur hexafluoride (e.g., sulfur tetrafluoride) can be toxic, causing nose and ear irritation, nausea and vomiting, coughing, shortening of breath, tightness in the chest, and pulmonary edema. Because sulfur hexafluoride is on the USEPA's Greenhouse Gas Action List, its use is being phased out and its future use is unlikely in testing exercises.

Refrigerant -134 (R-134). Refrigerant-134 is an inert colorless, odorless gas used primarily as a high temperature refrigerant for refrigeration and automobile air conditioners. It began to be used in the 1990s to replace dichlorodifluorometane (Freon-12), which was banned in the United States and other countries in 1994 because of its ozone-depleting properties. Refrigerant-134 exhibits relatively low toxicity in animals with a four-hour (acute toxicity) lethal concentration of 567,000 ppm (2,360 g/m^3) reported for rats and no effects observed at 81,000 ppm (338 g/m^3). At concentrations in excess of 200,000 ppm (834 g/m^3), exposure to 1,1,1,2-tetrafluoroethane depressed the central nervous system of rats (World Health Organization/International Program on Chemical Safety 1998). In aquatic systems, refrigerant-134 shows low toxicity for the few organisms upon which it has been tested. It also has a low estimated half-life of 3 hours for volatilization in a river (Hazardous Substances Data Bank 2008a). The low toxicity and high volatility indicate negligible risk to aquatic organisms (World Health Organization/International Program on Chemical Safety 1998). In addition, low estimated bioconcentration indicates that 1,1,1,2-tetrafluoroethane would not bioconcentrate in fish and aquatic organisms (Lyman et al. 1982).

Refrigerant -152a (R-152a). Refrigerant-152a is an inert colorless, odorless gas used primarily as a high temperature refrigerant for refrigeration and air conditioners and as an aerosol propellant. It is also known as Freon 152a, Genetron 152, and HCFC-152a. Refrigerant-152a is recommended as an

alternative refrigerant to refrigerant-134, as it has a lower global warming potential (U.S. Environmental Protection Agency 2008a).

A two-year inhalation study on rats was used to evaluate the toxicity of refrigerant-152a, where rats were exposed to 0, 2,000, 10,000, or 25,000 ppm 1,1-difluoroethane (equal to 0, 5,399, 26,994, or 67,485 mg/m^3, respectively) (McAlack and Schneider 2009). The 25,000 ppm concentration was designated as a chronic "no adverse effect level," as no significant respiratory, mortality, metabolic, or other effects were observed. Exposure to higher concentrations of refrigerant-152a in an acute study indicates it is practically nontoxic.

3.1.3.3.6.2 Chemical Simulant Safety

Naval Surface Warfare Center, Dahlgren Division uses an air dispersion/deposition model to estimate the amount of each simulant that would be deposited on the water's surface prior to testing. The analysis uses the DoD-approved Vapor, Liquid, and Solid Tracking Model (VLSTRACK: Version 3.1.1) to calculate the concentration and deposition levels resulting from testing under various release scenarios.

In addition to modeling, field test results were evaluated to understand airborne dispersal and surface deposition behavior for simulants. Field tests performed by Naval Surface Warfare Center, Dahlgren Division indicate that less than 1 percent of unvaporized liquid falls out on water surfaces. Testing conducted at the Potomac River Test Range showed surface deposition rates of 0.08 percent for glacial acetic acid and 0.35 percent for triethyl phosphate (Driscoll et al. 2004). Maximum water concentrations calculated were 7 parts per billion for glacial acetic acid, and 76 parts per billion for triethyl phosphate using a 0.1 meter mixing depth (Neil 2013).

Additional modeling and testing performed in 2003, 2005, and 2009 showed no impacts from the testing of chemical simulants. There were no observable environmental effects during or after testing (Organization for Economic Cooperation and Development 2005; U.S. Department of the Navy 2009). Based on all these findings, chemical simulants would not have measurable environmental impacts and will not be considered further.

3.1.3.3.6.3 Biological Simulants

Biological simulants are microorganisms that exhibit qualities similar to actual biological threat agents but do not present threats to human health. Biosafety Level 1 organisms are proposed for use as simulants. Because they rarely cause reactions or diseases, Biosafety Level 1 organisms are commonly used in high school and introductory college teaching laboratories. Examples of Biosafety Level 1 organisms are *Lactobacillus acidophilus,* which is used to turn milk into yogurt, and *Neurospora crassa*, a bread mold, which is used for genetic studies because its simple genome has been completely sequenced. All tests would be conducted in accordance with local, state, and federal regulations. Testing activities would use the following Biosafety Level 1 organisms, or something comparable, as simulants:

- Spore-forming bacteria: *Bacillus atrophaeus* (formerly known as *Bacillus globigii), Bacillus subtilis*, and *Bacillus thuringiensis*
- Non-spore-forming bacteria*: Pantoea agglomerans (*formerly known as *Erwinia herbicola)* and *Deinococcus radiodurans*
- The protein ovalbumin
- MS2 bacteriophages
- The fungus *Aspergillus niger*

These biological simulants are described below. Biological simulants would be applied as an aerosol and the amount of simulant used would be the minimum amount necessary to obtain the desired results, up to approximately 11 lb. (5 kg) dry weight per simulant per day.

Spore-Forming Bacteria: Bacillus atrophaeus, Bacillus subtilis, and Bacillus thuringiensis. *Bacillus* species produce an endospore, which is a dormant, tough, non-reproductive structure that allows the bacteria to survive through periods of environmental stress such as extreme heat and desiccation (U.S. Environmental Protection Agency 1997). Under most conditions *Bacillus* are not biologically active but exist in endospore form. The endospores are ubiquitous in soil and rocks and are easily dispersed by wind and water (Moeller et al. 2004). *Bacillus* species are also commonly found in dust, air, water, and on wet surfaces throughout the world (Center for Research Information Inc. 2004). They generally occur at population levels of 10 to 100 per gram of soil (Alexander 1977). However, concentrations of *Bacillus* occurring naturally in the desert have been measured at 100,000 spores per gram of surface soil (United States Army 2003). Benign species of *Bacillus* are used to simulate the toxic spore-forming bacterium, *Bacillus anthracis*, commonly known as anthrax. *Bacillus subtilis* and similar *Bacillus* species are common in the environment and are uncommon causes of disease to healthy individuals (Department of Defense 2003).

Bacillus atrophaeus produces its own toxins and can sicken people whose immune systems have been compromised. Human infection by *Bacillus atrophaeus* primarily results from deep incisions in the skin, such as penetrating injuries, surgical procedures, catheters and intravenous lines, or a debilitated health state. Infections are usually treated with antibiotics (Blue et al. 1995). Cases of long-term persistence or recurrence of extended latency have not been found. However, based on a recent reevaluation of *Bacillus atrophaeus*, it is now considered a pathogen for humans (Center for Research Information Inc. 2004).

Bacillus thuringiensis is a naturally occurring bacterial disease of insects and is used as an active ingredient in some insecticides. Several strains of *Bacillus thuringiensis* can infect and kill lepidopterans (moths, butterflies, and caterpillars) by producing proteins that react with the cells of the gut lining of susceptible insects and paralyze the digestive system. Infected insects generally die from starvation, which can take several days. The most commonly used strain of *Bacillus thuringiensis* (*kurstaki* strain) kills only leaf- and needle-feeding caterpillars. Among the various strains, insecticidal activity is specific to the target insect group, and *Bacillus thuringiensis* is considered safe to people and nontarget species. Some formulations are considered safe to be used on food crops (Cranshaw 2006).

Because the *Bacillus* species proposed for use are ubiquitous in the environment, the releases expected from activities would not increase *Bacillus* populations in the environment.

Non-Spore-Forming Bacteria: Pantoea agglomerans and Deinococcus radiodurans. *Pantoea agglomerans* is a gram-negative, rod-shaped bacterium associated with plants. No adverse human health effects associated with *Pantoea agglomerans* have been observed through data reports submitted to USEPA or public literature. Based on available data and its low toxicological significance, USEPA classifies *Pantoea agglomerans* (strain E325) as having the lowest toxicity level, toxicity category IV (U.S. Environmental Protection Agency 2006). Toxicity categories for pesticide products range from toxicity category I, for products that are considered highly toxic or severely irritating, to toxicity category IV, for products that are practically non-toxic and non-irritating.

Deinococcus radiodurans is a gram-positive extremophilic bacterium – an organism that thrives in physically or geochemically extreme conditions. It is one of the most radioresistant (resistant to radiation) organisms known and can survive conditions that include cold, dehydration, vacuum, and acid (DeWeerdt 2002). While *Deinococcus radiodurans* is quite hardy, it is a relatively weak competitor. It is not considered a human pathogen and a *Deinococcus*-related bacterium has been found living inside the human stomach (Bik et al. 2006).

Ovalbumin. Ovalbumin is a glycoprotein (a conjugated protein having a carbohydrate as the nonprotein component). It is the main protein found in egg white and is used as a key reference protein for immunization and *biochemical* studies. It can also be used to simulate protein toxins such as ricin – a protein extracted from the castor bean (*Ricinus communis*) – and botulinum toxin – a potent neurotoxic protein produced by the bacterium *Clostridium botulinum* (O'Connell et al. 2002). Ovalbumin is commonly consumed in food products and used as a medium to grow vaccines.

Bacteriophage MS2. Bacteriophage MS2 (family *Leviviridae*) is a small, icosahedral, bacteriophage of *Escherichia coli,* a bacterium commonly found in the intestine of warm-blooded animals, including humans. A bacteriophage is a virus that infects bacteria. MS2 are ubiquitous and are found in places populated by their bacterial hosts such as soil or the intestines of animals. The small size of MS2, its simple structure, its ribonucleic acid genome, and harmlessness to humans, animals, plants, and other higher organisms, make it a useful simulant for deadly small ribonucleic acid viruses such as Ebola virus (*Ebolavirus*), Marburg virus (*Marburgvirus*), and smallpox (*Variola major* and *Variola minor*). MS2 is used in place of pathogenic viruses in a wide variety of studies that range from the testing of compounds for disinfecting surfaces to studying the environmental fate and transport of pathogenic viruses in groundwater (O'Connell et al. 2006).

***Aspergillus niger*.** The fungus *Aspergillus niger* is one of the most common species of the genus *Aspergillus*. It causes a disease called black mold on certain fruits and vegetables such as grapes, onions, and peanuts, and is a common contaminant of food. It is ubiquitous in soil and is commonly reported in indoor environments. It is widely used in biotechnology and has been in use for many decades to produce extracellular (food) enzymes and citric acid (Schuster E. et al. 2002).

Aspergillus niger is less likely to cause human disease than some other *Aspergillus* species but, if large amounts of spores are inhaled, a serious lung disease, aspergillosis, can occur. Since *Aspergillus* is so common in the environment, most people breathe in *Aspergillus* spores every day (Centers for Disease Control and Prevention 2008). The spores do not harm people with healthy immune systems, but individuals with compromised immune systems breathing in many spores (such as in a very dusty environment) may become infected. Schuster et al. concluded that with appropriate safety precautions, *Aspergillus niger* is a safe production organism.

3.1.3.3.6.4 Biological Simulant Safety

All the proposed biological simulants that would potentially be used are considered Biosafety Level 1 organisms and would be dispersed in the air, with the potential for subsequent deposition of some smaller portion of the simulant onto the water surface. Biosafety Level 1 represents the basic level of protection and is appropriate for working with microorganisms that are not known to cause disease in normal healthy humans (Centers for Disease Control and Prevention and National Institutes of Health 2007). Based on these findings, biological simulants would not have environmental impacts and will not be considered further.

3.1.3.3.7 Approach to Analysis

Most testing activities related to the chemical and biological simulants discussed above would be conducted more than 3 nm offshore in each range complex. These activities would be subject to federal sediment and water quality standards and guidelines. The areas within each complex represent the region across which the chemicals discussed would be distributed. For properly functioning expended materials, the term "local" refers to the volume of water that each self-propelled subsurface training and testing material passes through. In these situations, impacts would be to water quality from combustion byproducts. For lost and malfunctioning expended material, the term "local" refers to a small zone around noncombusted propellant in sediment, perhaps a centimeter or two, and a smaller area if directly exposed to seawater.

State and federal standards and guidelines. No state or federal sediment and water quality standards or guidelines exist that are specific to the chemical and biological simulants discussed above.

3.1.3.3.8 Impacts from Chemicals Other than Explosives

The following sections discuss the potential impact on sediment and water quality from solid-fuel propellants for missiles and rockets, Otto Fuel II torpedo propellant, and combustion byproducts.

3.1.3.3.8.1 Solid-Fuel Propellants

The failure rate of rockets is 3.8 percent (Rand Corporation 2005; U.S. Army Corps of Engineers 2007). The remaining solid propellant fragments (i.e., one percent or less of the initial propellant weight) sink to the ocean floor and undergo physical and chemical changes in contact with sediment and seawater. Tests show that water penetrates about 0.06 in. (0.14 cm) into the propellant during the first 24 hours of immersion, and that fragments slowly release ammonium and perchlorate ions (Fournier and Brady 2005). These ions would disperse into the surrounding seawater, so local concentrations would be low. For example, a standard missile with 150 lb. (68 kg) of solid propellant would generate less than 1.5 lb. (0.7 kg) of propellant residue after completing its flight. If all the propellant deposited on the ocean floor were in the form of 4-in. (10-cm) cubes, about 0.42 percent of the propellant would be wetted during the first 24 hours of immersion. If all the ammonium perchlorate leached out of the wetted propellant, then approximately 0.01 lb. (0.005 kg) would enter the surrounding seawater (U.S. Department of the Navy 2008b). This leach rate would decrease over time as the concentration of perchlorate in the propellant declined. The aluminum in the binder would be converted to aluminum oxide by seawater.

Perchlorate. Ammonium perchlorate accounts for 50 to 85 percent of solid propellant by weight (Missile Technology Control Regime 1996). Perchlorates are highly soluble and stable in water. According to the Agency for Toxic Substances and Disease Registry (2008), perchlorate "does not readily bind to soil particles or to organic matter, and does not readily form ionic complexes with other materials in solution." Because of these characteristics, perchlorate is highly mobile in soil and does not readily leave solution through chemical precipitation. Thus, perchlorate has the potential to affect sediment and water quality because of its persistence in the environment.

Natural sources of perchlorate include Chilean caliche ore (U.S. Environmental Protection Agency 2008d) and ozone oxidation of atmospheric chlorine (Petrisor and Wells 2008). Martinelango (2006) stated that perchlorate was present in seawater at levels ranging from less than 0.07 µg/L to 0.34 µg/L (0.07 to 0.34 ppb). Studies indicate that it may accumulate in living organisms, such as fish and plants (Agency for Toxic Substances and Disease Registry 2008). Toxicity in plants and microbes is thought to be due to negative impacts on metabolic enzymes (van Wijk and Hutchinson 1995). Research by Martinelango

(2006) found that perchlorate can concentrate in marine algae from 200 to 5,000 times, depending on the species. Chaudhuri et al. (2002) noted that several species of microbes are capable of metabolizing chlorate and perchlorate. The end product is chloride. Logan et al. (2001) used sediment samples from a variety of marine and saline environments to demonstrate that microbial perchlorate reduction can occur in saline solutions greater than 3 percent. Seawater salinity is about 3.5 percent. The organism responsible for the perchlorate reduction was not identified in the study. However, Okeke et al. (2002) identified three species of halophilic ("salt-loving") bacteria that biodegrade perchlorate. The USEPA has established a drinking water standard for perchlorate, but no standards or guidelines have been established for perchlorate in marine systems.

Polyesters. Regarding other solid-fuel components, marine microbes and fungi are known to degrade biologically produced polyesters, such as polyhydroxyalkanoates, a bacterial carbon and energy source (Doi et al. 1992). These organisms are also capable of biodegrading other synthetic polymers, although at slower rates (Shah et al. 2008). The chemical structure of natural rubber is similar to that of polybutadiene (Tsuchii and Tokiwa 2006). Thus, although no specific studies were found that documented biodegradation of polybutadiene in marine ecosystems, the prospects seem likely based on the findings of researchers such as Tsuchii and Tokiwa (2006).

Nitriles. Nitriles are cyanide-containing organic compounds that are both natural and man-made. Several species of marine bacteria are capable of metabolizing acrylonitrile (Brandao and Bull 2003). Given that productivity of marine ecosystems is most often limited by available nitrogen (Vitousek and Howarth 1991), biodegradation of nitrate esters and nitrated plasticizers in the marine environment seems likely.

3.1.3.3.8.2 Otto Fuel II and Combustion Byproducts

Microbial degradation of the main components of Otto Fuel II (propylene glycol dinitrate and nitro-diphenylamine) has been demonstrated (Sun et al. 1996; Walker and Kaplan 1992). Although these studies did not involve marine microbes, other studies demonstrated that marine bacteria in anaerobic sediment were able to degrade 2-nitrodiphenylamine (Drzyzga and Blotevogel 1997; Powell et al. 1998). According to the Agency for Toxic Substances and Disease Registry (1995), 2-nitrodiphenyl-amine tends to bind to sediment and does not bioaccumulate in aquatic organisms and is not likely to biomagnify in the environment. The agency indicated that dibutyl sebacate "is readily degraded by environmental bacteria and fungi" (Agency for Toxic Substances and Disease Registry 1995).

Combustion byproducts from Otto Fuel II released into the ocean will dissolve, dissociate, or be dispersed and diluted in the water column. Except for hydrogen cyanide, combustion byproducts are not a concern (U.S. Department of the Navy 1996a, b) for the reasons detailed below:

- Most Otto Fuel II combustion products such as carbon dioxide, nitrogen, methane, and ammonia occur naturally in seawater;
- Several of the combustion products are bioactive. Nitrogen is converted into nitrogen compounds through nitrogen fixation by certain cyanobacteria, providing nitrogen sources and essential micronutrients for marine phytoplankton. Carbon dioxide and methane are integral parts of the carbon cycle in the oceans, and are taken up by many marine organisms;
- Carbon monoxide and hydrogen have low solubility in seawater and excess gases bubble to the surface;

- Trace amounts of oxides of nitrogen may be present, but they are usually below detectable limits. Oxides of nitrogen in low concentrations are not harmful to marine organisms and are a micronutrient source of nitrogen for aquatic plant life; and
- Ammonia can be toxic to marine organisms in high concentrations, but releases from the combustion of Otto Fuel II are quickly diluted to insignificant concentrations.

Hydrogen cyanide does not normally occur in seawater. Major releases of cyanide to water are from metal-finishing industries, iron and steel mills, and organic chemical industries (U.S. Environmental Protection Agency 1981). At high concentrations, cyanide can pose a risk to both humans and marine biota. Compared to recommendations of the USEPA of 1.0 µg/L (1.0 ppb) (U.S. Environmental Protection Agency 2010), hydrogen cyanide released from MK 48 torpedoes would result in ambient concentrations ranging from 140 to 150 µg/L (140 to 150 ppb) (U.S. Department of the Navy 1996b), well above the recommended levels. However, because hydrogen cyanide is soluble in seawater, it would be diluted to less than 1 µg/L (1.0 ppb) within a distance of 18 ft. (5.4 m) from the center of the torpedo's path when first discharged. Additional dilution would occur thereafter.

Approximately 30,000 exercise tests of the MK 48 torpedo have been conducted over the last 25 years. Most of these launches have been on Navy test ranges, where there have been no reports of harmful impacts on water quality from Otto Fuel II or its combustion products. Furthermore, U.S. Navy studies conducted at torpedo test ranges that have lower flushing rates than the open ocean did not detect residual Otto Fuel II in the marine environment (U.S. Department of the Navy 1996a, b).

3.1.3.3.8.3 Operational Failure – Torpedoes, Missiles, and Rockets

Some materials are recovered after use, such as torpedoes. However, sometimes these recoverable items are lost or they fail to perform correctly. For instance, the failure rate of rockets is 3.8 percent (Rand Corporation 2005; U.S. Army Corps of Engineers 2007). Corrosion of munitions in the marine environment is discussed in more detail in Section 3.1.3.2 (Metals).

3.1.3.3.9 Evaluation of Alternatives

Table 3.1-28 summarizes the types and numbers of military expended materials that contain chemicals other than explosives for all alternatives. The numbers represent amounts expended annually for each type of material under each alternative. The types and amounts of military expended materials in the table were drawn from the tables in Chapter 2 (Description of Proposed Action and Alternatives).

Table 3.1-28: Numbers of Military Expended Materials that Contain Chemicals Other than Explosives – All Alternatives Annually

Type of Military Expended Material	Chemical Component	No Action Alternative	Alternative 1	Alternative 2
Missiles	Solid fuel propellants			
Training		456	494	494
Testing		151	800	881
Total		607	1,294	1,375
Rockets	Solid fuel propellants			
Training		3,700	7,980	7,980
Testing		377	2,761	3,037
Total		4,077	10,741	11,017
Torpedoes	Otto Fuel II			
Training		1	1	1
Testing		12	42	45
Total		13	43	46
Expendable Subsurface Targets	Otto Fuel II			
Training		1,621	2,306	2,306
Testing		133	766	862
Total		1,754	3,072	3,168

The following sections evaluate each alternative in terms of the information provided in Sections 3.1.3.3.7 (Approach to Analysis) and 3.1.3.3.8 (Impacts from Chemicals Other than Explosives). Potential impacts on sediment and water quality from chemicals other than explosives should be viewed in the following context: (1) nearshore sediment and water quality in many areas have been negatively impacted; in particular, a wide variety of chemicals are delivered to the ocean by major river systems; and (2) the majority of those impacts are from human-generated and land-based activities. The numbers of military expended materials discussed below reflect amounts expended annually for each type of material under each alternative.

3.1.3.3.9.1 No Action Alternative

Under the No Action Alternative, 6,451 pieces of military expended materials that contain chemicals other than explosives. Of these materials, 63 percent are rockets and 27 percent are expendable subsurface targets.

Training Activities. Under the No Action Alternative, numerically, training activities would represent 90 percent of military expended materials that contain chemicals other than explosives. Of these training materials, rockets would comprise 64 percent, all of which would be used in the VACAPES Range Complex. Expendable subsurface targets comprise 28 percent of training materials. Half of such targets would be used in the JAX Range Complex, and another 47 percent would be used in three locations: the Northeast Range Complex, VACAPES Range Complex, and the Navy Cherry Point Range Complex.

Testing Activities. Under the No Action Alternative, numerically, testing activities would represent 10 percent of materials using chemicals other than explosives. Rockets would comprise 56 percent of

these materials and would be tested in two range complexes: VACAPES (70 percent) and JAX (30 percent). Expendable subsurface targets would comprise 20 percent of testing materials, of which 85 percent would be tested in three range complexes or testing ranges: VACAPES (53 percent), JAX (20 percent), and the Naval Undersea Warfare Center Division, Newport Testing Range (12 percent). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Table 2.8-2 and Table 2.8-3.

Summary of Impacts from Chemicals Other than Explosives

Under the No Action Alternative, impacts on sediment and water quality associated with training and testing activities involving chemical other than explosives would be short-term and local with properly functioning materials, and long-term and local with lost or malfunctioning materials.

For properly functioning materials, chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Impacts would be minimal for the following reasons: (1) the size of the area in which expended materials would be distributed is large; (2) the majority of propellant combustion byproducts are benign, while those of concern would be diluted to below detectable levels within a short time; (3) most propellants are consumed during normal operations; (4) the failure rate is low for such expended materials; and (5) most of the constituents of concern are biodegradable by various marine organisms or by physical and chemical processes common in marine ecosystems.

For lost or malfunctioning expended materials, chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Impacts would be minimal for the following reasons: (1) the size of the area in which expended materials would be distributed is large; (2) the majority of propellants (99 percent) are consumed during normal operations and the failure rate is low, so quantities of unused propellants would be low; and (3) studies indicate that most of the constituents of concern are biodegradable by various marine organisms or by physical and chemical processes common in marine ecosystems. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.3.9.2 Alternative 1

Under Alternative 1, military expended materials that contain chemicals other than explosives would increase from 6,451 to 15,150 (235 percent). Of these materials, 71 percent would be rockets (63 percent under the No Action Alternative) and 20 percent would be expendable subsurface targets (27 percent under the No Action Alternative).

Training Activities. Under Alternative 1, numerically, training materials would represent 71 percent of the military expended materials that contain chemicals other than explosives (89 percent under the No Action Alternative). These training materials would increase from 5,778 to 10,781 (71 percent compared to 90 percent for the No Action Alternative). Rockets would comprise 74 percent of these training materials (64 percent under the No Action Alternative), of which nearly half (48 percent) would be used in the VACAPES Range Complex (100 percent under the No Action Alternative) and nearly half (48 percent) in the JAX Range Complex (0 percent under the No Action Alternative). Expendable subsurface targets comprise 21 percent of these training materials (28 percent under the No Action Alternative), most of which would be used in the JAX Range Complex (63 percent; 50 percent under the No Action Alternative).

Testing Activities. Under Alternative 1, numerically, testing activities would represent 28 percent of all materials using chemicals other than explosives (10 percent under the No Action Alternative).

Testing of these materials would increase from 673 to 4,369 (649 percent increase) compared to the No Action Alternative. Specifically,

- Missile testing would increase from 151 to 800 events. Nearly all of this activity (98 percent) would occur in two range complexes: VACAPES (86 percent; 88 percent under the No Action Alternative) and JAX (12 percent; 7 percent under the No Action Alternative).
- Rocket testing would increase from 377 to 2,761 events. All of that activity would occur in two range complexes: VACAPES (75 percent; 70 percent under the No Action Alternative) and JAX (25 percent; 30 percent under the No Action Alternative).
- Torpedo testing would increase from 12 to 42 events. Much of this activity (81 percent) would occur in two locations: the VACAPES Range Complex (67 percent; 17 percent under the No Action Alternative); and the JAX Range Complex (14 percent; 17 percent under the No Action Alternative).
- Testing of expendable subsurface targets would increase from 133 to 766 events. Most of this activity (94 percent) would occur in three locations: the VACAPES Range Complex (56 percent; 53 percent under the No Action Alternative), Naval Undersea Warfare Center Division, Newport Testing Range (14 percent; 12 percent under the No Action Alternative), and the JAX Range Complex (24 percent; 20 percent under the No Action Alternative).

Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Chemicals Other than Explosives

Under Alternative 1, although training and testing with materials using chemicals other than explosives would increase compared to the No Action Alternative, the impacts are judged to be similar to the No Action Alternative for the reasons enumerated under the No Action Alternative. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.3.9.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, military expended materials that contain chemicals other than explosives would increase for training and testing from 6,451 to 15,606 (242 percent) over the No Action Alternative. Of these materials, 71 percent would be rockets (63 percent under the No Action Alternative) and 20 percent would be expendable subsurface targets (27 percent under the No Action Alternative).

Training Activities. Under Alternative 2, numerically, military expended materials from training would represent 71 percent of military expended materials that contain chemicals other than explosives (90 percent under the No Action Alternative). These training materials would increase from 5,778 to 10,781 (187 percent increase over the No Action Alternative). Rockets would comprise 74 percent of training materials (64 percent under the No Action Alternative, of which nearly half (48 percent) would be used in the VACAPES Range Complex (100 percent under the No Action Alternative) and nearly half (48 percent) in the JAX Range Complex (0 percent under the No Action Alternative). Expendable subsurface targets comprise 21 percent of these training materials (28 percent under the No Action

Alternative), most of which would be used in the JAX Range Complex (65 percent; 51 percent under the No Action Alternative).

Testing Activities. Under Alternative 2, military expended materials from testing activities represent 31 percent of all military expended materials that contain chemicals other than explosives (10 percent under the No Action Alternative). Testing of these materials would increase from 673 to 4,825 items (717 percent increase) compared to the No Action Alternative. Changes relative to the No Action Alternative are similar to those noted under Alternative 1. Specifically,

- Missile testing would increase from 151 to 881 events. Nearly all of this activity (97 percent) would occur in two range complexes: VACAPES (86 percent) and JAX (11 percent).
- Rocket testing would increase from 377 to 3,037 events. All of that activity would occur in two range complexes: VACAPES (75 percent) and JAX (25 percent).
- Torpedo testing would increase from 12 to 45 events. A majority of this activity (83 percent) would occur in two locations: the VACAPES Range Complex (67 percent); and the JAX Range Complex (16 percent).
- Testing of expendable subsurface targets would increase from 133 to 862 events. Most of this activity (93 percent) would occur in three locations: the VACAPES Range Complex (55 percent), Naval Undersea Warfare Center Division, Newport Testing Range (15 percent), and the JAX Range Complex (23 percent).

Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Chemicals Other than Explosives

Under Alternative 2, although military expended materials that contain chemicals other than explosives would increase for training and testing activities compared to the No Action Alternative, the impacts are judged to be similar to the No Action Alternative for the reasons enumerated under the No Action Alternative. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.4 Other Materials

3.1.3.4.1 Introduction

In the Proposed Action, other materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other materials. These materials and components are made mainly of nonreactive or slowly reactive materials (e.g., glass, carbon fibers, and plastics) or they break down or decompose into benign byproducts (e.g., rubber, steel, iron, and concrete). Most of these objects would settle to the sea floor where they would: (1) be exposed to seawater; (2) become lodged in or covered by sea floor sediment; (3) become encrusted by chemical processes such as rust; (4) slowly dissolve; or (5) be covered by marine organisms such as coral. Plastics may float or descend to the bottom, depending on their buoyancy. Markers and flares are largely consumed during use.

Steel in ordnance normally contains a variety of metals, some of potential concern. However, these other metals are present in low quantities (1 to 5 percent of content) such that steel is not generally considered a potential source of metal contamination. Metals are discussed in more detail in Section 3.1.3.2. Various chemicals and explosives are present in small amounts (mostly as components of flares and markers), but are not considered likely to cause negative impacts. Chemicals other than

explosives are discussed in more detail in Section 3.1.3.3, and explosives and explosion byproducts are discussed in more detail in Section 3.1.3.1.

The next sections provide the following overview:

- Sections 3.1.3.4.2, 3.1.3.4.3, and 3.1.3.4.4 provide more detail concerning marine markers, flares, and chaff;
- Section 3.1.3.4.5 discusses how these other materials described above are evaluated under each alternative;
- Section 3.1.3.4.6 reviews information regarding the behavior and potential negative impacts of those materials on sediment and water quality; and
- Section 3.1.3.4.7 evaluates each alternative in terms of the information in Sections 3.1.3.4.5 and 3.1.3.4.6.

Note: Towed and stationary targets include floating steel drums, towed aerial targets, the trimaran, and inflatable, floating targets. Potential impacts from floating steel drums are considered as part of the analysis of non-explosive practice munitions. The trimaran is a three-hulled boat with a four-foot-square sail that is towed as a moving target. Large, inflatable, plastic targets can be towed or left stationary. Towed aerial targets are either: (1) rectangular pieces of nylon fabric 7.5 ft. by 40 ft. (2.3 m by 12.2 m) that reflects radar or lasers; or (2) aluminum cylinders with a fiberglass nose cone, aluminum corner reflectors (fins), and a short plastic tail section. This second target is about 10 ft. long (3 m) and weighs about 75 lb. (34 kg). These four targets are recovered after use and will not be considered further.

3.1.3.4.2 Marine Markers and Flares

Marine markers are pyrotechnic devices dropped on the water's surface during training exercises to mark a position on the ocean surface for search and rescue activities, or as bomb targets. The MK-58 marker is a tin tube that weighs about 12 lb. (5.4 kg). Markers release smoke at the water surface for 40 to 60 minutes. After the pyrotechnics are consumed, the marine marker fills with seawater and sinks. Iron and aluminum constitute 35 percent of the marker weight. To produce the lengthy smoke effect, approximately 40 percent of the marker weight is made up of pyrotechnic materials. The propellant, explosive, and pyrotechnic constituents of the MK-58 include red phosphorus 2.19 lb. (1 kg) and manganese (IV) dioxide 1.40 lb. (0.6 kg). Other constituents include magnesium powder (0.29 lb. [0.1 kg]), zinc oxide (0.12 lb. [0.05 kg]), nitrocellulose (0.000017 lb. [0.008 g]), nitroglycerin (0.000014 lb. [0.006 g]), and potassium nitrate (0.2 lb. [0.09 kg]). The failure rate of marine markers is five percent (U.S. Department of the Navy 2010b).

Flares are used for signaling, nighttime illumination of surface areas in search and attack operations, and to assist with search and rescue activities. They range in weight from 12 to 30 lb. (5.4 to 14 kg). The major constituents of flares include magnesium granules and sodium nitrate. Containers are constructed of aluminum, and the entire assembly is usually consumed during flight. Flares may also contain a primer such as TNT, propellant (ammonium perchlorate), and other explosives. These materials are present in small quantities (e.g., 1.0×10^{-4} ounces of ammonium perchlorate and 1.0×10^{-7} ounces of explosives). Small amounts of metals are used to give flares and other pyrotechnic materials bright and distinctive colors. Combustion products from flares include magnesium oxide, sodium carbonate, carbon dioxide, and water. Illuminating flares and marine markers are usually entirely consumed during use; neither is intended to be recovered. Table 3.1-29 summarizes the components of markers and flares (U.S. Department of the Navy 2010b).

Table 3.1-29: Summary of Components of Marine Markers and Flares

Flare or Marker	Constituents
LUU-2 Paraflare	Magnesium granules, sodium nitrate, aluminum, iron, TNT, royal demolition explosive, ammonium perchlorate, potassium nitrate, lead, chromium, magnesium, manganese, nickel
MK 45 Paraflare	Aluminum, sodium nitrate, magnesium powder, nitrocellulose, TNT, copper, lead, zinc, chromium, manganese, potassium nitrate, pentaerythritol tetranitrate, nickel, potassium perchlorate
MK-58 Marine Marker	Aluminum, chromium, copper, lead, lead dioxide, manganese dioxide, manganese, nitroglycerin, red phosphorus, potassium nitrate, silver, zinc, zinc oxide

3.1.3.4.3 Chaff

Chaff consists of small, thin glass fibers coated in aluminum that are light enough to remain in the air anywhere from 10 minutes to 10 hours. Chaff is an electronic countermeasure designed to confuse enemy radar by deflecting radar waves and thereby obscuring aircraft, ships, and other equipment from radar tracking sources. Chaff is typically packaged in cylinders approximately 6 in. x 1.5 in. (15 cm x 4 cm) that weigh about 5 ounces (140 g) and contain a few million fibers. Chaff may be deployed from an aircraft or may be launched from a surface vessel.

The chaff fibers are approximately the thickness of a human hair (generally 25.4 microns in diameter), and range in length from 0.3 to 2 in. (0.75 to 5 cm). The major components of the chaff glass fibers and the aluminum coating are provided in Table 3.1-30 (U.S. Air Force 1994).

Table 3.1-30: Major Components of Chaff

Component	Percent by Weight
Glass Fiber	
Silicon dioxide	52–56
Alumina	12–16
Calcium oxide, magnesium oxide	16–25
Boron oxide	8–13
Sodium oxide, potassium oxide	1–4
Iron oxide	≤ 1
Aluminum Coating	
Aluminum	99.45 (min.)
Silicon and Iron	0.55 (max.)
Copper	0.05
Manganese	0.05
Zinc	0.05
Vanadium	0.05
Titanium	0.05
Others	0.05

"≤" means less than or equal to
min.: minimum; max.: maximum

3.1.3.4.4 Additional Examples of Other Materials

Miscellaneous components of other materials include small parachutes used with sonobuoys and flares; nylon cord, plastic casing, and antenna float used with sonobuoys; natural and synthetic rubber, carbon, or Kevlar® fibers used in missiles; and plastic end-caps and pistons used in chaff cartridges.

3.1.3.4.5 Approach to Analysis

Most activities involving military expended materials composed of the other materials discussed above would be conducted more than 3 nm offshore in each range complex. Most of the components of other materials are benign. In the analysis of alternatives, "local" refers to the area in which the material comes to rest.

State and federal standards and guidelines. No state or federal sediment and water quality standards or guidelines exist that are specific to major components of other materials discussed above.

3.1.3.4.6 Impacts from Other Materials

The rate at which other materials deteriorate in marine environments depends on the material and conditions in the immediate marine and benthic environment. Usually when buried deep in ocean sediment, materials tend to decompose at lower rates than when exposed to seawater (Ankley 1996). With the exception of plastic parts, sediment burial appears to be the fate of most ordnance used in marine warfare (Canadian Forces Maritime Experimental and Test Ranges 2005). The behavior of these other materials in marine systems is discussed in more detail below.

3.1.3.4.6.1 Marine Markers and Flares

Most of the pyrotechnic components of marine markers are consumed and released as smoke in the air. Thereafter, the aluminum and steel cartridge sink to the bottom. Combustion of red phosphorus produces phosphorus oxides, which have a low toxicity to aquatic organisms. The amount of flare residue is insignificant. Phosphorus contained in the marker settles to the sea floor, where it reacts with the water to produce phosphoric acid until all phosphorus is consumed by the reaction. Phosphoric acid is a variable, but normal, component of seawater (U.S. Department of the Navy 2006). The aluminum and iron cartridges are expected to be covered by sand and sediment over time, become encrusted by chemical corrosion, or covered by marine plants and animals. Elemental aluminum in seawater tends to be converted by hydrolysis to aluminum hydroxide, which is relatively insoluble, and adheres to particulates and transported to the bottom sediment (Monterey Bay Research Institute 2010).

Red phosphorus, the primary pyrotechnic ingredient, constitutes 18 percent of the marine marker weight. Toxicological studies of red phosphorus revealed an aquatic toxicity in the range of 10 to 100 mg/L (10 to 100 ppm) for fish, *Daphnia* (a small aquatic crustacean), and algae (European Flame Retardants Association 2002). Red phosphorus slowly degrades by chemical reactions to phosphine and phosphorus acids. Phosphine is very reactive and usually undergoes rapid oxidation (California Environmental Protection Agency 2003). The final products, phosphates, are harmless (U.S. Department of the Navy 2010b). A study by the U.S. Air Force (1997) found that, in salt water, the degradation products of flares that do not function properly include magnesium and barium.

3.1.3.4.6.2 Chaff

Chaff can remain suspended in air from 10 minutes to 10 hours and can travel considerable distances from its release point (Arfsten et al. 2002; U.S. Air Force 1997). Factors influencing chaff dispersion

include the altitude and location where it is released, prevailing winds, and meteorological conditions (Hullar et al. 1999). Doppler radar has tracked chaff plumes containing approximately 31.8 ounces (900 grams) of chaff drifting 200 mi. (322 km) from the point of release with the plume covering a volume of greater than 400 $mi.^3$ (1,666 km^3) (Arfsten et al. 2002). Based on the dispersion characteristics of chaff, large areas of open water would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar et al. (1999) calculated that an area 4.97 mi. by 7.46 mi. (37.1 $mi.^2$ or 28 nm^2) would be affected by deployment of a single cartridge containing 5.3 ounces (150 grams) of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This concentration corresponds to less than 179,000 $fibers/nm^2$ or less than 5 fibers per 1,000 $ft.^2$ (52.2 $fibers/m^2$), assuming that each cartridge contains five million fibers.

Chaff is generally resistant to chemical weathering and likely remains in the environment for long periods. However, all components of chaff's aluminum coating are present in seawater in trace amounts except magnesium, which is present at 0.1 percent (Nozaki 1997). Aluminum and silicon are the most common minerals in the earth's crust as aluminum oxide (Al_2O_3) and silicon dioxide (SiO_2), respectively. Aluminum itself is the most common metal in the earth's crust and is a trace element in natural waters. Since ocean waters are constantly exposed to crustal materials, there is little reason to believe that the addition of small amounts of chaff from a release would have any impact on either water or sediment composition (Hullar et al. 1999).

The dissolved concentration of aluminum in seawater ranges from 1 to 10 µg/L (1 to 10 ppb). For comparison, the concentration in rivers is 50 µg/L (50 ppb). In the ocean, concentrations tend to be higher on the surface, low at middle depths, and higher again at the bottom (Li et al. 2008). Aluminum is a very reactive element and is seldom found as the free metal in nature except under highly acidic (low pH) or alkaline (high pH) conditions. It is found combined with other elements, most commonly with oxygen, silicon, and fluorine. These chemical compounds are commonly found in soil, minerals, rocks, and clays (Agency for Toxic Substances and Disease Registry 2008; U.S. Air Force 1994). Elemental aluminum in seawater tends to be converted by hydrolysis to aluminum hydroxide, which is relatively insoluble, and is scavenged by particulates and transported to bottom sediment (Monterey Bay Research Institute 2010).

Because of their light weight, chaff fibers tend to float on the water surface for a time. The fibers are quickly dispersed by waves and currents. They may be accidentally or intentionally ingested by marine life, but the fibers are nontoxic. Chemicals leached from the chaff will be diluted by the surrounding seawater, reducing the potential for chemical concentrations reaching levels that can affect sediment quality and benthic habitats.

In a report by Systems Consultants, Inc. (1977), chaff samples were placed in Chesapeake Bay water for 13 days. No increases greater than 1 ppm of aluminum, cadmium, copper, iron, and zinc were detected. Given that no ongoing mixing was occurring in this experiment, accumulation and concentration of chaff constituents is not likely under natural conditions. In a U.S. Air Force study of chaff, nine elements were analyzed under various pH conditions: silicon, aluminum, magnesium, boron, copper, manganese, zinc, vanadium, and titanium. Only four were detected above the 0.02 mg/L (0.02 ppm) detection limit: magnesium, aluminum, zinc, and boron (U.S. Air Force 1994). In tests of marine organisms, no negative impacts from chaff exposure were found at levels in excess of those likely to be encountered in the Study Area (Farrell and Siciliano 2007; Systems Consultants 1977).

3.1.3.4.6.3 Additional Components of Other Materials

The majority of components of other materials are plastics. Although plastics are resistant to degradation, they do gradually breakdown into smaller particles due to sunlight and mechanical wear (Law et al. 2010). The fate of plastics that sink beyond the continental shelf is largely unknown, although marine microbes and fungi are known to degrade biologically produced polyesters (Doi et al. 1992) as well as other synthetic polymers, although the latter occurs more slowly (Shah et al. 2008). A more detailed discussion of plastics in the marine environment is provided in Section 3.1.2.2.6 (Marine Debris and Water Quality).

3.1.3.4.7 Evaluation of Alternatives

Table 3.1-31 summarizes the number of marine markers, flares, and chaff for all alternatives. The numbers represent amounts expended annually for each type of material under each alternative. The types and amounts of expended materials in the table were drawn from the tables in Chapter 2 (Description of Proposed Action and Alternatives).

Table 3.1-31: Summary of Military Expended Materials Involving Other Materials – All Alternatives Annually

Type of Military Expended Material	No Action Alternative	Alternative 1	Alternative 2
Marine Markers			
Training	1,349	1,682	1,682
Testing	190	193	240
Total	1,539	1,875	1,922
Flares			
Training	8,108	10,628	10,628
Testing	2,810	7,400	8,140
Total	10,918	18,028	18,768
Chaff Cartridges			
Training	64,590	45,612	45,612
Testing	2,984	10,660	11,650
Total	67,574	56,272	57,262

The following sections evaluate each alternative in terms of the information provided in Sections 3.1.3.4.5 (Approach to Analysis) and 3.1.3.4.6 (Impacts from Other Materials). Potential impacts on sediment and water quality from other materials should be viewed in the following context: (1) nearshore sediment and water quality in many areas have been negatively impacted; and (2) the majority of those impacts are from human-generated and land-based activities, especially plastics and other ocean debris. The numbers of military expended materials discussed below reflect amounts expended annually for each type of material under each alternative.

3.1.3.4.7.1 No Action Alternative

Under the No Action Alternative, a total of 80,031 military expended materials involving other materials would be used during training and testing. Chaff cartridges represent 84 percent of these materials, flares represent 14 percent, and marine markers represent 2 percent.

Training Activities. Under the No Action Alternative, numerically, training activities would represent 92.5 percent of other materials used under the No Action Alternative. Of those materials, 87 percent would be composed of chaff cartridges, 11 percent would be composed of flares, and 2 percent would be composed of marine markers. Most chaff used during training (77 percent) would occur in two range complexes: Key West (46 percent) and VACAPES (31 percent); most flare use would occur in the Key West Range Complex (42 percent).

Testing Activities. Under the No Action Alternative, numerically, testing activities would represent 7.5 percent of other materials used. Of those materials, 50 percent would be composed of chaff cartridges, 47 percent would be composed of flares, and 3 percent would be composed of marine markers. Most chaff testing would occur in the VACAPES Range Complex (67 percent), and most flare testing would also occur in the VACAPES Range Complex (66 percent). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Other Materials

Under the No Action Alternative, potential impacts on sediment and water quality from training and testing involving other materials would be short- and long-term and local. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Regarding chaff, its composition is much like clay minerals, common in ocean sediment (aluminosilicates). Study results indicate that adverse impacts are not anticipated even at concentrations many times the level realistically encountered during proposed training and testing activities. Regarding the remaining training and testing materials, the majority of pyrotechnics in marine markers and flares is consumed during use and expended in the air. The failure rate is low (5 percent), and the remaining amounts are small and subject to additional chemical reactions and subsequent dilution in the ocean. Plastics and other floating expended materials would either degrade over time or wash ashore. Materials would be widely scattered on the sea floor in areas used for training and testing. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.4.7.2 Alternative 1

Under Alternative 1, military expended materials involving other materials would decrease compared to the No Action Alternative (from 80,031 to 76,175 items). The relative contribution of the materials would also change. Chaff cartridges would represent 74 percent of these materials (84 percent under the No Action Alternative), flares would represent 24 percent (14 percent under the No Action Alternative), and marine markers would represent 2.5 percent (2 percent under the No Action Alternative).

Training Activities. Under Alternative 1, numerically, training activities would represent 76 percent of other materials (92.5 percent under the No Action Alternative). Of those materials, 79 percent would be composed of chaff cartridges (87 percent under the No Action Alternative), flares (18 percent; 11 percent under the No Action Alternative), and marine markers (3 percent; 2 percent under the No Action Alternative). In terms of location, under Alternative 1, most chaff use during training would occur in the Key West Range Complex (66 percent; 46 percent under the No Action Alternative). Most flare use would continue to occur in the Key West Range Complex (42 percent; 42 percent under the No Action Alternative). Flare use would also increase in two other range complexes: Navy Cherry Point (18 percent; 7 percent under the No Action Alternative) and JAX (16 percent; 6 percent under the No Action Alternative).

Testing Activities. Under Alternative 1, numerically, testing activities represent 24 percent of other materials (7.5 percent under the No Action Alternative). Of those materials, 58 percent would be composed of chaff cartridges (50 percent under the No Action Alternative), flares (41 percent; 47 percent under the No Action Alternative), and marine markers (1 percent; 3 percent under the No Action Alternative). Most chaff use during testing would occur in two areas: VACAPES Range Complex (34 percent; 67 percent under the No Action Alternative) and the GOMEX Range Complex (40 percent; 22 percent under the No Action Alternative). Most flare testing would occur in two areas: VACAPES Range Complex (41 percent; 66 percent under No Action Alternative) and the GOMEX Range Complex (38 percent; 32 percent under the No Action Alternative). Testing activities are described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Other Materials

Under Alternative 1, potential impacts on sediment and water quality from other materials associated with training and testing activities would be short- and long-term and local. The small increase in other materials, coupled with the nature of those materials, indicate that potential impacts would be similar to the No Action Alternative. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.3.4.7.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, training and testing materials involving other materials would decrease compared to the No Action Alternative (from 80,031 to 77,952 items). The relative contribution of the materials would also change in a similar manner to Alternative 1. Chaff cartridges would comprise 73 percent of these materials (84 percent under the No Action Alternative), flares would comprise 24 percent (14 percent under the No Action Alternative), and marine markers would comprise 2.5 percent (2 percent under the No Action Alternative).

Training Activities. Under Alternative 2, numerically, training activities represent 74.3 percent of other materials (92.5 percent under the No Action Alternative). Of those materials, 79 percent would be composed of chaff cartridges (87 percent under the No Action Alternative), flares (18 percent; 11 percent under the No Action Alternative), and marine markers (3 percent; 2 percent under the No Action Alternative). In terms of location, under Alternative 2, most chaff use during training would occur in the Key West Range Complex (66 percent; 46 percent under the No Action Alternative). Most flare use would continue to occur in the Key West Range Complex (42 percent; 42 percent under the No Action Alternative). Flare use would also increase in two other range complexes: Navy Cherry Point (18 percent; 7 percent under the No Action Alternative) and JAX (16 percent; 6 percent under the No Action Alternative).

Testing Activities. Under Alternative 2, numerically, testing activities represent 25.7 percent of other materials (7.5 percent under the No Action Alternative). Of those materials, 58 percent would be composed of chaff cartridges (50 percent under the No Action Alternative), flares (41 percent; 47 percent under the No Action Alternative), and marine markers (1 percent; 3 percent under the No Action Alternative). Most chaff testing (95 percent) would occur in two areas: the VACAPES Range Complex (33 percent; 67 percent under the No Action Alternative) and the GOMEX Range Complex (40 percent; 22 percent under the No Action Alternative). Most flare testing would occur in two areas: the VACAPES Range Complex (41 percent; 66 percent under the No Action Alternative) and the GOMEX Range Complex (54 percent; 32 percent under the No Action Alternative). Testing activities are

described in Chapter 2 (Description of Proposed Action and Alternatives) and listed in Tables 2.8-2 and 2.8-3.

Summary of Impacts from Other Materials

Under Alternative 2, potential impacts on sediment and water quality from other materials associated with training and testing activities would be short- and long-term and local. The small increase in other materials, coupled with the nature of those materials, indicate that potential impacts would be similar to the No Action Alternative. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. Neither state nor federal standards or guidelines would be exceeded.

3.1.4 Summary of Potential Impacts on Water Quality

The stressors that may impact sediment and water quality include explosives and explosion byproducts, metals, chemicals other than explosives, and other military expended materials.

3.1.4.1 No Action Alternative

Under the No Action Alternative, chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated uses. When considered together, the impact of the four stressors would be additive. However, chemical, physical, or biological changes to sediment or water quality would not be detectable and would remain below or within existing conditions or designated uses. This conclusion is based on the following:

- Although individual training and testing activities may occur within a fairly small area, overall military expended materials and activities are widely dispersed in space and time;
- Many components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign;
- Potential areas of negative impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives; and
- The failure rate is low for explosives and materials with propellant systems, limiting the potential impacts from the chemicals other than explosives involved.

3.1.4.2 Alternative 1

Under Alternative 1, when considered separately, the effects of the four stressors would not be additive:

- The impact of chemicals other than explosives and other materials on sediment and water quality would be similar to the No Action Alternative, that is, short- and long-term and local. Chemical, physical, or biological changes to sediment or water quality would not be detectable and would be below or within existing conditions or designated use; and
- The impact of explosives, explosion byproducts, and metals on sediment and water quality would also be short- and long-term and local. However, chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses.

When considered together, the impact of the four stressors would be additive. Chemical, physical, or biological changes to sediment or water quality would be measurable, but they would still be below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. Although most types of expended materials would increase over the No Action Alternative, this conclusion is based on the reasons provided under the No Action Alternative as follows:

- Although individual training and testing activities may occur within a fairly small area, overall military expended materials and activities are widely dispersed in space and time;
- Many components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign;
- Potential areas of negative impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives; and
- The failure rate is low for explosives and materials with propellant systems, limiting the potential impacts from the chemicals other than explosives involved.

3.1.4.3 Alternative 2 (Preferred Alternative)

Under Alternative 2, when considered separately, the impact on sediment and water quality of the four stressors would be the same as discussed under Alternative 1. This is because the types and amounts of military expended materials are relatively similar between the two alternatives.

When considered together, the impact of the four stressors would be additive, and changes to sediment or water quality would be measurable, but they would still be below applicable standards, regulations, and guidelines, and within existing conditions or designated uses. Because the types and amounts of military expended materials are similar between Alternatives 1 and 2, the reasons for this conclusion are the same as those discussed under the No Action Alternative as follows:

- Although individual training and testing activities may occur within a fairly small area, overall military expended materials and activities are widely dispersed in space and time;
- Many components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign;
- Potential areas of negative impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives; and
- The failure rate is low for explosives and materials with propellant systems, limiting the potential impacts from the chemicals other than explosives involved.

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3.2 AIR QUALITY

AIR QUALITY SYNOPSIS

The Navy evaluated all potential stressors and the following have been analyzed for air quality:

- Criteria air pollutants
- Hazardous air pollutants

Preferred Alternative (Alternative 2)

- All reasonably foreseeable direct and indirect emissions in nonattainment and maintenance areas do not equal or exceed applicable *de minimis* levels.*

*Note: The emissions thresholds for conformity requirements are referred to as *de minimis* levels.

3.2.1 INTRODUCTION AND METHODS

3.2.1.1 Introduction

Air pollution is a threat to human health and also damages the environment (U.S. Environmental Protection Agency 2007b). Air pollution damages trees, crops, other plants, lakes, and animals. In addition to damaging the natural environment, air pollution damages the exteriors of buildings, monuments, and statues. It creates haze or smog that reduces visibility in national parks and cities and interferes with aviation. To improve air quality and reduce air pollution, Congress passed the Clean Air Act and its amendments, which set regulatory limits on air pollutants and helps to ensure basic health and environmental protection from air pollution.

Air quality is defined by ambient concentrations of specific air pollutants – pollutants the U.S. Environmental Protection Agency (USEPA) determined may affect the health or welfare of the public. The six major pollutants of concern are called "criteria pollutants": carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), suspended particulate matter (dust particles less than or equal to 10 microns in diameter [particulate matter {PM_{10}}] and fine particulate matter less than or equal to 2.5 microns in diameter [$PM_{2.5}$]), and lead (Pb). The USEPA established National Ambient Air Quality Standards for these criteria pollutants.

In addition to the six criteria pollutants, the USEPA currently designates 188 substances as hazardous air pollutants under the federal Clean Air Act. Hazardous air pollutants are air pollutants known to cause or suspected of causing cancer or other serious health effects, or adverse environmental effects (U.S. Environmental Protection Agency 2010). National Ambient Air Quality Standards are not established for these pollutants; however, the USEPA developed rules that limit emissions from specific industrial sources. These emissions control standards are known as "maximum achievable control technologies" and "generally achievable control technologies." They are intended to achieve the maximum degree of reduction in emissions of the hazardous air pollutants, taking into consideration the cost of emissions control, non-air quality health and environmental impacts, and energy requirements. Examples of hazardous air pollutants include benzene, which is found in gasoline; perchloroethene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper in some industries. Hazardous air pollutants are regulated under the Clean Air Act's National Emission

Standards for Hazardous Air Pollutants, which apply to specific sources of hazardous air pollutants; and under the Urban Air Toxics Strategy, which applies to area sources.

Air pollutants are classified as either primary or secondary pollutants based on how they originate in the atmosphere. Primary air pollutants are emitted directly into the atmosphere from the source of the pollutant and retain their chemical form. Examples of primary pollutants are the ash produced by burning solid waste and volatile organic compounds emitted from a dry cleaner (U.S. Environmental Protection Agency 2010). Secondary air pollutants are those formed through atmospheric chemical reactions – reactions that usually involve primary air pollutants (or pollutant precursors) and normal constituents of the atmosphere (U.S. Environmental Protection Agency 2010). Ozone (O_3), a major component of photochemical smog, is a secondary air pollutant. O_3 precursors fall into two broad groups of chemicals: nitrogen oxides (NO_X) and organic compounds. NO_X consists of nitric oxide (NO) and nitrogen dioxide (NO_2). Organic compound precursors of O_3 are routinely described by various terms, including volatile organic compounds, reactive organic compounds, and reactive organic gases. Finally, some air pollutants are a combination of primary and secondary pollutants. PM_{10} and $PM_{2.5}$ are generated both as primary pollutants by various mechanical processes (e.g., abrasion, erosion, mixing, or atomization) or combustion processes. They are generated as secondary pollutants through chemical reactions or through the condensation of gaseous pollutants into fine aerosols.

Air pollutant emissions are reported as the amount (by weight or volume) of one or more specific compounds emitted into the atmosphere by a source. Most air pollutant emissions are expressed as a rate (e.g., pounds per hour, pounds per day, or tons per year). Typical units for emission rates from a source or source activity are pounds per thousand gallons of fuel burned, pounds per ton of material processed, and grams per vehicle-mile of travel.

Ambient air quality is reported as the atmospheric concentrations of specific air pollutants at a particular time and location. The units of measurement are expressed as a mass per unit volume (e.g., micrograms per cubic meter [$\mu g/m^3$] of air) or as a volume fraction (e.g., parts per million [ppm] by volume).The ambient air pollutant concentrations measured at a particular location are determined by the pollutant emissions rate, local meteorology, and atmospheric chemistry. Wind speed and direction and precipitation patterns affect the dispersal, dilution, and removal of air pollutant emissions from the atmosphere.

3.2.1.2 Methods

Section 176(c)(1) of the Clean Air Act, commonly known as the General Conformity Rule, requires federal agencies to ensure their actions conform to applicable implementation plans for achieving and maintaining the National Ambient Air Quality Standards for criteria pollutants.

3.2.1.2.1 Application of Regulatory Framework

3.2.1.2.1.1 National Ambient Air Quality Standards

The National Ambient Air Quality Standards for criteria pollutants are set forth in Table 3.2-1. Areas that exceed a standard are designated as “nonattainment” for that pollutant, while areas in compliance with a standard are in “attainment” for that pollutant. An area may be nonattainment for some pollutants and attainment for others simultaneously.

Table 3.2-1: National Ambient Air Quality Standards

Pollutant [final rule cite]		Primary / Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO) [76 FR 54294, Aug 31, 2011]		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead (Pb) [73 FR 66964, Nov 12, 2008]		Primary and Secondary	Rolling 3-month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2) [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb(2)	Annual mean
Ozone (O_3) [73 FR 16436, Mar 27, 2008]		Primary and Secondary	8-hour	0.075 ppm(3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution [71 FR 61144, Oct 17, 2006]	$PM_{2.5}$	Primary and Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
			24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2) [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		Primary	1-hour[1]	75 ppb(4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: (U.S. Environmental Protection Agency 2012a), last updated October 2011.

Notes:

[1] Final Rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard. Areas designated nonattainment under the 1978 standard remain in effect until implementation plans are approved to attain or maintain the 2008 standard.

[2] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

[3] Final Rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

[4] Final Rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Other Acronyms: PM – particulate matter; ppb – parts per billion; ppm – parts per million.

States, through their air quality management agencies, are required to prepare and implement State Implementation Plans for nonattainment areas, which demonstrate how the area will meet the National Ambient Air Quality Standards. Areas that achieved attainment may be designated as "maintenance areas," subject to maintenance plans showing how the area will continue to meet federal air quality standards. Nonattainment areas for some criteria pollutants are further classified, depending on the severity of their air quality problem, to facilitate their management:

- Ozone – marginal, moderate, serious, severe, and extreme
- Carbon monoxide – moderate and serious
- Particulate matter – moderate and serious

The USEPA delegates the regulation of air quality to the state once the state has an approved State Implementation Plan. The Clean Air Act also allows states to establish air quality standards more stringent than the National Ambient Air Quality Standards.

The Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) is offshore of several states, and some elements of the Proposed Action occur within or over state waters. Most of the Study Area is substantially offshore, beyond state boundaries where attainment status is unclassified and Clean Air Act National Ambient Air Quality Standards do not apply. However, given fluctuations in wind direction, air quality in adjacent onshore areas may be affected by releases of air pollutants from Study Area sources. Therefore, National Ambient Air Quality Standards attainment status of adjacent onshore areas is considered in determining whether appropriate controls on air pollution sources in the adjacent offshore state waters is warranted.

3.2.1.2.1.2 General Conformity Evaluation

Federal actions are required to conform with the approved State Implementation Plan for those areas of the United States designated as nonattainment or maintenance air quality areas for any criteria air pollutant under the Clean Air Act (40 Code of Federal Regulations [C.F.R.] §§ 51 and 93). The purpose of the General Conformity Rule is to demonstrate that the Proposed Action would not cause or contribute to a violation of an air quality standard and that the Proposed Action would not adversely affect the attainment and maintenance of federal ambient air quality standards. A federal action would not conform if it increased the frequency or severity of any existing violations of an air quality standard or delayed the attainment of a standard, required interim emissions reductions, or any other air quality milestone. To ensure that federal activities do not impede local efforts to control air pollution, Section 176(c) of the Clean Air Act (42 United States Code [U.S.C.] § 7506(c)) prohibits federal agencies from engaging in or approving actions that do not conform to an approved State Implementation Plan. The emissions thresholds that trigger the conformity requirements are called *de minimis* levels.

Federal agency compliance with the General Conformity Rule is demonstrated in several ways. The review can be satisfied by (1) a determination that the action is not subject to the General Conformity Rule, (2) a record of nonapplicability, or (3) a conformity determination.

Compliance is presumed if the net increase in emissions from a federal action would be less than the relevant *de minimis* threshold. If net emissions increases exceed the *de minimis* thresholds, then a formal conformity determination must be prepared. *De minimis* levels are shown in Table 3.2-2. Note that *de minimis* levels are lower in the ozone transport region[1]. The states within the established ozone transport region include Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the Washington, D.C. Metropolitan Statistical Area, including the northern Virginia suburbs (Connecticut Department of Environmental Protection 2008).

[1] The ozone transport region in the northeastern United States experiences an ozone problem that is generated by local emissions as well as emissions released upwind of the area [from coal fired power plants and other sources in the Midwest] and transported over time to this area of concern (New Jersey Department of Environmental Protection 2007).

Table 3.2-2: *de Minimis* Thresholds for Conformity Determinations

Pollutant	Nonattainment or Maintenance Area Type	*de Minimis* Threshold (TPY)
Ozone (VOC or NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
CO, SO_2 and NO_2	All nonattainment and maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$	All nonattainment and maintenance	100
Lead (Pb)	All nonattainment and maintenance	25

Source: (U.S. Environmental Protection Agency 2012b)

CO: carbon monoxide; NO_X: nitrogen oxides; Pb: lead; PM_{10}: particulate matter under 10 microns; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

3.2.1.2.2 Conformity Analyses in Nonattainment and Maintenance Areas

Certain Navy training and testing activities take place within specific nonattainment and maintenance areas. These nonattainment and maintenance areas are identified by their air quality control region (an area designated by the federal government where communities share a common air pollution problem). Four such air quality control regions were identified as relevant to co-located AFTT Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) training or testing activities. Coastal waters within 3 nautical miles (nm) of a shoreline are part of the same air quality jurisdiction area as the contiguous land area.

3.2.1.2.2.1 Metropolitan Portland Intrastate Air Quality Control Region

The Proposed Action includes testing activities in the Metropolitan Portland Intrastate Air Quality Control Region (40 C.F.R. § 81.78). The region consists of the territorial area encompassed by the boundaries of the following jurisdictions or described area (including the territorial area of all municipalities [as defined in Section 302(f) of the Clean Air Act, 42 U.S.C. § 1857(h)(f)]) geographically located within the outermost boundaries of the area so delimited: in the State of Maine, the counties of Cumberland, Sagadahoc, and York and the towns of Brownfield, Denmark, Fryeburg, Hiram, and Porter. The Portsmouth Naval Shipyard lies within York County, Maine, and the Bath shipyard lies within Sagadahoc County.

The Metropolitan Portland Intrastate Air Quality Control Region is designated as a maintenance area for the federal 8-hour O_3 standard. The Metropolitan Portland Intrastate Air Quality Control Region is classified as an attainment area for the National Ambient Air Quality Standards for SO_x, NO_x, Pb, PM_{10}, and $PM_{2.5}$, and CO (40 C.F.R. § 81.320 and (U.S. Environmental Protection Agency 2011d)). The Portland

8-hour O_3 Maintenance Area includes the Maine counties of York, Cumberland, Androscoggin, and Sagadahoc (Maine Department of Transportation 2011).

The General Conformity Rule states that a federal action is exempt from the requirements of a full conformity demonstration for those criteria air pollutants for which emissions increases are below specific *de minimis* emissions levels. The Proposed Action is required to demonstrate conformity with the approved State Implementation Plan. In accordance with the General Conformity Rule, the *de minimis* levels for nonattainment and maintenance pollutants in the Metropolitan Portland Intrastate Air Quality Control Region are 50 tons per year for O_3 precursors (volatile organic compounds) and 100 tons per year for NO_x. Because this area lies within an ozone transport region, the *de minimis* threshold for volatile organic compounds is 50 tons per year instead of 100 tons per year.

The Metropolitan Portland Intrastate Air Quality Control Region included air pollutant emissions from shipyard activities in its State Implementation Plan inventory of O_3 emissions. These estimated emissions were accounted for in the state's management plan for the air basin and are deemed consistent with the State Implementation Plan emissions budget for the Metropolitan Portland Intrastate Air Quality Control Region. This EIS/OEIS includes emissions estimates for testing activities conducted at the Portsmouth Naval Shipyard in Kittery, Maine, and the shipyard in Bath, Maine, to evaluate whether a conformity determination is required.

Air emissions were calculated for relevant tests at Portsmouth Naval Shipyard and Bath shipyard. For air quality analysis, impacts of activities at the Portsmouth Naval Shipyard and Bath shipyard were evaluated concurrently because they are in the same air quality control region. No emissions are associated with testing activities at the Portsmouth Naval Shipyard or the Bath shipyard (i.e., pierside sound navigation and ranging [sonar] tests and electronic warfare systems testing). Therefore, a conformity determination is not required and testing activities at the Portsmouth Naval Shipyard or the Bath shipyard are not further analyzed in this EIS/OEIS.

3.2.1.2.2.2 Metropolitan Providence Air Quality Control Region

The Proposed Action includes activities in the Metropolitan Providence Interstate Air Quality Control Region (40 C.F.R. § 81.31). This Region, consisting of the five Rhode Island counties, is classified as an attainment area for the federal 8-hour O_3 (2008 standard) (Figure 3.2-1 for a map of the 8-hour ozone nonattainment areas within the USEPA Region 1). The Metropolitan Providence Air Quality Control Region is classified as an attainment area for the National Ambient Air Quality Standards for SO_x, NO_x, Pb, $PM_{10,}$ $PM_{2.5}$, CO and 8-hour O_3 (2008 standard) effective July 20, 2012. It was previously classified as a "moderate" nonattainment area of the 8-hour (1997 standard) for O_3 (40 C.F.R. § 81.340 and USEPA (2011a)).

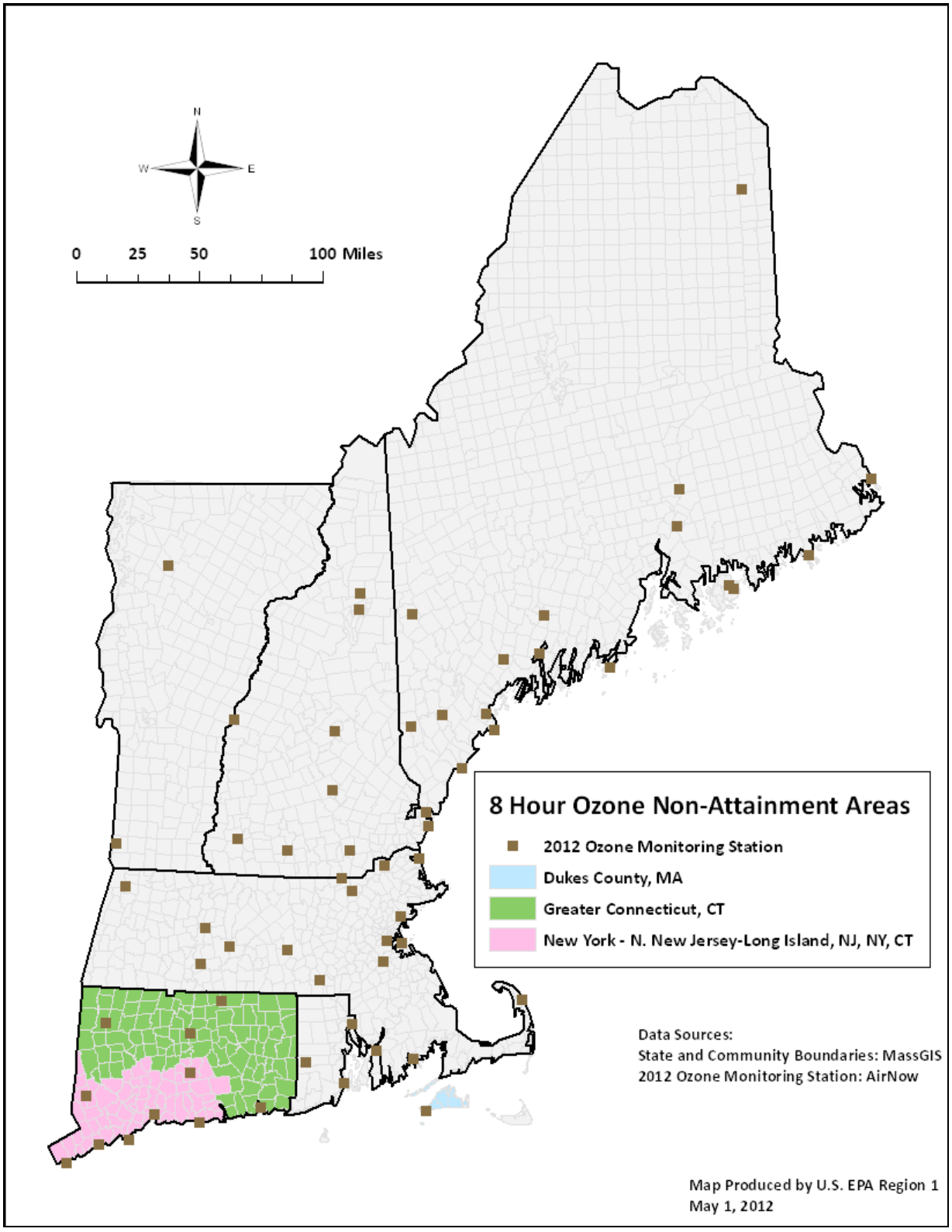

Figure 3.2-1: 8-Hour Ozone Nonattainment Areas in U.S. Environmental Protection Agency Region 1
Source: (U.S. Environmental Protection Agency 2007a)
CT: Connecticut; EPA: Environmental Protection Agency; MA: Massachusetts; NJ: New Jersey; NY: New York

The Proposed Action is required to demonstrate conformity with the approved State Implementation Plan. In accordance with the General Conformity Rule, the *de minimis* levels for nonattainment and maintenance pollutants in the Metropolitan Providence Air Quality Control Region are: 50 tons per year for O_3 precursors (volatile organic compounds or reactive organic gases) and 100 tons per year for CO and NO_2. Because this area lies within an ozone transport region, the *de minimis* threshold for volatile organic compounds is 50 tons per year instead of 100 tons per year.

The Metropolitan Providence Air Quality Control Region included air pollutant emissions from Naval Undersea Warfare Center Division, Newport, and Naval Station Newport military activities in its State Implementation Plan inventory of O_3 emissions. These estimated emissions were accounted for in the management plan for the air basin and are deemed consistent with the State Implementation Plan emissions budget for the Metropolitan Providence Air Quality Control Region. This EIS/OEIS includes emissions estimates for testing activities conducted at the Naval Undersea Warfare Center Division, Newport, Rhode Island, to evaluate whether a conformity determination is required (see Table 2.8-3 for torpedoes, launchers, towed equipment, and unmanned vehicle testing).

3.2.1.2.2.3 Greater Connecticut Air Quality Control Region

The Proposed Action includes activities in the Greater Connecticut Air Quality Control Region. This Region is classified as a marginal nonattainment area for the federal 8-hour O_3 standard (Figure 3.2-1 for a map of the 8-hour ozone nonattainment areas located within the USEPA Region 1). This Region is classified as an attainment area for the National Ambient Air Quality Standards for SO_x, NO_x, Pb, $PM_{10,}$ $PM_{2.5}$, and CO, but is classified as a marginal nonattainment area of the 8-hour standard for O_3 (U.S. Environmental Protection Agency 2011a).

The Proposed Action is required to demonstrate conformity with the currently approved State Implementation Plan. In accordance with the General Conformity Rule, the *de minimis* levels for nonattainment and maintenance pollutants in the Greater Connecticut Air Quality Control Region are 50 tons per year for O_3 precursors (volatile organic compounds) and 100 tons per year for CO and NO_2. Because this area lies within an ozone transport region, the *de minimis* threshold for volatile organic compounds is 50 tons per year instead of 100 tons per year.

The Greater Connecticut Air Quality Control Region included air pollutant emissions from military testing and maintenance activities at the Naval Submarine Base New London and the Groton shipyard in its State Implementation Plan inventory of O_3 emissions. These estimated emissions were accounted for in the management plan for the air basin and are deemed consistent with the State Implementation Plan emissions budget for the Greater Connecticut Air Quality Control Region. No emissions are associated with testing activities at the Naval Submarine Base New London and the Groton shipyard (i.e., pierside sound navigation and ranging [sonar] tests and electronic warfare systems testing). Therefore, a conformity determination is not required and testing activities at the Naval Submarine Base New London and the Groton shipyard are not further analyzed in this EIS/OEIS.

3.2.1.2.2.4 Hampton Roads Intrastate Air Quality Control Region

The Proposed Action includes training and testing activities in the Hampton Roads Intrastate Air Quality Control Region (40 C.F.R. § 81.93). The Hampton Roads area is located in southeastern Virginia within USEPA Region 3 (Figure 3.2-2 for a map that illustrates the attainment, nonattainment, and maintenance areas within the region [*Note: Figure 3.2-2 was drawn prior to the U.S. Environmental Protection Agency issuance of the 2008 Ozone Standard Designations Final Rule on May 21, 2012*]). The Hampton Roads Intrastate Air Quality Control Region is in attainment (maintenance) of the 1997 8-hour

O_3 national ambient air quality standard (U.S. Environmental Protection Agency 2011a) and is classified as an attainment area for the National Ambient Air Quality Standards for SO_x, NO_x, Pb, $PM_{10,}$ $PM_{2.5}$, and CO (40 C.F.R. § 81.347). The Hampton Roads Intrastate Air Quality Control Region is also in attainment (maintenance) of the 2008 8-hour O_3 national ambient air quality standard, which became effective July 20, 2012 (40 C.F.R. Part 81).

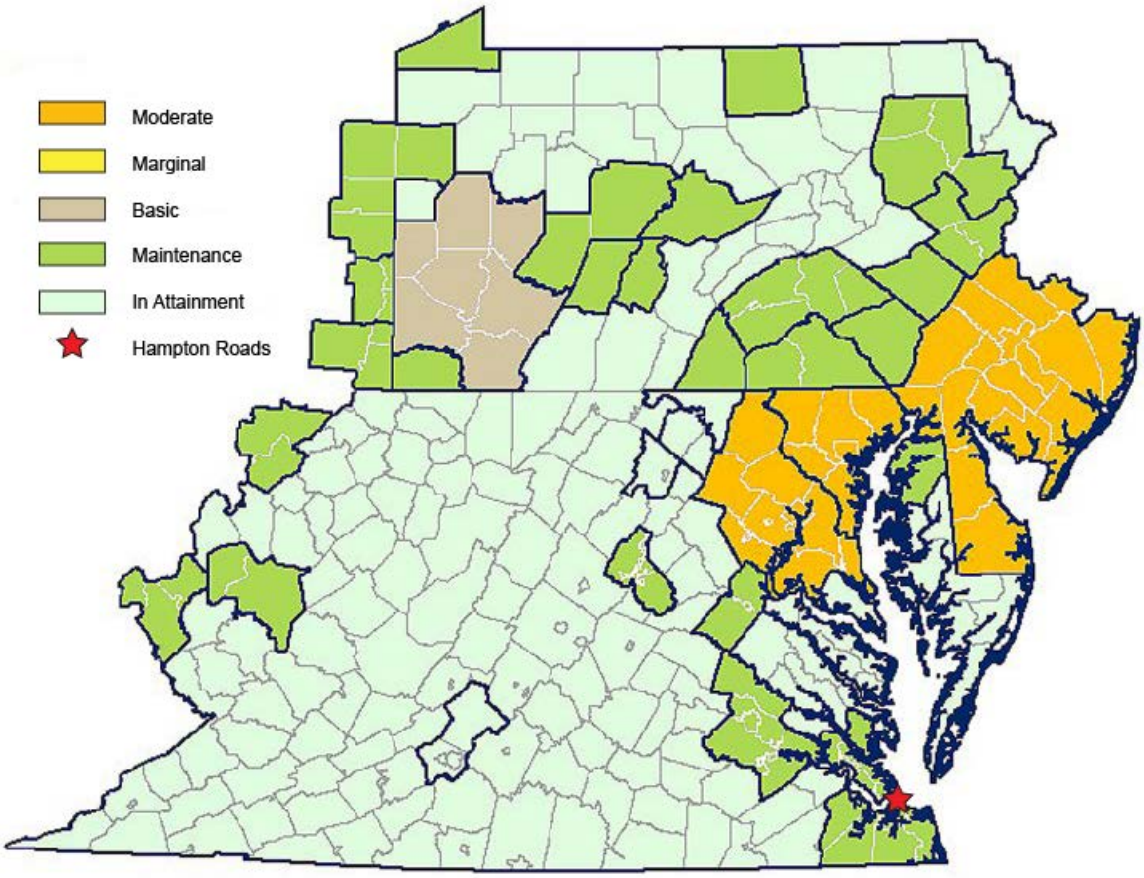

Figure 3.2-2: 8-Hour Ozone Nonattainment and Maintenance Areas in U.S. Environmental Protection Agency Region 3
Source: (U.S. Environmental Protection Agency 2011c)
Note: Figure does not reflect the 2008 8-hour O_3 Final Rule Designations (effective 20 July 2012).

In accordance with the General Conformity Rule, the *de minimis* levels (rates in tons per year) applicable to maintenance areas outside the ozone transport region, such as the Hampton Roads Intrastate Air Quality Control Region, are 100 tons per year for ozone precursors (NO_x and volatile organic compounds). This EIS/OEIS includes emissions estimates for mine warfare training activities conducted in the state waters of the lower Chesapeake Bay north of Norfolk Naval Station, and in the state waters adjacent to Virginia Beach. The emissions estimates (Section 3.2.1.4) for these nearshore training and testing activities are evaluated to determine whether a conformity determination is required.

3.2.1.2.2.5 Other Air Basins Adjacent to the Study Area

As mentioned, the conformity review is satisfied by a determination that the action is not subject to the General Conformity Rule, a record of nonapplicability, or a conformity determination. Actions not subject to the Rule include actions that occur in attainment areas, and that do not generate emissions in nonattainment areas. If National Environmental Policy Act (NEPA) documentation is prepared for an action, the determination that the Proposed Action is not subject to the General Conformity Rule is described in that documentation. Otherwise, no documentation is required. This EIS/OEIS includes the determination that actions in the attainment areas that do not generate emissions in nonattainment areas are not subject to the General Conformity Rule.

With the exception of activities within the Metropolitan Portland, Metropolitan Providence, Greater Connecticut, and Hampton Roads Air Quality Control Regions mentioned in the preceding sections, training and testing in the Study Area take place either within an attainment area or they take place beyond 3 nm from shore in unclassified portions of the Study Area. Although the Operating Areas and special use airspace of the Northeast Range Complexes are adjacent to air quality control regions classified as maintenance or nonattainment areas for O_3, training or testing conducted within these offshore sea and air spaces is conducted beyond state waters (at least 3 nm offshore and typically more than 12 nm offshore) within areas whose attainment status is unclassified. There is no provision for any classification in the Clean Air Act for waters outside the boundaries of state waters.

Nearshore counties in the southeastern United States are in attainment of the 8-hour ozone standard (see Figure 3.2-3 [range complexes are shown in relation to these areas in Figure 3.2-4] [*Note: Figure 3.2-3 was drawn prior to the U.S. Environmental Protection Agency issuance of the 2008 Ozone Standard Designations Final Rule on May 21, 2012*]). Therefore, training and testing conducted over or upon state waters of the southeastern United States do not generate emissions in nonattainment areas. The Navy Cherry Point, Jacksonville (JAX), Key West, and Gulf of Mexico (GOMEX) Range Complexes lie adjacent to nearshore counties of the southeastern United States in attainment of the National Ambient Air Quality Standards. A substantial portion (over 70 percent) of all AFTT EIS/OEIS training and testing activities occur within these range complexes adjacent to coastal attainment areas. For example, a portion of Maritime Security Operations training in the Corpus Christi Operating Area (GOMEX Range Complex) takes place within Corpus Christi–Victoria Intrastate Air Quality Control Region, an attainment area. As a second example, Naval Surface Warfare Center, Panama City Division testing activities occur within or adjacent to the Mobile (Alabama)–Pensacola–Panama City (Florida)–Southern Mississippi Interstate Air Quality Control Region, an attainment area. Thirdly, portions of anti-submarine warfare testing conducted within the Key West Range Complex occur within the Southeast Florida Intrastate Air Quality Control Region, an attainment area. Furthermore, search and rescue training in Jacksonville, Florida, takes place within the Jacksonville (Florida)–Brunswick (Georgia) Interstate Air Quality Control Region, an attainment area. Finally, amphibious assaults and amphibious raids conducted within the Navy Cherry Point Range Complex occur within the Northern Coastal Plain and Southern Coastal Plain Air Quality Control Regions, areas in attainment for all criteria pollutants.

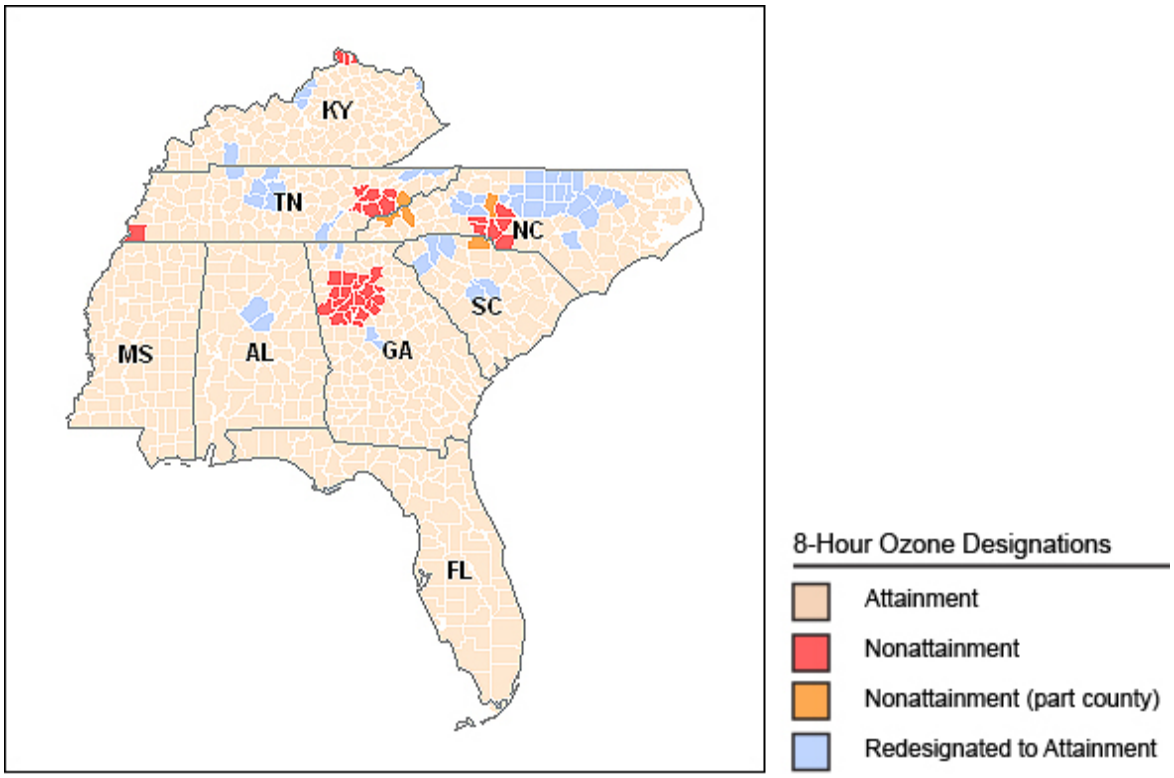

Figure 3.2-3: 8-Hour Ozone Nonattainment Areas in U.S. Environmental Protection Agency Region 4
Source: (U.S. Environmental Protection Agency 2009e)
Note: Figure does not reflect the 2008 8-hour O_3 Final Rule Designations (effective 20 July 2012).
AL: Alabama; FL: Florida; GA: Georgia; KY: Kentucky; MS: Mississippi;
NC: North Carolina; SC: South Carolina; TN: Tennessee

3.2.1.3 Approach to Analysis

The air quality impact evaluation requires two separate analyses: (1) impacts of air pollutants emitted by Navy training and testing in the Atlantic Ocean and Gulf of Mexico in U.S. territorial seas (i.e., within 12 nm of the coast) are assessed under NEPA, and (2) impacts of air pollutants emitted by Navy training and testing activities outside U.S. territorial seas are evaluated as required under Executive Order (EO) 12114. State waters are within the jurisdiction of the respective state and, because each state has a distinct State Implementation Plan, the air quality analysis separately addresses those activities that emit air pollutants within each state's jurisdiction. Portions of the Study Area that lie within 3 nm of the east coastline of states from Maine to Georgia, and the southern coasts of Alabama, Mississippi, and Louisiana, are within those state air quality jurisdictions. Portions of the Study Area that lie within 9 nm of the Gulf of Mexico coastlines of Texas and Florida are within the air quality jurisdictions of those states.

Air pollutants emitted more than 3,000 ft. (914 m) above ground level are considered to be above the atmospheric inversion layer and, therefore, do not affect ground-level air quality (U.S. Environmental Protection Agency 1992). These emissions thus do not affect the concentrations of air pollutants in the lower atmosphere, measured at ground-level monitoring stations, upon which federal, state, and local regulatory decisions are based. For the analysis of the effects on global climate change, however, all emissions of greenhouse gases from aircraft and vessels participating in training and testing activities, as well as targets and ordnance expended, are included regardless of altitude (Chapter 4, Cumulative

Impacts). Analysis of health-based air quality impacts under NEPA includes estimates of criteria air pollutants for all training and testing activities where aircraft, missiles, or targets operate at or below the aforementioned inversion layer or that involve vessels in U.S. territorial seas. The analysis of health-based air quality impacts under EO 12114 includes emissions estimates of only those training and testing activities in which aircraft, missiles, or targets operate at or below the aforementioned inversion layer, or that involve vessels outside of U.S. territorial seas.

Criteria air pollutants are generated by the combustion of fuel by surface vessels and by fixed-wing and rotary-wing aircraft. They also are generated by the combustion of explosives and propellants in various types of munitions. Propellants used to fire small-, medium-, and large-caliber projectiles generate criteria pollutants when detonated. Nonexplosive practice munitions contain spotting charges and propellants that generate criteria air pollutants when they function. Powered targets require fuel, generating criteria air pollutants during their operation, and towed targets generate criteria air pollutants secondarily because another aircraft or vessel is required to provide power. Stationary targets may generate criteria air pollutants if all or portions of the item burn in a high-order detonation. Chaff cartridges used by ships and aircraft are launched by an explosive charge that generates small quantities of criteria air pollutants. Countermeasure flares, parachute flares, and smoke floats are designed to burn for a prescribed period, emitting criteria pollutants in the process.

The air quality analysis also estimates the amounts of hazardous air pollutants emitted by the proposed activities and assesses their potential impacts on air quality. Trace amounts of hazardous air pollutants would be emitted by combustion sources and use of ordnance. Hazardous air pollutants, such as rocket motor exhaust and unspent missile fuel vapors, may be emitted during missile and target use. Hazardous air pollutants are generated, in addition to criteria air pollutants, by combustion of fuels, explosives, propellants, and the materials of which targets, munitions, and other training and testing materials are constructed (e.g., plastic, paint, and wood). Fugitive volatile and semi-volatile petroleum compounds also may be emitted whenever mechanical devices are used. These emissions are typically one or more orders of magnitude smaller than concurrent emissions of criteria air pollutants, and only become a concern when large amounts of fuel, explosives, or other materials are consumed during a single activity or in one location.

Emissions of hazardous air pollutants are intermittent and dispersed over a vast ocean area. Because only small quantities of hazardous air pollutants are emitted into the lower atmosphere, which is well mixed over the ocean, the potential for exposure is very low and the risk presented by the emissions is similarly very low. The primary emissions from many munition types are CO_2, CO, and particulate matter; hazardous air pollutants are emitted at low levels (U.S. Environmental Protection Agency 2008). A quantitative evaluation of hazardous air pollutant emissions is thus not warranted and was not conducted.

Electronic warfare countermeasures generate emissions of chaff, a form of particulate not regulated under the federal Clean Air Act as a criteria air pollutant. Virtually all radio frequency chaff is 10 to 100 times larger than particulate matter under PM_{10} and $PM_{2.5}$ (Spargo et al. 1999). The types of training and testing that produce these other emissions may take place throughout the Study Area but occur primarily within special use airspace. Chaff emissions during training and testing primarily occur 3 nm or more from shore and at altitudes over 3,000 ft. (914 m) (above the mixing layer). Chaff released over the ocean would disperse in the atmosphere and then settle onto the ocean surface. The air quality impacts of chaff were evaluated by the Air Force in *Environmental Effects of Self-Protection Chaff and Flares* (U.S. Air Force 1997). The study concluded that most chaff fibers maintain their integrity after ejection.

Although some fibers are likely to fracture during ejection, it appears this fracturing does not release particulate matter. Tests indicate that the explosive charge in the impulse cartridge results in minimal releases of particulate matter. A later study at Naval Air Station Fallon found that the release of 50,000 cartridges of chaff per year over 10,000 square miles would result in an annual average PM_{10} or $PM_{2.5}$ concentration of 0.018 $\mu g/m^3$. This is far below the then National Ambient Air Quality Standard of 50 $\mu g/m^3$ for PM_{10} and 15 $\mu g/m^3$ for $PM_{2.5}$ (Agency for Toxic Substances and Disease Registry 2003).[2] Similar predictions were made for St. Mary's County, Maryland (on the Chesapeake Bay), where chaff releases contribute no more than 0.008 percent of total particulate matter emissions (Arfsten et al. 2001). Therefore, chaff is not further evaluated as an air quality stressor in this EIS/OEIS.

As discussed in Section 3.1.3.3.6 (Chemical and Biological Simulants), chemical and biological simulant testing is performed against surface ships to verify the integrity of the ship's defense system, including installed detection, protection, and decontamination systems. Methods of simulant delivery include aerial dispersal and hand-held spray. The chemical and biological simulants are neither hazardous air pollutants nor criteria pollutants under the Clean Air Act. Depending on the particular simulant, up to 20 gallons of chemical simulant or 5 kg (dry weight) of biological simulant may be released into the air for the tests. Analysis of simulant testing on the Potomac River Test Range is informative to the AFTT EIS/OEIS analysis in that the type and quantity of a simulant employed during a test at the Potomac River Test Range is comparable to the type and quantity of simulant proposed for testing within the AFTT Study Area. Furthermore, the Potomac River Test Range analysis was conducted within a metropolitan region, a portion of which is designated as an ozone nonattainment area. In contrast, the majority of the AFTT Study Area is unclassified or designated in attainment of the National Ambient Air Quality Standards. Dispersion modeling conducted as a part of the Potomac River Test Range analysis showed that simulant concentrations decrease rapidly after release, with concentrations returning to undetectable levels within minutes (Driscoll and Neil 2009). Actual exposure concentrations of simulants are likely to be lower than predicted based on previous dispersion modeling and field tests conducted (Bossart 2006; Driscoll et al. 2004). Chemical and biological simulant testing may result in negligible, long-term, direct and indirect, negative air quality impacts. Therefore, chemical and biological simulants are not further evaluated as an air quality stressor in this EIS/OEIS.

The Proposed Action includes testing activities in select pierside nonattainment areas for O_3. The NEPA analysis includes a Clean Air Act General Conformity Analysis to support a determination pursuant to the General Conformity Rule (40 C.F.R. Part 93B). This analysis focuses on training and testing activities that could impact nonattainment or maintenance areas within the Region of Influence. As noted above, the Study Area lies partly within certain air basins of this classification (e.g., Hampton Roads Intrastate Air Quality Control Region, the Metropolitan Providence Interstate Air Quality Control Region, and the Metropolitan Portland Intrastate Air Quality Control Region). To evaluate the conformity of the Proposed Action with the State Implementation Plan elements of each air quality control region, air pollutant emissions within the applicable states are estimated, based on an assumed distribution of the proposed training and testing activities within these respective portions of the Study Area. The Clean Air Act Conformity Applicability Analysis addresses the applicability of the General Conformity Rule.

Air pollutant emissions outside U.S. territorial seas are estimated and their potential impacts on air quality are assessed through the EO 12114 compliance analysis. Emissions outside U.S. territorial seas are calculated in the same manner as emissions over territorial waters. The General Conformity Rule

[2] The current standard for PM_{10} is 150 $\mu g/m^3$ over a 24-hour average time (See Table 3.2-1).

does not apply to activities outside of U.S. territorial seas because the Clean Air Act does not apply to actions outside of the United States.

Data for the air quality analysis are based, wherever possible, on information from Navy subject matter experts and established training and testing requirements. These data were used to estimate the numbers and types of aircraft, surface ships and vessels, submarines, and munitions (i.e., potential sources of air emissions) that would be involved in training and testing activities under each alternative. Emissions sources and the approach used to estimate emissions under the No Action Alternative, Alternative 1, and Alternative 2 are presented herein.

3.2.1.4 Emissions Estimates

3.2.1.4.1 Aircraft Activities

To estimate aircraft emissions, the operating modes, number of hours of operation, and type of engine for each type of aircraft were evaluated. For estimating purposes, training and testing aircraft flights are assumed to originate offshore from aircraft carriers or other Navy vessels outfitted with flight decks. Emissions associated with airfield or air station operations ashore are analyzed within the home-basing environmental planning process (e.g., environmental impact statements or environmental assessments for (1) Introduction of F/A-18 E/F (Super Hornet) Aircraft to the East Coast of the United States (U.S. Department of the Navy 2003); (2) Introduction of the P-8A Multi-Mission Aircraft into the U.S. Navy Fleet (U.S. Department of the Navy 2008); and (3) Transition of E-2C Hawkeye to E-2D Advanced Hawkeye at Naval Station Norfolk, Virginia and Naval Base Ventura County Point Mugu, California (U.S. Department of the Navy 2009). All aircraft are assumed to travel to and from training and testing ranges at or above 3,000 ft. (914 m) above mean sea level and, therefore, their transits to and from the ranges do not affect surface air quality. Air combat maneuvers and air-to-air missile exercises are primarily conducted at altitudes well in excess of 3,000 ft. (914 m) above mean sea level and, therefore, are not included in the estimated emissions of criteria air pollutants. Activities or portions of those training or testing activities occurring below 3,000 ft. (914 m) are included in emissions estimates. Examples of activities typically occurring below 3,000 ft. (914 m) include those involving helicopter platforms such as mine warfare, anti-surface warfare, and anti-submarine warfare training and testing activities. The list of all training and testing activities and the estimated time spent above or below 3,000 ft. (914 m) for calculation purposes is included in the air quality emissions estimates presented in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

The types of aircraft used and the numbers of sorties flown under the No Action Alternative are derived from previously conducted environmental analysis. The types of aircraft identified include the typical aircraft platforms that conduct a particular training or testing exercise (or the closest surrogate when information is not available), including range support aircraft (e.g., non-Navy commercial air services). For Alternatives 1 and 2, estimates of future aircraft sorties are based on evolutionary changes in the Navy's force structure and mission assignments. Where there are no major changes in types of aircraft, future activity levels are estimated from the distribution of baseline activities. The types of aircraft used in each training or testing activity and numbers of sorties flown by such aircraft are presented in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Time on range (activity duration) under the No Action Alternative was calculated from average times derived from range records and Navy subject matter experts. To estimate time on range for each aircraft activity in Alternatives 1 and 2, the average flight duration approximated in the baseline data was used in the calculations. Estimated altitudes of activities for all aircraft were obtained from aircrew members in operational squadrons. Several testing activities are similar to training activities, and therefore similar

assumptions were made for such activities in terms of aircraft type, altitude, and flight duration. Table 2.4-2 lists Naval Air Systems Command testing activities similar to certain training activities. Where aircraft testing activities were dissimilar to training activities, assumptions for time on range were derived from Navy subject matter experts.

Air pollutant emissions were estimated based on the Navy's Aircraft Environmental Support Office Memorandum Reports for individual aircraft categories (Aircraft Emission Estimates: Mission Operations). When Aircraft Environmental Support Office emission factors were not available, emission factors were obtained from other published sources.

The emissions calculations performed for each alternative conservatively assume that each aircraft training and testing activity listed in Tables 2.8-1 to 2.8-3 is separately conducted. In practice, a testing activity may be conducted during a training flight. It is also probable that two or more training activities may be conducted during one flight (e.g., chaff or flare exercises may occur during electronic warfare activities; or air-to-surface gunnery and air-to-surface bombing activities may occur during a single flight operation). Conservative assumptions may produce elevated aircraft emissions calculations but accounts for the possibility, however remote, that each aircraft training and testing activity is separately conducted.

3.2.1.4.2 Surface Ship Activities

Marine vessel traffic in the Study Area includes military ship and boat traffic, unmanned surface vessels, and range support vessels providing services for military training and testing activities. Nonmilitary commercial vessels and recreational vessels are also regularly present. These commercial vessels are not evaluated in the air quality analysis because they are not part of the Proposed Action. The methods for estimating marine vessel emissions involve evaluating the type of activity, the number of hours of operation, the type of propulsion, and the type of onboard generator for each vessel type.

The types of surface ships and numbers of activities for the No Action Alternative are derived from range records and Navy subject matter experts regarding vessel participant data. For Alternatives 1 and 2, estimates of future ship activities are based on anticipated evolutionary changes in the Navy's force structure and mission assignments. Where there are no major changes in types of ships, estimates of future activities are based on the historical distribution of ship activities.

For surface ships, the durations of activities were estimated by taking an average over the total number of activities for each type of training and testing. Emissions for baseline activities and for future activities were estimated based on discussions with exercise participants. In addition, information provided by participants in surface ship activity was used to develop a breakdown of time spent at each operational mode (i.e., power level) used during activities in which marine vessels participated. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of vessel type, power level, and event duration.

Emission factors for marine vessels were obtained from the database developed for Naval Sea Systems Command by John J. McMullen Associates, Inc. (John J. McMullen Associates 2001). Emission factors were provided for each marine vessel type and power level. The resulting calculations provided information on the time spent at each power level in each part of the Study Area, emission factors for that power level (in pounds of pollutant per hour), and total emissions for each marine vessel for each operational type and mode.

The pollutants for which calculations are made include exhaust total hydrocarbons, CO, NO_x, PM, CO_2, and SO_2. For non-road engines, all particulate matter emissions are assumed to be smaller than PM_{10}, and 92 percent of the particulate matter from gasoline and diesel-fueled engines is assumed to be smaller than $PM_{2.5}$ (U.S. Environmental Protection Agency 2002). For gaseous-fueled engines (liquefied petroleum gas/compressed natural gas), 100 percent of the particulate matter emissions are assumed to be smaller than $PM_{2.5}$ (U.S. Environmental Protection Agency 2002).

The emissions calculations performed for each alternative conservatively assume that each vessel training and testing activity listed in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-1 to 2.8-3 is separately conducted and separately produces vessel emissions. In practice, one or more testing activities may take advantage of an opportunity to travel at sea and test aboard a vessel conducting a related or unrelated training activity. It is also probable that two or more training activities may be conducted during one training vessel movement (e.g., a ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Furthermore, multiple unit level training activities may be conducted during a larger composite training unit exercise. Conservative assumptions may produce elevated vessel emissions calculations but accounts for the possibility, however remote, that each training and testing activity is separately conducted.

3.2.1.4.3 Submarine Activities

No U.S. submarines burn fossil fuel under normal operating conditions. Therefore, no air pollutants are emitted during submarine training or testing activities.

3.2.1.4.4 Naval Gunfire, Missiles, Bombs, Other Munitions, and Military Expended Material

Naval gunfire, missiles, bombs, and other types of munitions used in training and testing activities emit air pollutants. To estimate the amounts of air pollutants emitted by ordnance during its use, the numbers and types of munitions used during training or testing activities are first totaled. Then generally accepted emissions factors (AP-42, Compilation of Air Pollutant Emission Factors, Chapter 15: Ordnance Detonation ([U.S. Environmental Protection Agency 1995]) for criteria air pollutants are applied to the total amounts. Finally, the total amounts of air pollutants emitted by each munition type are summed to produce total amounts of each criteria air pollutant under each alternative.

Certain proposed Navy training and testing activities involve the expenditure of chaff bundles from both aircraft and vessels at sea. Such activities include air combat maneuvers, electronic warfare activities, chaff exercises, air-to-air weapons system tests, air-to-air missile tests, chaff tests, electronic system evaluations, vertical launch system tests, and combat system ship qualification trial–air defense tests. PM_{10} and $PM_{2.5}$ emissions are estimated, and their concentrations are monitored by the USEPA because they are inhalable and thus have a potential negative human health effect. Because virtually all chaff fibers retain a size greater than PM_{10} upon expenditure, impacts on air quality in terms of particulate matter in the Study Area are not separately evaluated in this EIS/OEIS.

3.2.1.5 Sensitive Receptors

Identification of sensitive receptors is part of describing the existing air quality environment. Sensitive receptors are residential areas, schools, parks, hospitals, or other sites for which there is a reasonable expectation of continuous human exposure during the timeframe coinciding with peak pollution concentrations. On the oceanic portions of the Study Area, crews of commercial vessels and recreational users of the northern Atlantic Ocean and Gulf of Mexico could encounter the air pollutants generated by the Proposed Action, but few such individuals are expected to be present and the duration of substantial

exposure to these pollutants is limited because the areas are cleared of nonparticipants before event commencement. These potential receptors are not considered sensitive.

3.2.1.6 Climate Change

Greenhouse gases are compounds that contribute to the greenhouse effect—a natural phenomenon in which gases trap heat within the lowest portion of the earth's atmosphere (surface-troposphere system), causing heating (radiative forcing) at the surface of the earth. The primary long-lived greenhouse gases directly emitted by human activities are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6). CO_2, CH_4, and N_2O occur naturally in the atmosphere. However, their concentrations increased from the preindustrial era (1750) to 2007–2008: CO_2 (38 percent), CH_4 (149 percent), and N_2O (23 percent) (U.S. Environmental Protection Agency 2009b). These gases influence the global climate by trapping heat in the atmosphere that would otherwise escape to space. The heating effect from these gases is considered the probable cause of the global warming observed over the last 50 years (U.S. Environmental Protection Agency 2009b). Global warming and climate change affect many aspects of the environment. Not all effects of greenhouse gases are related to climate. For example, elevated concentrations of CO_2 can lead to ocean acidification and stimulate terrestrial plant growth, and CH_4 emissions can contribute to higher ozone levels.

The administrator of the USEPA determined that six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations. The USEPA specifically identified CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and SF_6 as greenhouse gases ([U.S. Environmental Protection Agency 2009f); 74 Federal Register 66496, 15 December 2009].

To estimate global warming potential, the United States quantifies greenhouse gas emissions using the 100-year timeframe values established in the Intergovernmental Panel on Climate Change Second Assessment Report (Intergovernmental Panel on Climate Change 1995), in accordance with United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change 2004) reporting procedures. All global warming potentials are expressed relative to a reference gas, CO_2, which is assigned a global warming potential equal to 1. The five other greenhouse gases have global warming potentials of 21 for CH_4, 310 for N_2O, 140 to 6,300 for hydrofluorocarbons, 6,500 to 9,200 for perfluorocarbons, and up to 23,900 for SF_6. To estimate the CO_2 equivalency of a non-CO_2 greenhouse gas, the appropriate global warming potential of that gas is multiplied by the amount of the gas emitted. All six greenhouse gases are multiplied by their global warming potential and the results are added to calculate the total equivalent (Eq) emissions of CO_2 (CO_2 Eq). The dominant greenhouse gas emitted is CO_2, mostly from fossil fuel combustion (85.4 percent) (U.S. Environmental Protection Agency 2009d). Weighted by global warming potential, CH_4 is the second largest component of emissions, followed by N_2O. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of teragrams (1 million metric tons or 1 billion kilograms [Tg]) of carbon dioxide equivalents (Tg CO_2 Eq). The Proposed Action is anticipated to release greenhouse gases to the atmosphere. These emissions are quantified (using methods elaborated upon in the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (Council on Environmental Quality 2010) for the proposed Navy training and testing in the Study Area, and estimates are presented in Chapter 4.

The potential effects of proposed greenhouse gas emissions are by nature global and may result in cumulative impacts because individual sources of greenhouse gas emissions are not large enough to have any noticeable effect on climate change. Therefore, the impact of proposed greenhouse gas emissions to climate change is discussed in the context of cumulative impacts in Chapter 4.

3.2.1.7 Other Compliance Considerations, Requirements, and Practices

3.2.1.7.1 Executive Order 12088

EO 12088, *Federal Compliance with Pollution Control Standards*, requires each federal agency to comply with applicable pollution control standards, defined as, "the same substantive, procedural, and other requirements that would apply to a private person." The EO further requires federal agencies to cooperate with USEPA, state, and local environmental regulatory officials.

3.2.1.7.2 Chief of Naval Operations Instruction 5090.1

The Navy developed Chief of Naval Operations Instruction 5090.1 series, which contains instruction for environmental evaluations. Chapter 7 and Appendix F of this series contain guidance for air quality analysis and general conformity determinations. The analysis in this EIS/OEIS was performed in compliance with this instruction.

3.2.1.7.3 Current Requirements and Practices

Equipment used by military units in the Study Area, including ships and other marine vessels, aircraft, and other equipment, are properly maintained and fueled in accordance with applicable Navy requirements. Operating equipment meets federal and state emission standards, where applicable. For example, in accordance with the Chief of Naval Operations Instruction 5090.1 series, Chapter 7, Navy commands shall comply with Navy and regulatory requirements for composition of fuels used in all motor vehicles, equipment, and vessels. To prevent misfueling, installations shall enforce appropriate controls to ensure that any fuel that does not meet low-sulfur requirements is not dispensed to commercial motor vehicles, equipment, or vessels not covered under a national security exemption.

3.2.2 AFFECTED ENVIRONMENT

3.2.2.1 Region of Influence

The region of influence for air quality is a function of the type of pollutant, emission rates of the pollutant source, proximity to other emission sources, and local and regional meteorology (Figure 3.2-4 for a map of the nonattainment areas in the vicinity of the Study Area). For inert pollutants (all pollutants other than O_3 and its precursors), the region of influence is generally limited to a few miles downwind from the source. For a photochemical pollutant such as O_3, however, the region of influence may extend much farther downwind. O_3 is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors (volatile organic compounds and NO_X). The maximum effects of precursors on O_3 levels tend to occur several hours after the time of emission during periods of high solar load, and may occur many miles from the source. O_3 and O_3 precursors transported from other regions can also combine with local emissions to produce high local O_3 concentrations. Therefore, the region of influence for air quality includes the Study Area as well as adjoining land areas several miles inland, which may from time to time be downwind from emission sources associated with the Proposed Action.

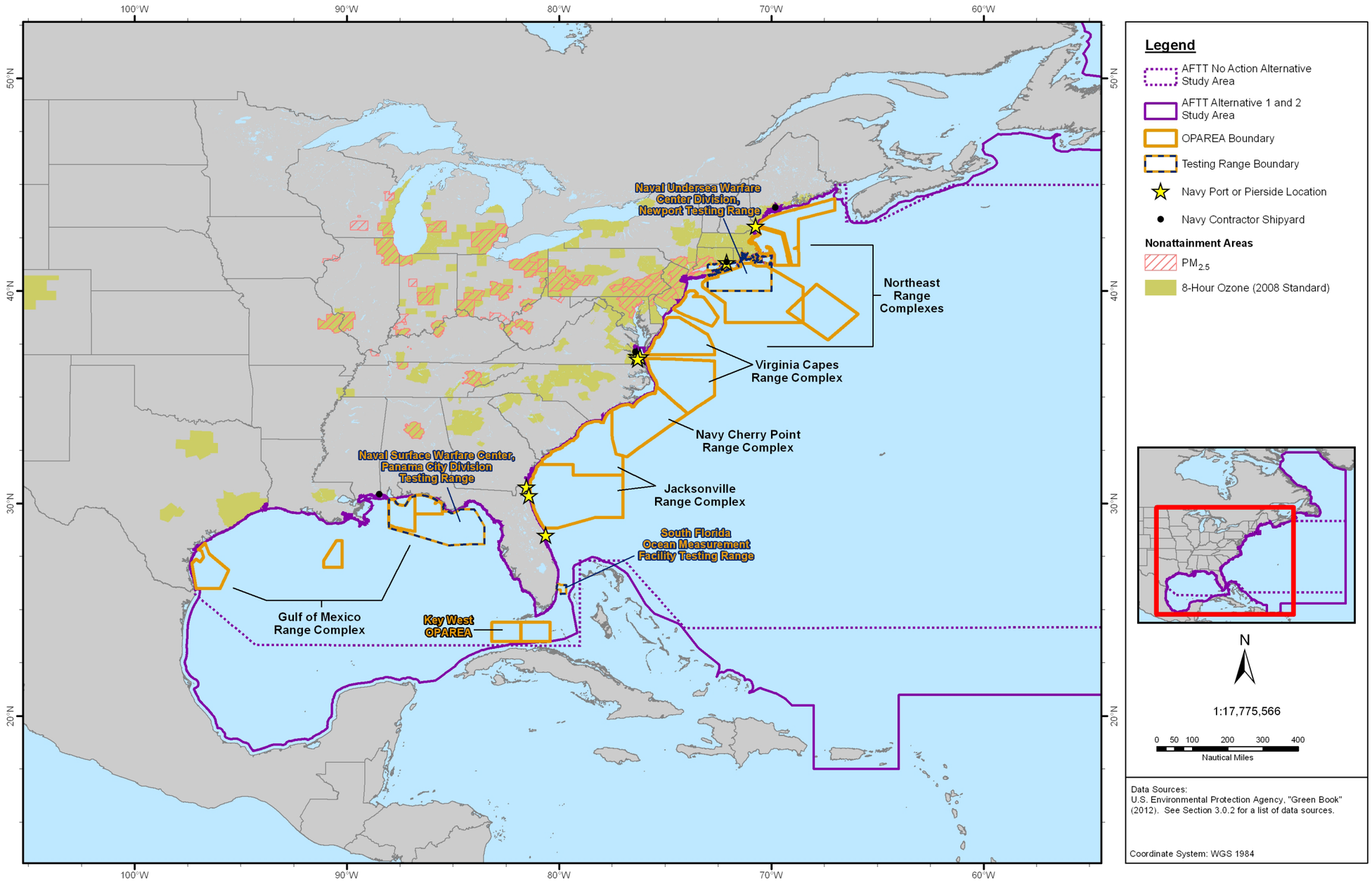

Figure 3.2-4: Nonattainment Areas in the Vicinity of the Study Area

Source: (U.S. Environmental Protection Agency 2009c). Notes: $PM_{2.5}$ = particulate matters ≤ 2.5 microns
AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

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3.2.2.2 Climate of the Study Area

The climatic conditions in the Study Area provide background on factors influencing air quality. Climate zones within the Study Area vary with latitude or region. For air quality, the Study Area can be divided into four areas: the North Atlantic Region (Arctic region to Nova Scotia), the Mid-Atlantic Region (Maine to Virginia), the Southeast Atlantic Region (North Carolina to southern Florida) and the Gulf of Mexico Region (southern Florida to Texas).

The climate is arctic near the 65-degree north latitude line and tropical at the 20-degree north latitude line, but most activities and their potential effects would occur in the northern temperate to subtropical climate zones between Maine, Florida, and the gulf coast.

The climate of the offshore Atlantic Ocean and adjacent land areas is influenced by the temperatures of the surface waters and water currents as well as by wind blowing across the water. Offshore climates are moderate and seldom have extreme seasonal variations because the ocean is slow to change temperature. Ocean currents of the Atlantic Ocean (i.e., Labrador, Gulf Stream, North Atlantic Drift, Canary, and North Equatorial) influence climate by moving warm and cold water between regions. Adjacent land areas are affected by wind that is cooled or warmed when blowing over these currents. In addition to its influence on temperature, the wind moves evaporated moisture from the ocean to adjacent land areas and is a major source of rainfall.

Atmospheric stability and mixing height provide a measure of the amount of vertical mixing of pollutants. Over water, the atmosphere tends to be neutral to slightly unstable because heat and moisture flow into the area. Over land, the atmospheric stability is more variable, being unstable during the daytime, especially in the summer due to rapid surface heating, and stable at night, especially under clear conditions in the cooler season. The mixing height over water typically ranges from 1,640 to 3,281 ft. (500 to 1,000 m), with a slight daily variation (Holzworth 1972). Mixing height over land can be 4,921 ft. (1,500 m) or greater during the afternoon in summer and near zero during clear, calm conditions at night in winter. For this EIS/OEIS, 3,000 ft. (914 m) is used as the typical maximum afternoon mixing height.

3.2.2.2.1 Newfoundland-Labrador Shelf and Scotian Shelf

In the North Atlantic (Newfoundland-Labrador Shelf and Scotian Shelf) winter begins (when daily temperatures average 32°F [0°C]) as early as mid-August in the Labrador Sea or as late as October 1 off the coast of the island of Newfoundland (Canadian Coast Guard 2010). Winter ends in this region in mid-June. Sea ice begins to grow shortly after the onset of winter as average sea temperatures reach 29°F to 35°F (-1.7°C to 1.7°C). Polar lows usually occur during the fall, winter, and early spring. Polar lows form near the ice edge or coast where very cold air flows from ice or land surfaces over open water, which is warm relative to the air temperature. Polar lows are often accompanied by strong winds (the winds generally blow from west to east) and areas of moderate to heavy precipitation. A polar low can form in as few as 12 hours and seldom lasts more than a day. However, under stagnant weather systems, polar lows or a family of polar lows can persist for several days. In the Labrador Sea, the main cause of vessel icing is freezing spray. Freezing spray is also responsible for the heaviest ice accretions. Arctic sea smoke can accompany spray icing if air temperatures are very cold. Vessel icing reports from east coast waters show that combined spray and fog icing conditions are more frequently experienced in the Labrador Sea. The potential for spray icing exists from October to May.

3.2.2.2.2 Northeast United States Continental Shelf

Along the coasts of Maine to New Jersey, the most frequent wind directions measured by buoys are from the west or west-northwest, but wind can come from any direction (Department of Commerce 2010). The average wind speeds are between 12.4 and 16.2 miles per hour (mph) (20 to 26 kilometers per hour [kph]). Wind speeds are typically lowest in July at 9.0 to 12.1 mph (15 to 20 kph), and highest in January at 15.7 to 20.0 mph (25 to 32 kph).

Annual average air temperature ranges from 47°F to 60°F (8.3°C to 15.6°C) along the coast of Maine to New Jersey (Department of Commerce 2010). Seasonal variations in temperature are greatest during the winter months. In January and February, the ambient temperature averages 28°F (-2.2°C) along the coast of Maine to New Jersey. During the warmer months, there is little daily variation in temperature. In August, the average temperature is 75°F (23.9°C) along the coast of this region.

Along the coasts of Maine to New Jersey, precipitation is frequent and abundant but occurs evenly throughout the year (Minerals Management Service 2007). Average annual rainfall along the Atlantic coast ranges from about 42 inches (in.) (107 centimeters [cm]) in Block Island, Rhode Island, to 58 in. (147 cm) in Miami, Florida. Rainfall in the warmer months is usually associated with cloud systems that produce showers and thunderstorms. Winter rains are associated with the passage of frontal systems through the eastern seaboard. Precipitation also falls as snow along the coasts of Maine to New Jersey. The highest snowfall among coastal U.S. areas within the Study Area occurs in Portland, Maine, with a maximum monthly average of 62.4 in. (158 cm).

3.2.2.2.3 Southeast United States Continental Shelf

Off the coast of North Carolina, the prevailing winds are from south to southwest, with average wind speeds between 13 to 16 mph (21 to 26 kph). Off the coasts of South Carolina and Georgia, the prevailing wind direction is from south to southwest, and from southeast to east-southeast off of Florida. Average wind speeds range from 12 to 14 mph (20 to 23 kph), and wind speeds exhibit smaller monthly variations than northern coastal states.

Annual average air temperatures range from 70°F to 75°F (21°C to 24°C) along the coast of the Southeast U.S. Continental Shelf (Department of Commerce 2010). In January and February, ambient temperatures average 55°F (13°C) along the coast of the Southeast U.S. Continental Shelf. During the warmer months, there is little daily variation in temperature. In August, average temperatures are 83°F (29°C) along the coast of this region. Air temperatures over the southern coast and offshore Atlantic Ocean have smaller daily and seasonal ranges than temperatures over inland areas because the ocean, which is slow to change temperature, has an important influence on ocean and coastal atmospheric temperatures.

At various locations along the Atlantic coast, fog occurs occasionally in the cooler months as a result of warm, moist air from the Gulf of Mexico blowing over cool land or water surfaces. The poorest visibility occurs from November through April. During periods of air stagnation, industrial pollution and agricultural burning also can affect visibility.

In the Southeast U.S. Continental Shelf coastal areas (generally from North Carolina to Florida), precipitation is frequent and abundant throughout the year, but tends to peak in the summer months.

Hurricanes develop in the southern part of the Atlantic Ocean. Hurricane season in the Atlantic Ocean runs from June to November, with a peak in mid-September. Most storms form in warm waters several

hundred miles north of the equator. Once a tropical system forms, it usually travels west and slightly north while strengthening. Many storms curve to the northeast near the Florida peninsula. The Atlantic basin averages about 10 storms of tropical storm strength or greater per year; about half reach hurricane level (Department of Commerce 2005). Storms weaken as they encounter cooler water, land, or vertical wind shear, sometimes slowing to an extra-tropical storm, mostly affecting northern Atlantic coastal areas.

3.2.2.2.4 Gulf of Mexico

The climate of the Gulf of Mexico is influenced mainly by the clockwise circulation around the semi-permanent area of high barometric pressure commonly known as the Bermuda High (U.S. Department of the Interior 2002). The Gulf of Mexico is southwest of this center of circulation. This high-pressure system results in a predominantly southeasterly wind flow in the Gulf of Mexico. Two important classes of storms occasionally occur with this circulation pattern. During the winter months, cold fronts associated with cold air masses from land influence the northern coast of the Gulf of Mexico. Behind the fronts, strong north winds bring drier air into the region. Secondly, hurricanes may develop in or migrate into the Gulf of Mexico during the warmer months. These storms may affect any area of the Gulf of Mexico and substantially change the local wind circulation around them. In coastal areas, the sea breeze may become the primary circulation feature during the summer months. Conversely, land breezes (particularly at night) transport air pollutants from land to offshore areas. Locally, the land breeze diminishes as more heat is retained within large, growing coastal cities (National Science Foundation 2011). In general, however, the subtropical maritime climate is the dominant feature driving all aspects of the weather in this region. As a result, the climate shows very little daily or seasonal variation (U.S. Department of the Interior 2002).

Average air temperatures at Gulf of Mexico coastal locations (Texas to Florida) vary with latitude and exposure. Air temperatures range from highs in the summer of 88°F to 96°F (31°C to 6°C) to lows in the winter of 37°F to 59°F (3°C to 15°C) (U.S. Department of the Interior 2002). Temperatures depend on the frequency and intensity of polar air masses from the north. Air temperatures over the open waters of the Gulf of Mexico are more moderate and have smaller daily and seasonal temperature ranges than land temperatures because the Gulf of Mexico is slow to change temperature (Minerals Management Service 2006). The average temperature over the center of the Gulf of Mexico is about 84°F (29°C) in the summer and between 63°F to 73°F (17°C to 23°C) in the winter (Minerals Management Service 2006).

In the Gulf of Mexico portion of the Study Area, precipitation is frequent and abundant throughout the year (U.S. Department of the Interior 2002). Stations along the entire gulf coast record the highest precipitation values during the warmer months of the year. The warmer months usually have cloud systems that produce showers and thunderstorms; however, these thunderstorms rarely cause any damage or have hail (U.S. Department of the Interior 2002). The month of maximum rainfall for most locations in the Gulf of Mexico is July. Winter rains often come with frontal systems passing through the area. Rainfall is generally light, steady, and relatively continuous, often lasting several days. Snowfall is rare, and when snow or sleet does occur, it usually melts on contact with the ground. The chance for snow or sleet decreases with distance offshore, rapidly reaching zero.

Hurricanes affecting the Gulf of Mexico form near the equator in the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico (U.S. Department of the Interior 2002). Data from 1886 to 1986 show that almost half (44.5 percent) of these hurricanes, or 3.7 storms per year, will affect the Gulf of Mexico (U.S. Department of the Interior 2002).

3.2.2.3 Regional Emissions

Few studies document pollutant emissions within the vast offshore expanse of the Study Area. However, one 2008 study of emissions within the Gulf of Mexico portion of the Study Area provides insight to the many emission sources within that region. The 2008 Gulfwide Emission Inventory indicates that outer continental shelf oil and gas production platform and nonplatform sources emit the majority of criteria pollutants and greenhouse gases in the Gulf of Mexico. PM, SO_2 (primarily emitted from commercial marine vessels) and N_2O (from biological sources) are exceptions (Wilson et al. 2010). The outer continental shelf oil and gas production platform and nonplatform sources account for 93 percent of the total CO emissions, 74 percent of NO_x emissions, 76 percent of volatile organic compound emissions, 99 percent of methane emissions, and 84 percent of CO_2 emissions. Natural gas engines on platforms were the largest CO emission sources, accounting for 60 percent of the estimated total. Support vessels were the largest emitters for NO_x accounting for 35 percent of the estimated total. Platform vents and fugitive sources accounted for the highest percentage of the volatile organic compounds and methane emissions. Support vessels (29 percent of total emissions), platform natural gas turbines (15 percent of total emissions), and drilling rigs (12 percent of total emissions) emitted the majority of the CO_2 emissions. The summary of this 2008 inventory is presented in Table 3.2-3.

The 2008 Gulfwide Emission Inventory noted that military vessels accounted for a small percentage of the total gulfwide criteria pollutant emissions. The percentage contribution from all military vessels (Navy and non-Navy) is shown in Table 3.2-4. The military vessel percentage contribution of criteria pollutant emissions to total emissions from all sources is less than 2.5 percent for each criteria pollutant.

Table 3.2-3: Total Platform and Nonplatform Emissions Estimates for Criteria Pollutants (Gulf of Mexico)

Equipment / Source Category	Emissions (TPY)					
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Total Platform	82,651	75,117	689	679	1,028	65,423
Drilling Rigs	5,343	58,288	971	971	7,772	971
Pipelaying Operations	2,186	10,535	398	398	1,789	398
Support Helicopters	13,636	1,114	217	217	275	2,693
Support Vessels	12,880	135,222	2,342	2,342	18,221	2,342
Survey Vessels	141	1,690	26	26	204	26
Total Outer Continental Shelf Oil/Gas Production	116,837	281,966	4,643	4,633	29,289	71,853
Total Non-Outer Continental Shelf Oil/Gas Production	8,432	100,880	7,004	6,481	52,022	22,442
Total	**125,269**	**382,846**	**11,647**	**11,114**	**81,311**	**94,295**

Source: (Wilson et al. 2010)

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns; PM_{10}: particulate matter ≤ 10 microns; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Totals may not sum due to rounding. Table includes criteria pollutant precursors (e.g., VOC).

Table 3.2-4: Estimated Gulfwide Criteria Pollutant Emissions Estimates (All Sources)

Equipment / Source Category	Emissions (TPY)					
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Boilers/heaters/burners	716	1,482	26	17	9	46
Combustion Flares	1,315	257	2	2	2	22
Commercial Fishing Vessels	681	8,120	124	124	988	124
Commercial Marine Vessels	6,593	79,329	6,603	6,080	49,009	2,794
Diesel Engines	1,816	7,463	308	307	715	353
Drilling Equipment	549	2,072	37	36	262	52
Drilling Rigs	5,343	58,288	971	971	7,772	971
Louisiana Offshore Oil Platform	136	1,832	33	33	219	40
Military Vessels	702	8,539	158	158	1,409	130
Natural Gas Engines	75,408	52,736	250	250	15	1,312
Natural Gas Turbines	2,847	11,107	66	66	21	73
Pipelaying Operations	2,186	10,535	398	398	1,789	398
Support Helicopters	13,636	1,114	217	217	275	2,693
Support Vessels	12,880	135,222	2,342	2,342	18,221	2,342
Survey Vessels	141	1,690	26	26	204	26
Vessel Lightering	320	3,060	86	86	397	4,423
Total	**125,269**	**382,846**	**11,647**	**11,114**	**81,311**	**94,295**
Military Vessels as a Percentage of Total Gulfwide Criteria Pollutant Emissions	**0.56%**	**2.23%**	**1.36%**	**1.42%**	**1.73%**	**0.14%**

Source: (Wilson et al. 2010)

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns; PM_{10}: particulate matter ≤ 10 microns; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Note: In this table, not all VOC source categories are listed in order to display only like sources. The VOC sources were cold vents, fugitives, and biogenic and geogenic sources. Table includes criteria pollutant precursors (e.g., VOC).

Unknown quantities of air pollutants are emitted by commercial and recreational aircraft and vessels operating in the Study Area. The types of air pollutants emitted from vessels operating in the Study Area can include CO, NO_x, SO_x and PM from diesel fuel combustion (Markle and Brown 1995) and CO, NO_x, SO_x, polycyclic aromatic hydrocarbons, and formaldehyde from Jet Propellant-8 combustion (Ritchie et al. 2001). Other common fuels combusted by recreational aircraft and vessels include 100-Low-Lead (resulting in lead emissions in addition to those previously listed) and gasoline.

Given the prevailing wind directions in many parts of the Study Area, air pollutants generated in adjacent urban or industrial land areas can negatively affect air quality in the Study Area. In the northeastern United States, urban areas are large area sources of air pollutants, but these pollutants readily disperse during warm weather. In winter, when ground-based inversions are common, air pollutants from urban sources such as wood-burning stoves and automobiles become concentrated near the ground where their concentrations may exceed health-based air quality standards. In rural areas, mining, gas and coal extraction, and other extractive industries are major point sources of air pollutants, as are large wildfires in the southeastern United States.

3.2.2.4 Existing Air Quality

As a whole, the air quality of the Study Area is very good. As shown on Figure 3.2-4, most 8-hour ozone and $PM_{2.5}$ nonattainment areas in the eastern half of the continental United States are in the northeastern states or inland, urban, industrialized areas. This condition results from the relatively low number of air pollutant sources, size, and topography of the Study Area, and prevailing meteorological conditions. In general, air quality in the coastal counties of the lower-middle and southern Atlantic is in attainment of the National Ambient Air Quality Standards. Coastal counties near offshore training and testing areas in the Gulf of Mexico, and coastal counties near offshore training and testing areas along the southeastern United States are in attainment for all criteria pollutants (U.S. Environmental Protection Agency 2011b). None of the coastal counties in this region (lower-middle and southern Atlantic counties) are subject to the 8-hour O_3 standard, and all counties meet the National Ambient Air Quality Standards for SO_2, NO_2, and Pb.

In the Hampton Roads, Virginia area (in the vicinity of Naval Station Norfolk on Figure 3.2-4), concentrations of air pollutants, except O_3, are within the National Ambient Air Quality Standards. The Hampton Roads area is in attainment (maintenance) of the 1997 8-hour ozone National Ambient Air Quality Standards. The two Virginia counties on the Delmarva Peninsula, Accomack and Northampton Counties, are in attainment of the 8-hour O_3 standard.

Some other coastal counties in mid-Atlantic and northeastern states, however, are in nonattainment for O_3 or $PM_{2.5}$.

- New York County in New York is in nonattainment for PM_{10} and coastal counties in Connecticut, New Jersey, and New York are in nonattainment for both O_3 and $PM_{2.5}$. O_3 is a regional air pollutant issue. Emission controls are needed for local and regional sources to reduce ambient O_3 levels. Prevailing southwest to west winds carry air pollution from the Ohio River Valley, where major NO_x emission sources (e.g., power plants) are located, and from mid-Atlantic metropolitan areas, to the northeast, contributing to high-O_3 episodes.
- Some near-coastal areas between Delaware and Massachusetts are classified as marginal nonattainment areas for the 2008 8-hour O_3 Standard. Eight-hour O_3 nonattainment areas include Philadelphia-Wilmington-Trenton, Pennsylvania-Delaware-New Jersey-Maryland; New York-New York, New Jersey-Long Island, New York-New Jersey-Connecticut; Greater Connecticut, Connecticut; and Boston-Worcester-Manchester, Massachusetts-New Hampshire. Of these O_3 nonattainment areas, nonattainment areas for $PM_{2.5}$ are limited to Philadelphia-Wilmington-Trenton, Pennsylvania-Delaware-New Jersey-Maryland and New York-New York, New Jersey-Long Island, New York-New Jersey-Connecticut.

With the exception of the Houston-Galveston-Brazoria metropolitan region (an eight-county area in marginal nonattainment of the 2008 H-hour O_3 standard), Gulf of Mexico coastal counties are in attainment for all criteria pollutants. Coastal counties near offshore training and testing areas in the Gulf of Mexico, and coastal counties near offshore training and testing areas along the southeastern United States, are in attainment for all criteria pollutants.

Among the training and testing locations within the Study Area, several of the northeastern United States pierside surface ship and submarine sonar maintenance and testing locations are within nonattainment or maintenance areas. Table 3.2-5 lists Study Area pierside locations and the attainment status for each.

Table 3.2-5: Pierside Locations and Their Corresponding Air Quality Control Region's Attainment Status

Pierside Location	Air Quality Control Region	National Ambient Air Quality Standards (NAAQS) Attainment Status
Portsmouth Naval Shipyard, Kittery Maine Shipyard – Bath, Maine	Metropolitan Portland Intrastate	In attainment (maintenance) of the 8-hr ozone NAAQS Attainment of all other applicable NAAQS
Naval Submarine Base New London, Groton, Connecticut Shipyard – Groton, Connecticut	Greater Connecticut	Marginal nonattainment (8-hr ozone) Attainment of all other applicable NAAQS
Naval Undersea Warfare Center, Division, Newport, Newport, Rhode Island	Metropolitan Providence Interstate	In attainment (maintenance) of the 8-hr ozone NAAQS Attainment of all other applicable NAAQS
Naval Station Norfolk, Norfolk, Virginia Joint Expeditionary Base Little Creek-Fort Story, Virginia Beach, Virginia Norfolk Naval Shipyard, Portsmouth, Virginia Shipyard – Newport News, Virginia	Hampton Roads Intrastate	In attainment (maintenance) of the 8-hr ozone NAAQS Attainment of all other applicable NAAQS
Naval Submarine Base Kings Bay, Georgia Naval Station Mayport, Jacksonville, Florida	Jacksonville (Florida)-Brunswick (Georgia) Interstate	Attainment of all applicable NAAQS
Port Canaveral, Cape Canaveral, Florida	Central Florida Intrastate	Attainment of all applicable NAAQS
Shipyard – Pascagoula, Mississippi	Mobile (Alabama)-Pensacola-Panama City (Florida)-Southern Mississippi Interstate	Attainment of all applicable NAAQS

Source: 40 C.F.R. Part 81 and (U.S. Environmental Protection Agency 2011a)
NAAQS: National Ambient Air Quality Standards

3.2.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact air quality within the Study Area. Tables 2.8-1 to 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of activities and ordnance expended). The air quality stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to air quality in the Study Area are analyzed below and include the following:

- Criteria air pollutants
- Hazardous air pollutants

In this analysis, criteria air pollutant emissions estimates were calculated for vessels, aircraft, and ordnance. For each alternative, emissions estimates were developed by range complex and other training or testing locations and totaled for the Study Area. Details of the emission estimates are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability). Hazardous air pollutants are analyzed qualitatively in relation to the prevalence of the sources emitting hazardous air pollutants during training and testing activities.

3.2.3.1 Criteria Air Pollutants

The potential impacts of criteria air pollutants are evaluated by first estimating the emissions from training and testing activities in the Study Area for each alternative. These estimates are then used to determine the potential impact of the emissions on the attainment status of the adjacent air quality control region. Emissions of criteria air pollutants may affect human health directly by degrading local or regional air quality or indirectly by their effects on the environment. Air pollutant emissions may also have a regulatory effect separate from their physical effect, if additional air pollutant emissions change the attainment status of an air quality control region.

The estimate of criteria air pollutant emissions for each alternative is organized by training emissions and testing emissions. These emissions are further categorized by region (e.g., by range complex or testing range) so that differences in background air quality, atmospheric circulation patterns, regulatory requirements, and sensitive receptors can be addressed. An overall estimate of air pollutant emissions for Navy training and testing activities in the Study Area under each alternative is also provided.

3.2.3.1.1 No Action Alternative

3.2.3.1.1.1 Training

Table 3.2-6 lists training-related criteria air pollutant and precursor emissions in the Study Area. Emissions are totaled for each major training region (i.e., range complex or Other AFTT Areas) of the Study Area. Total emissions for each major training region are then summed to arrive at the total emissions within the Study Area. Totals include aircraft and vessel emissions based on estimated numbers of vessels and aircraft involved in training activities. The air pollutants emitted in the greatest quantity are CO and NO_x.

Table 3.2-6: Annual Criteria Air Pollutant Emissions from Training under the No Action Alternative

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	1.66	7.67	0.37	0.36	1.81	1.81
Vessels	11.52	13.10	1.00	2.50	0.27	0.27
Ordnance	0.01	<0.01	<0.01	<0.01	0.08	0.01
Total	13.18	20.77	1.37	2.86	2.16	2.09
Virginia Capes Range Complex						
Aircraft	36.82	69.54	3.57	3.19	19.04	19.04
Vessels	287.50	176.63	27.71	72.00	6.21	6.21
Ordnance	7.63	0.19	<0.01	<0.01	0.97	0.64
Total	331.95	246.36	31.28	75.19	26.22	25.88
Navy Cherry Point Range Complex						
Aircraft	14.52	21.43	1.44	1.15	6.22	6.22
Vessels	602.26	381.20	54.09	176.10	14.56	14.56
Ordnance	0.88	0.02	<0.01	<0.01	0.09	0.02
Total	617.67	402.66	55.53	177.25	20.86	20.80
Jacksonville Range Complex						
Aircraft	20.84	37.60	2.26	1.88	10.26	10.26
Vessels	474.09	293.80	49.67	102.10	8.72	8.72
Ordnance	1.75	0.07	<0.01	<0.01	0.21	0.05
Total	496.69	331.47	51.92	103.98	19.20	19.04
Key West Range Complex						
Aircraft	10.07	10.37	0.89	0.65	3.40	3.40
Vessels	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ordnance	0.59	0.01	<0.01	<0.01	0.01	0.01
Total	10.66	10.38	0.89	0.65	3.41	3.40
Gulf of Mexico Range Complex						
Aircraft	4.54	8.52	0.45	0.40	2.34	2.34
Vessels	73.23	43.68	6.91	19.17	1.64	1.64
Ordnance	0.74	0.01	<0.01	<0.01	0.03	0.01
Total	78.51	52.21	7.36	19.57	4.01	3.99
Other AFTT Areas						
Aircraft	0.10	0.61	0.01	0.02	0.14	0.14
Vessels	25.14	11.65	1.97	4.45	0.30	0.30
Ordnance	0.04	0.06	<0.01	<0.01	<0.01	<0.01
Total	25.28	12.32	1.98	4.47	0.45	0.44
Study Area Total						
Aircraft	**88.54**	**155.75**	**8.99**	**7.65**	**43.20**	**43.20**
Vessels	**1,473.74**	**920.05**	**141.35**	**376.32**	**31.71**	**31.71**
Ordnance	**11.65**	**0.36**	**<0.01**	**<0.01**	**1.39**	**0.75**
Total	**1,573.94**	**1,076.16**	**150.33**	**383.97**	**76.30**	**75.66**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Under the No Action Alternative, the annual numbers of Navy training activities in the Study Area would remain at baseline (existing) levels. The air pollutants emitted in the greatest quantities from aircraft are typically NO_x, followed by particulate matter (PM_{10} and $PM_{2.5}$) and CO. These emissions are associated with aircraft involvement in a variety of training activities: anti-air warfare, electronic warfare, and mine warfare. The air pollutants emitted in the greatest quantities from surface vessels are typically CO, NO_x, and SO_x. These emissions are associated with vessel involvement in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which is emitted under the No Action Alternative from a variety of munitions: bombs, rockets, missiles, smokes, flares, and gun rounds.

As shown in Table 3.2-6, certain regions (e.g., Virginia Capes [VACAPES], Navy Cherry Point, and JAX Range Complexes) account for the majority of the total Study Area emissions. These three regions account for 92 percent of the emissions but constitute only 5 percent of the total Study Area. The spatial distribution of emissions reflects the locations where Navy training most regularly occurs. The remaining 8 percent of emissions are spread across smaller geographical areas, including the Northeast, GOMEX, and Key West Range Complexes, and across the vast expanse of the Study Area outside of the range complexes.

While pollutants emitted in the Study Area may be carried ashore by prevailing winds, most training activities would occur more than 3 nm offshore, and natural mixing would substantially disperse pollutants before they reach the boundaries of the adjacent air quality control regions. Moreover, given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 85 percent of training-related emissions are produced at least 3 nm from shore. The contributions of air pollutants generated in the Study Area to the air quality in the air quality control regions are insignificant and unlikely to measurably add to existing onshore pollutant concentrations because of the distances these offshore pollutants would be transported and their substantial dispersion during transport.

3.2.3.1.1.2 Testing

Table 3.2-7 lists testing-related criteria air pollutant and precursor emissions in the Study Area. Emissions are totaled for each major testing region (i.e., range complex, Other AFTT Areas, individual testing ranges, and pierside facilities) of the Study Area. Total emissions for each major testing region are then summed to arrive at the total testing emissions within the Study Area. Totals include aircraft and vessel emissions based on estimated numbers of vessels and aircraft involved in tests. The air pollutants emitted in the greatest quantity are CO and NO_x.

Under the No Action Alternative, the annual numbers of Navy testing activities in the Study Area would remain at baseline (existing) levels. Pollutants emitted in the Study Area may be transported ashore by periodic changes to prevailing winds, possibly affecting air basins along the U.S. coast. The air pollutants emitted in the greatest quantities from aircraft are typically NO_x, followed by particulate matter (PM_{10} and $PM_{2.5}$) and CO. These emissions are associated with aircraft involvement in a variety of testing activities, including anti-air warfare, electronic warfare, and mine warfare. The air pollutants emitted in the greatest quantities from surface vessels are typically CO, NO_x, and SO_x. These emissions are associated with vessel involvement in a variety of testing activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which is emitted under the No Action Alternative from a variety of munitions, including bombs, rockets, missiles, smokes, flares, and gun rounds.

Table 3.2-7: Annual Criteria Air Pollutant Emissions from Testing under the No Action Alternative

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	0.12	0.39	0.02	0.02	0.10	0.10
Vessels	4.45	2.73	0.38	0.86	0.07	0.07
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	4.57	3.13	0.40	0.87	0.17	0.17
Virginia Capes Range Complex						
Aircraft	3.84	5.54	0.36	0.28	1.58	1.58
Vessels	58.71	35.69	5.27	16.82	1.46	1.46
Ordnance	1.02	0.01	<0.01	<0.01	0.10	0.04
Total	63.57	41.24	5.63	17.10	3.15	3.09
Navy Cherry Point Range Complex						
Aircraft	0.39	0.57	0.04	0.03	0.17	0.17
Vessels	2.59	1.79	0.24	0.62	0.06	0.06
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	2.98	2.36	0.28	0.65	0.23	0.22
Jacksonville Range Complex						
Aircraft	0.65	0.95	0.07	0.05	0.28	0.28
Vessels	5.16	3.34	0.44	1.10	0.09	0.09
Ordnance	0.41	0.01	<0.01	<0.01	0.03	0.02
Total	6.23	4.30	0.51	1.16	0.41	0.40
Key West Range Complex						
Aircraft	0.02	0.07	<0.01	<0.01	0.02	0.02
Vessels	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	0.02	0.09	<0.01	0.01	0.02	0.02
Gulf of Mexico Range Complex						
Aircraft	1.63	1.85	0.15	0.11	0.59	0.59
Vessels	5.21	3.65	0.51	1.96	0.18	0.18
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	6.84	5.50	0.66	2.08	0.77	0.77
Other AFTT Areas						
Aircraft	0.10	0.29	0.02	0.02	0.08	0.08
Vessels	1.07	0.80	0.10	0.20	0.02	0.02
Ordnance	0.08	<0.01	<0.01	<0.01	<0.01	<0.01
Total	1.25	1.09	0.12	0.22	0.10	0.10

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Table 3.2–7: Annual Criteria Air Pollutant Emissions from Testing under the No Action Alternative (Continued)

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Naval Undersea Warfare Center Division, Newport Testing Range						
Aircraft	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vessels	42.10	37.52	1.95	3.41	1.26	1.26
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	42.10	37.52	1.95	3.41	1.26	1.26
Naval Surface Warfare Center, Panama City Division Testing Range						
Aircraft	0.96	0.98	0.08	0.06	0.32	0.32
Vessels	39.82	47.32	2.42	4.05	1.81	1.81
Ordnance	0.10	<0.01	<0.01	<0.01	<0.01	<0.01
Total	40.87	48.30	2.51	4.11	2.14	2.13
Study Area Total (less pierside testing emissions separately quantified for conformity analyses)						
Aircraft	**7.70**	**10.65**	**0.75**	**0.58**	**3.14**	**3.14**
Vessels	**159.11**	**132.85**	**11.31**	**29.02**	**4.95**	**4.95**
Ordnance	**1.61**	**0.02**	**<0.01**	**<0.01**	**0.15**	**0.07**
Total	**168.42**	**143.52**	**12.06**	**29.60**	**8.24**	**8.16**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

As shown in Table 3.2-7, certain regions (e.g., VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range) account for the majority of the total Study Area testing-related emissions. These two regions account for over 60 percent of the testing-related emissions but constitute only 5 percent of the total Study Area. The spatial distribution of emissions reflects the locations where Navy testing most regularly occurs. Given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 90 percent of testing emissions are produced at least 3 nm from shore.

The remaining 40 percent of emissions are spread across several smaller geographical areas, including the Northeast, GOMEX, and JAX Range Complexes; the Naval Undersea Warfare Center Division, Newport Testing Range, and pierside facilities. The contributions of testing-related air pollutants generated in the Study Area to the air quality in air quality control regions ashore are insignificant and unlikely to measurably add to existing onshore pollutant concentrations because of the distances these offshore pollutants would have to be transported and their substantial dispersion during transport.

Criteria Pollutant Emissions in Nonattainment or Maintenance Areas

Metropolitan Providence Air Quality Control Region

The U.S. Environmental Protection Agency Final Rule: Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards designated the Metropolitan Providence Air Quality Control Region (all Rhode Island counties) unclassifiable/attainment of the 2008 8-Hour Ozone National Ambient Air Quality Standards (U.S. Environmental Protection Agency 2012a). Nevertheless, given recent Rhode Island monitoring results, the region is likely to be redesignated nonattainment in the near future. Therefore, as a conservative measure, a conformity review is included herein. The amounts of criteria air pollutants emitted under the No Action Alternative by Navy testing activities in the Metropolitan

Providence Air Quality Control Region of the Study Area are presented in Table 3.2-8. The largest source of air pollutants associated with the proposed Navy testing activities in Narragansett Bay in the Rhode Island region is vessels. Various vessels support testing activities, including a 120-ft. long support vessel, the TWR-841, which also employs a diesel-powered electricity generator; the WB-30, a 36-ft. work boat; and smaller vessels ranging from 12-ft. to 22-ft. lengths. The two larger vessels are diesel powered, while the rest employ gasoline engines. The unmanned surface vehicles employ diesel engines. High-speed ferries may also be used to support Navy testing in Narragansett Bay.

The air pollutants expected to be emitted under the No Action Alternative would not have a measurable impact on air quality over Rhode Island coastal waters or adjacent land areas because of the distances from land at which the pollutants are emitted and the generally strong ventilation resulting from regional meteorological conditions. Air pollutant emissions under the No Action Alternative would not result in violations of state or federal air quality standards because they would not have a measurable impact on air quality in land areas.

Table 3.2-8: Estimated Annual Air Pollutant Emissions over Rhode Island State Waters (within 3 nm), No Action Alternative

	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft Emissions	0.09	0.43	0.02	0.02	0.10	0.10
Vessels Emissions	42.68	38.13	2.00	3.53	1.27	1.27
Total Emissions from all Sources	**42.78**	**38.56**	**2.02**	**3.55**	**1.37**	**1.37**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Hampton Roads Intrastate Air Quality Control Region

The amounts of criteria air pollutants that would be emitted under the No Action Alternative by Navy testing activities over state waters with proximity to the Hampton Roads Intrastate Air Quality Control Region of the Study Area are presented in Table 3.2-9. The largest source of CO associated with the proposed Navy testing activities in the lower Chesapeake Bay and state waters of the Atlantic Ocean in Virginia is helicopters, while small boats emit primarily NO_x. Various helicopters are used in mine warfare, anti-submarine warfare, and anti-surface warfare activities, including: the SH-60H, CH-46D, CH-46E, CH-53E, H-3, SH-60R, and SH-60S.

The air pollutants expected to be emitted under the No Action Alternative would not have a measurable impact on air quality over Virginia coastal waters or adjacent land areas because of the distances from land at which the pollutants are emitted, and the generally strong ventilation resulting from regional meteorological conditions. Air pollutant emissions under the No Action Alternative would not result in violations of state or federal air quality standards because they would not have a measurable impact on air quality in land areas.

Table 3.2-9: Estimated Annual Air Pollutant Emissions over Virginia State Waters (within 3 nm), No Action Alternative

	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft Emissions	20.46	21.09	1.81	1.32	6.90	6.90
Vessels Emissions	1.22	3.49	0.59	0.50	0.04	0.04
Total Emissions over Virginia State Waters	**21.67**	**24.58**	**2.40**	**1.82**	**6.94**	**6.94**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Summary – No Action Alternative

Total criteria air pollutant emissions under the No Action Alternative are summarized in Table 3.2-10. While criteria air pollutants emitted in the Study Area over territorial waters may be transported ashore, they would not affect the attainment status of the relevant air quality control regions. The amounts of air pollutants emitted in the Study Area and subsequently transported ashore would be insignificant because (1) emissions from Navy training and testing activities are small compared to the amounts of air pollutants emitted by sources ashore, (2) the distances the air pollutants would be transported are often large, and (3) the pollutants are substantially dispersed during transport. The criteria air pollutants emitted over non-territorial waters within the Study Area would be dispersed over vast areas of open ocean and thus would not have a measurable impact on environmental resources in those areas.

Estimates of air pollutant emissions under the No Action Alternative are a projection into the future of existing baseline emissions. Under the No Action Alternative, the annual numbers of Navy training and testing activities in the Study Area would remain at baseline levels. Emissions rates would remain constant for those pollutant sources not affected by other federal requirements to reduce air emissions. Any effects of the No Action Alternative on regional air quality are reflected in the current ambient criteria air pollutant concentrations in air quality control regions ashore. The No Action Alternative is exempt from the federal General Conformity Rule because training and testing activities under the No Action Alternative would not increase criteria air pollutant emissions above baseline levels.

Table 3.2-10: Estimated Annual Criteria Air Pollutant Emissions in the Study Area, No Action Alternative

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Training-Related Emissions	1,573.94	1,076.16	150.33	383.97	76.30	75.66
Testing-Related Emissions	168.42	143.52	12.06	29.60	8.24	8.16
Total Study Area	**1,742.36**	**1,219.68**	**162.40**	**413.57**	**84.54**	**83.82**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

3.2.3.1.2 Alternative 1

3.2.3.1.2.1 Training

Under Alternative 1, the annual number of Navy training activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Air pollutant emissions for CO, NO_x, volatile organic compounds, SO_x PM_{10}, and $PM_{2.5}$ would increase relative to emissions under the No Action Alternative. Emissions of most criteria pollutants would increase more than 100 percent over concentrations estimated under the No Action Alternative. Table 3.2-11 lists the estimated training-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 1.

As shown in Table 3.2-11, under Alternative 1, the air pollutant emitted in the greatest quantity by aircraft is NO_x, followed by PM_{10}, $PM_{2.5}$, and CO. These emissions are associated with aircraft involvement in a variety of training activities, including anti-air warfare, electronic warfare, and mine warfare. As shown in Table 3.2-11, the air pollutants emitted in the greatest quantities by surface vessels are CO, NO_x, and SO_x. These emissions are associated with vessel involvement in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 1 by the same variety of munitions as under the No Action Alternative. Training activities involving the expenditure of ordnance primarily occur 3 nm or more from shore, thus reducing the likelihood that offshore emissions under the Proposed Action would affect regional air quality and receptors ashore.

Under Alternative 1, emissions are estimated to increase by 75 to 150 percent (depending on the pollutant) within the Study Area when compared to the No Action Alternative. Nevertheless, given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 85 percent of training emissions are produced at least 3 nm from shore.

Table 3.2-11: Annual Criteria Air Pollutant Emissions from Training under Alternative 1

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	0.81	3.37	0.17	0.16	0.81	0.81
Vessels	6.60	7.26	0.90	1.45	0.16	0.16
Ordnance	0.04	<0.01	<0.01	<0.01	0.03	0.01
Total	7.46	10.63	1.07	1.61	1.00	0.98
Virginia Capes Range Complex						
Aircraft	49.22	80.10	5.04	3.90	22.31	22.31
Vessels	718.59	502.24	78.41	211.80	19.35	19.35
Ordnance	22.75	0.91	<0.01	<0.01	1.35	0.87
Total	790.56	583.25	83.45	215.70	43.00	42.53
Navy Cherry Point Range Complex						
Aircraft	26.32	194.15	3.18	5.97	45.00	45.00
Vessels	916.68	553.33	81.18	266.14	21.47	21.47
Ordnance	5.56	0.15	<0.01	<0.01	0.14	0.07
Total	948.56	747.62	84.36	272.11	66.61	66.54
Jacksonville Range Complex						
Aircraft	38.54	222.43	4.98	7.33	52.01	52.01
Vessels	832.32	490.85	82.32	198.38	16.44	16.44
Ordnance	12.42	0.54	<0.01	<0.01	1.28	0.75
Total	883.29	713.82	87.30	205.71	69.72	69.20
Key West Range Complex						
Aircraft	10.07	10.37	0.89	0.65	3.40	3.40
Vessels	0.01	0.34	<0.01	0.04	<0.01	<0.01
Ordnance	0.92	0.01	<0.01	<0.01	0.02	0.01
Total	11.00	10.72	0.89	0.68	3.42	3.41
Gulf of Mexico Range Complex						
Aircraft	7.95	11.47	0.73	0.60	3.38	3.38
Vessels	71.68	45.83	6.96	19.26	1.65	1.65
Ordnance	1.64	0.03	<0.01	<0.01	0.11	0.07
Total	81.27	57.33	7.69	19.85	5.15	5.11
Other AFTT Areas						
Aircraft	0.49	0.52	0.06	0.03	0.15	0.15
Vessels	32.44	24.41	3.44	9.14	0.86	0.86
Ordnance	0.87	0.08	<0.01	<0.01	0.02	0.02
Total	33.80	25.01	3.50	9.17	1.03	1.02
Study Area Total- Alternative 1	**2,755.94**	**2,148.39**	**268.26**	**724.83**	**189.92**	**188.78**
No Action Alternative	1,573.94	1,076.16	150.33	383.97	76.30	75.66
Net Increase (+) / Decrease (-) from No Action Alternative	+1,182.00	+1,072.23	+117.92	+340.86	+113.62	+113.13
Net Increase (+) / Decrease (-) (%) from No Action Alternative	+75.10%	+99.63%	+78.44%	+88.77%	+148.91%	+149.53%

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

3.2.3.1.2.2 Testing

Under Alternative 1, the annual number of Navy testing activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Air pollutant emissions for all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-12 lists the estimated testing-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 1 when compared to the No Action Alternative.

Table 3.2-12: Annual Criteria Air Pollutant Emissions from Testing under Alternative 1

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	1.36	1.70	0.14	0.11	0.54	0.54
Vessels	61.05	42.73	5.59	18.53	1.69	1.69
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	62.42	44.44	5.73	18.63	2.24	2.23
Virginia Capes Range Complex						
Aircraft	13.81	18.35	1.29	0.97	5.43	5.43
Vessels	280.05	169.88	24.65	65.50	5.54	5.54
Ordnance	2.80	0.04	<0.01	<0.01	0.14	0.07
Total	296.67	188.27	25.94	66.48	11.12	11.05
Navy Cherry Point Range Complex						
Aircraft	3.65	3.90	0.33	0.24	1.26	1.26
Vessels	30.53	23.51	3.02	12.08	1.16	1.16
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	34.18	27.41	3.34	12.32	2.43	2.42
Jacksonville Range Complex						
Aircraft	5.44	6.44	0.50	0.37	2.01	2.01
Vessels	93.94	78.44	9.67	27.89	2.88	2.88
Ordnance	1.34	0.02	<0.01	<0.01	0.06	0.04
Total	100.72	84.89	10.18	28.27	4.96	4.94
Key West Range Complex						
Aircraft	0.44	0.51	0.04	0.03	0.16	0.16
Vessels	7.61	5.77	0.72	1.96	0.19	0.19
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	8.05	6.28	0.76	1.99	0.35	0.35
Gulf of Mexico Range Complex						
Aircraft	5.80	6.15	0.52	0.38	2.00	2.00
Vessels	25.62	24.13	2.78	14.90	1.46	1.46
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	31.42	30.28	3.30	15.28	3.46	3.46

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Table 3.2-12: Annual Criteria Air Pollutant Emissions from Testing under Alternative 1 (Continued)

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Other AFTT Areas						
Aircraft	0.06	0.30	0.01	0.01	0.07	0.07
Vessels	4.53	4.06	0.48	1.37	0.15	0.15
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	4.59	4.36	0.50	1.39	0.22	0.22
South Florida Ocean Measurement Facility Testing Range						
Aircraft	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vessels	39.11	12.45	1.35	3.30	0.62	0.62
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	39.11	12.45	1.35	3.30	0.62	0.62
Naval Undersea Warfare Center Division, Newport Testing Range						
Aircraft	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vessels	57.58	50.87	2.64	4.63	1.71	1.71
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	57.58	50.87	2.64	4.63	1.71	1.71
Naval Surface Warfare Center, Panama City Division Testing Range						
Aircraft	0.96	0.98	0.08	0.06	0.32	0.32
Vessels	39.82	47.32	2.42	4.05	1.81	1.81
Ordnance	0.32	0.01	<0.01	<0.01	0.01	<0.01
Total	41.09	48.31	2.51	4.11	2.14	2.14
Study Area Total – Alternative 1 (less pierside testing emissions separately quantified for conformity analyses)	**675.83**	**497.56**	**56.25**	**156.40**	**29.24**	**29.14**
No Action Alternative	168.42	143.52	12.06	29.06	8.24	8.16
Net Increase (+) / Decrease (-) from No Action Alternative	**+507.40**	**+354.03**	**+44.19**	**+126.80**	**+21.00**	**+20.98**
Net Increase (+) / Decrease (-) (%) from No Action Alternative	**+301.27%**	**+246.67%**	**+366.34%**	**+428.41%**	**+254.89%**	**+257.13%**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

As shown in Table 3.2-12, under Alternative 1, the air pollutant emitted in the greatest quantity by aircraft is NO_x, followed by CO and particulate matter (PM_{10} and $PM_{2.5}$). These emissions are associated with aircraft involvement in a variety of testing activities, including anti-air warfare, electronic warfare, and mine warfare. The air pollutants emitted in the greatest quantities by surface vessels are CO, NO_x, and SO_x. These emissions are associated with vessel involvement in a variety of testing activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 1 by the same variety of munitions as under the No Action Alternative. Testing activities involving the expenditure of ordnance primarily occur 3 nm or more from shore, thus reducing the likelihood that offshore emissions under the Proposed Action would affect regional air quality and receptors ashore.

Under Alternative 1, emissions from testing activities are estimated to increase by 247 to 428 percent (depending on the pollutant) within the Study Area. Nevertheless, given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 90 percent of testing emissions are produced at least 3 nm from shore.

3.2.3.1.2.3 General Conformity Threshold Determinations

To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in air quality control regions of the Study Area under Alternative 1 were estimated, relative to their corresponding emissions under the No Action Alternative. As shown in Tables 3.2-13 through 3.2-14, the emissions increases for nonattainment and maintenance pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 1. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Metropolitan Providence Air Quality Control Region

The U.S. Environmental Protection Agency Final Rule: Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards designated the Metropolitan Providence Air Quality Control Region (all Rhode Island counties) unclassifiable/attainment of the 2008 8-Hour Ozone National Ambient Air Quality Standards (U.S. Environmental Protection Agency 2012c). Nevertheless, given recent Rhode Island monitoring results, the region is likely to be redesignated nonattainment in the near future. Therefore, as a conservative measure, a conformity review is included herein. To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in the Metropolitan Providence Air Quality Control Region portion of the Study Area under Alternative 1 were estimated, relative to their corresponding emissions under the No Action Alternative. As shown in Table 3.2-13, the emissions increases for nonattainment pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 1. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Table 3.2-13: Metropolitan Providence Air Quality Control Region Emissions Increases Compared to General Conformity *de Minimis* Thresholds, Alternative 1

Parameter	Emissions by Air Pollutant (TPY)		
	CO	NO_X	VOC
No Action Alternative, Metropolitan Providence Air Quality Control Region	42.78	38.56	2.02
Alternative 1, Metropolitan Providence Air Quality Control Region	**58.74**	**54.58**	**2.82**
Net Increase (+) / Decrease (-)	**+15.96**	**+16.02**	**+0.80**
de Minimis Threshold	100	100	50
Exceeds Threshold	No	No	No

CO: carbon monoxide; NO_X: nitrogen oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Hampton Roads Intrastate Air Quality Control Region

To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in the Hampton Roads Intrastate Air Quality Control District portion of the Study Area under Alternative 1 were estimated, relative to their corresponding emissions under the No Action

Alternative. As shown in Table 3.2-14, the emissions increases for nonattainment pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 1. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Table 3.2-14: Hampton Roads Intrastate Air Quality Control Region Emissions Increases Compared to General Conformity *de Minimis* Thresholds, Alternative 1

Parameter	Emissions by Air Pollutant (TPY)		
	CO	NO_X	VOC
No Action Alternative, Hampton Roads Intrastate Air Quality Control Region	21.67	24.58	2.40
Alternative 1, Hampton Roads Intrastate Air Quality Control Region	**28.79**	**60.11**	**5.32**
Net Increase (+) / Decrease (-)	**+7.12**	**+35.54**	**+2.93**
de Minimis Threshold	100	100	100
Exceeds Threshold	No	No	No

CO: carbon monoxide; NO_X: nitrogen oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

3.2.3.1.3 Alternative 2 (Preferred Alternative)

3.2.3.1.3.1 Training

Under Alternative 2, the annual number of Navy training activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Air pollutant emissions for all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-15 lists the estimated training-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 2.

As shown in Table 3.2-15, under Alternative 2, the air pollutant emitted in the greatest quantity by aircraft is NO_x, followed by particulate matter (PM_{10} and $PM_{2.5}$) and CO. These emissions are associated with aircraft involvement in a variety of training activities, including anti-air warfare, electronic warfare, and mine warfare. As shown in Table 3.2-15, the air pollutants emitted in the greatest quantities by surface vessels are CO, NO_x, and SO_x. These emissions are associated with vessel involvement in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 2 by the same variety of munitions as the No Action Alternative. Training activities involving the expenditure of ordnance primarily occur 3 nm or more from shore, thus reducing the likelihood that offshore emissions under the Proposed Action would affect regional air quality and receptors ashore.

Under Alternative 2, training-related emissions are estimated to increase by 75 to 151 percent (depending on the pollutant) within the Study Area when compared to the No Action Alternative. Nevertheless, given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 85 percent of training-related emissions are produced at least 3 nm from shore.

Table 3.2-15: Annual Criteria Air Pollutant Emissions from Training under Alternative 2

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	0.81	3.37	0.17	0.16	0.81	0.81
Vessels	6.60	7.26	0.90	1.45	0.16	0.16
Ordnance	0.04	<0.01	<0.01	<0.01	0.03	0.01
Total	7.46	10.63	1.07	1.61	1.00	0.98
Virginia Capes Range Complex						
Aircraft	49.22	80.10	5.04	3.90	22.31	22.31
Vessels	718.86	502.46	78.43	211.87	19.36	19.36
Ordnance	22.75	0.91	<0.01	<0.01	1.35	0.87
Total	790.82	583.47	83.48	215.77	42.84	42.54
Navy Cherry Point Range Complex						
Aircraft	26.32	194.15	3.18	5.97	45.00	45.00
Vessels	916.81	553.44	81.20	266.17	21.47	21.47
Ordnance	5.56	0.15	<0.01	<0.01	0.14	0.07
Total	948.69	747.73	84.37	272.14	66.61	66.54
Jacksonville Range Complex						
Aircraft	38.60	222.48	4.99	7.33	52.02	52.02
Vessels	836.93	499.81	82.72	208.44	17.33	17.33
Ordnance	12.42	0.54	<0.01	<0.01	1.28	0.75
Total	887.95	722.83	87.71	215.77	70.62	70.10
Key West Range Complex						
Aircraft	10.07	10.37	0.89	0.65	3.40	3.40
Vessels	0.01	0.34	<0.01	0.04	<0.01	<0.01
Ordnance	0.92	0.01	<0.01	<0.01	0.02	0.01
Total	11.00	10.72	0.89	0.68	3.42	3.41
Gulf of Mexico Range Complex						
Aircraft	7.95	11.47	0.73	0.60	3.38	3.38
Vessels	71.68	45.83	6.96	19.26	1.65	1.65
Ordnance	1.64	0.03	<0.01	<0.01	0.11	0.07
Total	81.27	57.33	7.69	19.85	5.15	5.11
Other AFTT Areas						
Aircraft	0.49	0.52	0.06	0.03	0.15	0.15
Vessels	32.57	24.51	3.45	9.18	0.86	0.86
Ordnance	0.87	0.08	<0.01	<0.01	0.02	0.02
Total	33.93	25.12	3.51	9.21	1.03	1.03
Study Area Total – Alternative 2	**2,761.13**	**2,157.83**	**268.72**	**735.04**	**190.84**	**189.70**
No Action Alternative	1,573.94	1,076.16	150.33	383.97	76.30	75.66
Net Increase (+) / Decrease (-) from No Action Alternative	**+1,187.19**	**+1,081.67**	**+118.39**	**+351.07**	**+114.54**	**+114.04**
Net Increase (+) / Decrease (-) (%) from No Action Alternative	**+75.43%**	**+100.51%**	**+78.75%**	**+91.43%**	**+150.11%**	**+150.73%**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOCP: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

3.2.3.1.3.2 Testing

Under Alternative 2, the annual number of Navy testing activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Air pollutant emissions for all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-16 lists the estimated testing-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 2.

Table 3.2-16: Annual Criteria Air Pollutant Emissions from Testing under Alternative 2

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Northeast Range Complexes						
Aircraft	1.54	2.06	0.16	0.12	0.64	0.64
Vessels	66.86	47.02	6.12	20.19	1.85	1.85
Ordnance	0.02	<0.01	<0.01	<0.01	0.01	<0.01
Total	68.42	49.08	6.29	20.31	2.50	2.49
Virginia Capes Range Complex						
Aircraft	15.23	20.30	1.42	1.07	6.01	6.01
Vessels	309.96	188.84	27.34	72.51	6.16	6.16
Ordnance	4.06	0.19	<0.01	<0.01	0.58	0.39
Total	329.25	209.32	28.76	73.59	12.74	12.55
Navy Cherry Point Range Complex						
Aircraft	4.08	4.43	0.37	0.27	1.42	1.42
Vessels	34.12	26.36	3.37	13.35	1.29	1.29
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	38.20	30.80	3.74	13.62	2.72	2.71
Jacksonville Range Complex						
Aircraft	6.21	7.37	0.58	0.43	2.30	2.30
Vessels	104.09	86.49	10.67	30.75	3.17	3.17
Ordnance	1.69	0.05	<0.01	<0.01	0.18	0.13
Total	111.98	93.91	11.25	31.18	5.65	5.59
Key West Range Complex						
Aircraft	0.52	0.59	0.05	0.04	0.19	0.19
Vessels	9.02	6.85	0.86	2.22	0.21	0.21
Ordnance	0.12	0.03	<0.01	<0.01	<0.01	<0.01
Total	9.66	7.47	0.90	2.25	0.41	0.40
Gulf of Mexico Range Complex						
Aircraft	6.42	6.87	0.58	0.43	2.23	2.23
Vessels	29.30	27.60	3.18	16.96	1.67	1.67
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	35.72	34.47	3.76	17.39	3.89	3.89

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOCP: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Table 3.2-16: Annual Criteria Air Pollutant Emissions from Testing under Alternative 2 (Continued)

Location	Air Pollutant Emissions (TPY)					
	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Other AFTT Areas						
Aircraft	0.11	0.52	0.03	0.02	0.12	0.12
Vessels	5.53	5.05	0.59	1.56	0.17	0.17
Ordnance	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Total	5.64	5.57	0.61	1.58	0.30	0.29
South Florida Ocean Measurement Facility Testing Range						
Aircraft	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vessels	41.12	13.16	1.43	3.49	0.65	0.65
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	41.12	13.16	1.43	3.49	0.65	0.65
Naval Undersea Warfare Center Division, Newport Testing Range						
Aircraft	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vessels	63.25	56.79	2.93	5.10	1.90	1.90
Ordnance	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	63.25	56.79	2.93	5.10	1.90	1.90
Naval Surface Warfare Center, Panama City Division Testing Range						
Aircraft	1.08	1.10	0.09	0.07	0.36	0.36
Vessels	46.23	56.20	2.83	4.67	2.12	2.12
Ordnance	0.35	0.01	<0.01	<0.01	0.01	0.01
Total	47.65	57.31	2.93	4.73	2.49	2.48
Study Area Total - Alternative 2 (less pierside testing emissions separately quantified for conformity analyses)	**750.90**	**557.89**	**62.61**	**173.25**	**33.23**	**32.96**
No Action Alternative	168.42	143.52	12.06	29.06	8.24	8.16
Net Increase (+) / Decrease (-) from No Action Alternative	**+582.48**	**+414.36**	**+50.55**	**+143.66**	**+24.99**	**+24.80**
Net Increase (+) / Decrease (-) (%) from No Action Alternative	**+345.84%**	**+288.71%**	**+419.05%**	**+485.37%**	**+303.31%**	**+304.02%**

CO: carbon monoxide; NO_X: nitrogen oxides; $PM_{2.5}$: particulate matter ≤ 2.5 microns in diameter; PM_{10}: particulate matter ≤ 10 microns in diameter; SO_x: sulfur oxides; TPY: tons per year; VOCP: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

As shown in Table 3.2-16, under Alternative 2, the air pollutant emitted in the greatest quantity by aircraft is NO_x, followed by particulate matter (PM_{10} and $PM_{2.5}$) and CO. These emissions are associated with aircraft involvement in a variety of testing activities, including anti-air warfare, electronic warfare, and mine warfare. As shown in Table 3.2-16, the air pollutants emitted in the greatest quantities from surface vessels are CO, NO_x, and SO_x, in decreasing order. These emissions are associated with vessel involvement in a variety of testing activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 2 by the same variety of munitions as the No Action Alternative. Testing

activities involving the expenditure of ordnance primarily occur 3 nm or more from shore, thus reducing the likelihood that offshore emissions under the Proposed Action would affect regional air quality and receptors ashore.

Under Alternative 2, testing-related emissions are estimated to increase by 289 to 485 percent (depending on the pollutant) within the Study Area when compared to the No Action Alternative. Nevertheless, given the spatial distribution of emissions, only a fraction (approximately one quarter) of overall Study Area emissions are produced at latitudes consistent with nonattainment or maintenance areas, and of these, over 90 percent of testing-related emissions are produced at least 3 nm from shore.

3.2.3.1.3.3 General Conformity Threshold Determinations

To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in air quality control regions of the Study Area under Alternative 2 were estimated, relative to their corresponding emissions under the No Action Alternative. As shown in Tables 3.2-17 through 3.2-18, the emissions increases for nonattainment and maintenance pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 2. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Metropolitan Providence Air Quality Control Region

The U.S. Environmental Protection Agency Final Rule: Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards designated the Metropolitan Providence Air Quality Control Region (all Rhode Island counties) unclassifiable/attainment of the 2008 8-Hour Ozone National Ambient Air Quality Standards (U.S. Environmental Protection Agency 2012c). Nevertheless, given recent Rhode Island monitoring results, the region is likely to be redesignated nonattainment in the near future. Therefore, as a conservative measure, a conformity review is included herein. To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in the Metropolitan Providence Air Quality Control Region portion of the Study Area under Alternative 2 were estimated, relative to their corresponding emissions under the No Action Alternative. As shown in Table 3.2-17, the emissions increases for nonattainment pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 2. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Table 3.2-17: Metropolitan Providence Air Quality Control Region Emissions Increases Compared to General Conformity *de Minimis* Thresholds, Alternative 2

Parameter	Emissions by Air Pollutant (TPY)		
	CO	NO_X	VOC
No Action Alternative, Metropolitan Providence Air Quality Control Region	42.78	38.56	2.02
Alternative 2, Metropolitan Providence Air Quality Control Region	**64.51**	**60.84**	**3.12**
Net Increase (+) / Decrease (-)	**+21.73**	**+22.28**	**+1.10**
de Minimis Threshold	100	100	50
Exceeds Threshold	No	No	No

CO: carbon monoxide; NO_X: nitrogen oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Hampton Roads Intrastate Air Quality Control Region

To address the requirements of the federal General Conformity Rule, the net change in criteria air pollutant emissions in the Hampton Roads Intrastate Air Quality Control Region portion of the Study Area under Alternative 2 were estimated, relative to their corresponding emissions under the No Action Alternative. As shown in Table 3.2-18, the emissions increases for nonattainment pollutants would be below the *de minimis* thresholds for a full conformity determination. The General Conformity Rule, therefore, does not apply under Alternative 2. Representative air pollutant emissions calculations are provided in Appendix D (Air Quality Example Emissions Calculations and Example Record of Non-Applicability).

Table 3.2-18: Hampton Roads Intrastate Air Quality Control Region Emissions Increases Compared to General Conformity *de Minimis* Thresholds, Alternative 2

Parameter	Emissions by Air Pollutant (TPY)		
	CO	NO_X	VOC
No Action Alternative, Hampton Roads Intrastate Air Quality Control Region	21.67	24.58	2.27
Alternative 2, Hampton Roads Intrastate Air Quality Control Region	**29.53**	**60.78**	**5.39**
Net Increase (+) / Decrease (-)	**+7.86**	**+36.20**	**+2.99**
de Minimis Threshold	100	100	100
Exceeds Threshold	No	No	No

CO: carbon monoxide; NO_X: nitrogen oxides; TPY: tons per year; VOC: volatile organic compounds

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

3.2.3.2 Hazardous Air Pollutants

3.2.3.2.1 No Action Alternative

The USEPA listed 188 hazardous air pollutants regulated under Title III (Hazardous Air Pollutants), Section 112(g) of the Clean Air Act. Hazardous air pollutants are emitted by several processes associated with Navy training and testing activities, including fuel combustion. Trace amounts of hazardous air pollutants are emitted by combustion sources participating in training and testing activities, including aircraft, vessels, targets, and munitions. The amounts of hazardous air pollutants emitted are small compared to the emissions of criteria pollutants; emission factors for most hazardous air pollutants from combustion sources are roughly three or more orders of magnitude lower than emission factors for criteria pollutants (California Air Resources Board 2007). For example, the fuel combustion product, benzene emission factor is 1.09×10^{-4} lb./gal. Emissions of hazardous air pollutants from munitions use are smaller still, with emission factors ranging from roughly 10^{-5} to 10^{-15} lb. of individual hazardous air pollutants per item for cartridges to 10^{-4} to 10^{-13} lb. of individual hazardous air pollutants per item for mines and smoke canisters (U.S. Environmental Protection Agency 2009a). As an example, 10^{-5} is equivalent to 0.0001 and 10^{-15} is equivalent to 0.00000000000001. In other words, to generate one pound of hazardous air pollutants would require the expenditure of ten thousand or ten trillion pounds of munitions, respectively.

3.2.3.2.1.1 Training and Testing

No health effects would result from training- or testing-related emissions of hazardous air pollutants in the Study Area under the No Action Alternative because (1) minute quantities of hazardous air pollutants are emitted during training and testing events in comparison to criteria air pollutants, (2) hazardous air pollutant emissions from training and testing activities would be released to the

environment in a remote area (typically greater than 3 nm from shore) with few existing sources of air pollutants, (3) training- and testing-related hazardous air pollutant emissions would be distributed over the entire Study Area and rapidly dispersed over a large ocean area where few individuals would be exposed to them, and (4) hazardous air pollutant emissions would be diluted through mixing in the atmosphere to a much lower ambient concentration. Residual hazardous air pollutant impacts during respites between training and testing activities would not be detectable and would be below or within historical or desired air quality conditions. Therefore, hazardous air pollutant emissions from training and testing for the Proposed Action will not be quantitatively estimated in this EIS/OEIS.

3.2.3.2.2 Alternative 1

3.2.3.2.2.1 Training and Testing

Trace amounts of hazardous air pollutants would be emitted from sources participating in Alternative 1 training and testing activities, including aircraft, vessels, targets, and munitions. Hazardous air pollutant emissions under Alternative 1 would increase relative to the No Action Alternative emissions. As noted for the No Action Alternative in Section 3.2.3.2.1, hazardous air pollutant emissions are not quantitatively estimated, but the increase in hazardous air pollutant emissions under Alternative 1 would be roughly proportional to the increase in emissions of criteria air pollutants. Therefore, the amounts that would be emitted as a result of Alternative 1 activities would be somewhat greater than those emitted under the No Action Alternative, but would remain very small compared to the emissions of criteria air pollutants. The potential health effects of training- and testing-related hazardous air pollutant emissions under Alternative 1 would be the same as those discussed under the No Action Alternative.

3.2.3.2.3 Alternative 2 (Preferred Alternative)

3.2.3.2.3.1 Training and Testing

The amounts and distribution of training- and testing-related hazardous air pollutant emissions under Alternative 2 would be similar to but slightly greater than those described under Alternative 1. The potential health effects of training- and testing-related hazardous air pollutant emissions under Alternative 2 would be the same as those discussed under the No Action Alternative.

3.2.4 SUMMARY OF IMPACTS

3.2.4.1 No Action Alternative

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing primarily occur 3 nm or more from shore. For fixed-wing aircraft activities, emissions typically occur above the 3,000-ft. (914 m) mixing layer.

Even though these stressors co-occur in time and space, there would be sufficient dispersion so the impacts would be short term. Because changes in criteria pollutant emissions, hazardous air pollutant emissions, and chaff emissions are not expected to be detectable, air quality is expected to fully recover before experiencing a subsequent exposure. Given these characteristics, the impacts on air quality from the combination of these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually without any additive, synergistic, or antagonistic interaction.

3.2.4.2 Alternative 1

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants) emissions associated with Study Area training and testing under Alternative 1 primarily occur at least 3 nm

offshore. For fixed-wing aircraft activities, emissions typically occur above the 3,000-ft. (914 m) mixing layer. Even though these stressors co-occur in time and space, there would be sufficient dispersion so the impacts would be short term. Air quality is expected to fully recover before experiencing a subsequent exposure. Given these characteristics, the impacts on air quality from the combination of these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually without any additive, synergistic, or antagonistic interaction. Emissions of most criteria pollutants and hazardous air pollutants are expected to increase under Alternative 1 in comparison to the No Action Alternative.

3.2.4.3 Alternative 2

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants) emissions associated with Study Area training and testing under Alternative 2 primarily occur at least 3 nm offshore. For fixed-wing aircraft activities, emissions typically occur above the 3,000-ft. (914 m) mixing layer. Even though these stressors co-occur in time and space, there would be sufficient dispersion so the impacts would be short term. Air quality is expected to fully recover before experiencing a subsequent exposure. Given these characteristics, the impacts on air quality from the combination of these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually without any additive, synergistic, or antagonistic interaction. Emissions of most criteria pollutants and hazardous air pollutants are expected to increase under Alternative 2 in comparison to the No Action Alternative.

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3.3 MARINE HABITATS

MARINE HABITATS SYNPOSIS

The Navy considered all potential stressors and analyzed the following for potential impacts on marine habitats as a non-living substrate for sedentary biological communities (marine vegetation and invertebrates):

- Acoustic (explosives on or near the bottom only)
- Physical disturbance and strikes (military expended materials and seafloor devices)

Alternative 2 (Preferred Alternative)

- Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom, military expended materials, and seafloor devices during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. Essential Fish Habitat conclusions for associated marine vegetation and sedentary invertebrates are summarized in corresponding resource sections (e.g., marine vegetation, invertebrates). Impacts to the water column as Essential Fish Habitat are summarized in corresponding resource sections (e.g., invertebrates, fish) because they are impacts on the organisms themselves.

3.3.1 INTRODUCTION

This section analyzes potential impacts on marine nonliving (abiotic) substrates found in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area). The Study Area covers a range of marine habitats that support communities of organisms that vary by season and area. The intent of this section is to cover abiotic habitats not covered in the individual living resource chapters. The substance and substrate of the water column and bottom provides the necessary habitat for sedentary biological communities and mobile organisms discussed in other sections of this chapter.

Table 3.3-1 lists the types of habitats discussed in this section in relation to the open ocean areas; large marine ecosystems; and bays, estuaries, and rivers in which they occur. For intertidal shore and subtidal bottom habitats, a modified version of the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) is used. The modified classification system starts at the subsystem level (e.g., intertidal shores/subtidal bottoms) and focuses analysis on a modified class level (e.g., soft shores/bottoms, hard shores/bottoms) differentiating non-living substrates from the living structures on the substrate. Living structures on the substrate are termed biogenic habitats, and include wetland shores, aquatic plant beds (floating or attached macroalgae, rooted vascular plants), sedentary invertebrate beds, and reefs. These habitats constitute Essential Fish Habitats and components of Habitat Areas of Particular Concern for one or more life-stages of managed species. The Essential Fish Habitat Assessment for AFTT is a supporting technical document, with concurrence from the National Marine Fisheries Service (NMFS)(U.S. Department of the Navy 2013).

Table 3.3-1: Habitat Types within the Atlantic Fleet Training and Testing Study Area

Habitat Types (sub-system/class level)	Open Ocean	Large Marine Ecosystems	Bays, Estuaries, and Rivers
Substrates			
Soft Shores (e.g., beaches, mudflats)	–	All	All
Hard Shores (e.g., rocky intertidal)	–	Northeast U.S. Continental Shelf	Bath, ME; Portsmouth Naval Shipyard; Kittery, ME; coastal southern New England waters; Naval Submarine Base New London; Groton, CT
Soft Bottoms	All	All	All
Hard Bottoms	All	All	All
Artificial Structures (e.g., shipwrecks, artificial reefs, oil/gas platforms)	All	All	All
Biogenic habitats			
Wetland Shores and Aquatic Plant Beds (e.g., attached macroalgae, seagrass, *Sargassum*)	Section 3.7 (Marine Vegetation)		
Sedentary Invertebrate Beds and Reefs	Section 3.8 (Marine Invertebrates)		

CT: Connecticut; ME: Maine

The fundamental habitat descriptors of unconsolidated (soft) or rocky (hard) substrate are key factors in structuring sedentary biological communities (Nybakken 1993). The difference between substrates represents a viable target for the best available mapping technology (e.g., multibeam sonar) and corresponds well to characterizations of Navy impacts (e.g., explosive charges on soft bottom). Other classification systems include levels of detail well beyond the basic substrate level (Allee et al. 2000; Valentine et al. 2005). Table 3.3-1 indicates habitat types discussed in subsequent sections in a comprehensive habitat classification scheme for the Study Area.

Description and distribution information is not provided for the water column itself because any impacts resulting from Navy training and testing activities would be minimal and short-lived (e.g., disruption of vertical mixing in a small spatial area). Impacts on federally managed species via the water column (e.g., noise, contaminants), are summarized in corresponding resource sections (e.g., marine vegetation, invertebrates, fish).

Rationale for evaluating the impact of stressors on marine substrate differs from the rationale applied to other biological resources. Unlike organisms, habitats are valued mainly for their function, which is largely based on their structural components. Accordingly, the assessment focuses on the ability of substrates to function as habitats. An impact on abiotic marine habitat is anticipated where training, testing, or associated transit activities could convert one substrate type into another (i.e., bedrock to unconsolidated soft bottom, or soft bottom to parachute canvas). Whereas the impacts to the biogenic growth are covered in their respective resource sections, the impacts to bottom substrate are considered here.

3.3.2 AFFECTED ENVIRONMENT

The majority of the Study Area occurs outside of state waters in the open ocean greater than 12 nautical miles (nm) offshore. Relatively little of the Study Area includes intertidal and shallow subtidal areas in

state waters where numerous habitats are exclusively present (i.e., salt/brackish marsh, mangrove, seagrass beds, kelp forests, oyster reefs). Intertidal nonliving (abiotic) habitats (i.e., beaches, tidal deltas, mudflats, rocky shores) are addressed only where intersections with naval training or testing activities are reasonably likely to occur. Distribution of abiotic marine habitats among the large marine ecosystems and open ocean areas is described in their respective sections.

Abiotic marine habitats vary according to underlying geology, hydrodynamics, atmospheric conditions, and suspended particle matter. Flow and sediment from creeks and rivers create channels, tidal deltas, intertidal/subtidal flats, and shoals of unconsolidated material along the shorelines and estuaries. The influence of land-based nutrients and sediment increases with proximity to nearshore and inland waters. In the open ocean, gyres and oceanic currents create dynamic microhabitats that influence the distribution of organisms. A patchwork of diverse habitats exists on the open-ocean floor where there is no sunlight, low nutrient levels, and minimum sediment movement (Levinton 2009). Major bathymetric features in offshore areas of large marine ecosystems include shelves, banks, breaks, slopes, canyons, plains, and seamounts (see Table 3.0-4). Geologic features such as these affect hydrodynamics of the ocean water column (i.e., currents, gyres, upwellings) as well as living resources present. Bathymetric features of the Study Area are described in Section 3.0.3.2 (Bathymetry).

3.3.2.1 General Threats

Estuarine and ocean environments worldwide are under increasing pressure from human development and expansion, accompanied by increased ship traffic, pervasive pollution, invasive species, destructive fishing practices, vertical shoreline stabilization, offshore energy infrastructure, and global climate change (Crain et al. 2009; Lotze et al. 2006; Pandolfi et al. 2003). Stressors associated with these activities are not distributed randomly across the patchwork of habitat types and ecosystems (Halpern et al. 2008). Areas where heavy concentrations of human activity co-occur with naval training or testing activities have the highest potential for cumulative stress on the marine ecosystem (see Chapter 4, Cumulative Impacts, for more information). Large areas of bottom waters lacking dissolved oxygen, or "dead zones," are documented in the Study Area off the Mississippi River outlet (Rabalais et al. 2002) and other large rivers flowing into coastal ocean waters (Diaz and Rosenberg 2008). Refer to individual resource sections (Section 3.1, Sediment and Water Quality; Section 3.7, Marine Vegetation; Section 3.8, Marine Invertebrates; and Section 3.9, Fish) for specific stressors and impacts on biological resources associated with marine substrates.

3.3.2.2 Biogenic Habitats

Biogenic habitats on intertidal shores are characterized by erect, rooted, wetland plants (Cowardin et al. 1979). Wetland plant habitat includes soft shores in all water regimes except subtidal and irregularly exposed. Wetland shores in the Study Area are formed by salt marsh (e.g., cordgrass) or mangrove plant species. Salt marsh and mangrove plants are living marine resources and biogenic habitat where they dominate the intertidal zone. Plant species forming wetland shores are covered in Section 3.7 (Marine Vegetation).

Biogenic habitats seaward of wetland shores include aquatic plant beds, sedentary invertebrate beds, and reefs. Aquatic plant beds are dominated by vascular or non-vascular plants that grow principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Water regimes include subtidal, irregularly exposed, regularly flooded, permanently flooded, intermittently exposed, semipermanently flooded, and seasonally flooded. Seagrasses, attached macroalgae (i.e., kelp), and floating macroalgae (i.e., *Sargassum* species) form submerged beds or

floating mats where they dominate layers of the water column. Refer to Section 3.7 (Marine Vegetation) for the discussion of species forming aquatic plant beds.

Sedentary invertebrate beds are characterized by aggregations of unattached shellfish, soft corals, and other stationary invertebrates inhabiting soft or hard bottom substrate. Such aggregations do not form ridge-like or mound-like structures on hard bottom substrate; they form "meadows" or "beds" where they dominate shore or bottom areas. The Class Reef includes ridge-like or mound-like structures formed by the colonization and growth of sedentary invertebrates (Cowardin et al. 1979). Reefs are characterized by their three-dimensional structure, elevation above the surrounding substrate, and interference with normal wave flow; they are primarily subtidal, but parts of some reefs may be intertidal as well. Refer to Section 3.8 (Marine Invertebrates) for the discussion of species forming sedentary invertebrate beds and reefs.

3.3.2.3 Soft Shores

Soft shores include all wetland habitats having three characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; (2) less than 30 percent areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded (Cowardin et al. 1979). Soft shores include beaches, tidal flats/deltas, and streambeds of the tidal riverine and estuarine systems.

Intermittent or intertidal channels of the riverine system and intertidal channels of the estuarine system are classified as streambed. Intertidal flats, also known as tidal flats or mudflats, are unvegetated areas consisting of loose mud, silt, and fine sand, with organic-mineral mixtures, and are regularly exposed and flooded by the tides (Karleskint et al. 2006). Muddy fine sediment tends to be deposited where wave energy is low, such as in sheltered bays and estuaries (Holland and Elmore 2008). Mudflats are typically unvegetated but may be covered with mats of green algae and substrate diatoms (single-celled algae) or sparsely vegetated with low-growing aquatic species (New York Natural Heritage Program 2009). Muddy intertidal habitat occurs most often as part of a patchwork of intertidal habitats that may include rocky shores, tidal creeks, sandy beaches, salt marshes, and mangroves.

Beaches form through the interaction of waves and tides, as particles are sorted by size and are deposited along the shoreline (Acropora Biological Review Team 2005). Wide flat beaches occur where wave energy and tidal ranges are high and sands are fine-grained. Narrow steep beaches of coarser sand form where energy is limited (Speybroeck et al. 2008). Three zones characterize beach habitats: (1) dry areas above mean high water, (2) wrack lines at mean high water, and (3) high-energy intertidal zones. Refer to living resource sections for more information of species use of tidal deltas, intertidal flats, and beaches.

Distribution

Mudflats occur to some extent in virtually every large marine ecosystem within the Study Area. Muddy deposits accumulate in many wave-protected pockets on the Gulf of Maine coast along the northern part of the Northeast United States (U.S.) Continental Shelf Large Marine Ecosystem, especially at the heads of bays. Extensive mudflats occur in the upper reaches of the Bay of Fundy (Tyrrell 2004). In the Southeast U.S. Continental Shelf Large Marine Ecosystem, mudflats are most often associated with tidal creeks and estuaries. In the South Atlantic Bight area, salt marshes and tidal creeks feather the coastal margins. Mudflats associated with mangroves occur on the east coast of Florida, roughly from St. Augustine to the Florida Keys, and north to Cedar Key on the west coast (Mitsch et al. 2009) in the

southern part of the Southeast U.S Continental Shelf Large Marine Ecosystem. Tidal deltas and intertidal flats are present along the coast of Puerto Rico and Vieques (National Ocean Service 2011). In the central portion of the Gulf of Mexico Large Marine Ecosystem, west of the Mississippi River, large expanses of unique muddy subtidal bottoms are stirred by storms and deposited at the shoreline (Draut et al. 2005).

Pure stands of sandy beaches are less abundant but do occur in the northern part of the Northeast U.S. Continental Shelf Large Marine Ecosystem, which are otherwise dominated by rocky coasts. Small pocket beaches occur within the northern Gulf of Maine, and sandy beaches are abundant on Cape Cod in the southern Gulf of Maine (Roman et al. 2000). Some sandy intertidal habitats occur in all the states and provinces on the Gulf of Maine coast (Tyrrell 2004).

The Mid- and South Atlantic coast region is protected by an almost continuous string of barrier islands, which provide sandy intertidal shores (National Ocean Service 2011). Sandy coasts and barrier islands are common from Long Island, New York to as far south as Florida. A long arc of barrier islands known as the Outer Banks protects the shore stretching from southeastern Virginia almost to South Carolina.

Sandy intertidal habitat predominates in the Southeast U.S. Continental Shelf Large Marine Ecosystem (Mitsch et al. 2009). The east and west coasts of Florida have long stretches of sandy beaches. The West Central Barrier Chain, a series of sandy barrier islands, stretches from Anclote Key (north of Tampa Bay) all the way south to Cape Romano and protects the west coast of Florida (Hine et al. 2003). Sandy beaches are present along the shoreline of Puerto Rico and Vieques.

The eastern portion of the Gulf of Mexico Large Marine Ecosystem is fringed by sandy intertidal habitat, including barrier islands off the coast of the Florida panhandle. Shorelines of the western portion of the Gulf of Mexico Large Marine Ecosystem are dominated by sand that forms broad straight beaches and barrier islands (Britton and Morton 1998). The longest undeveloped barrier island in the world is Padre Island National Seashore in Texas, which has 70 miles (mi.) (113 kilometers [km]) of sand beaches that provide nesting ground for sea turtles, foraging ground for shorebirds, and sandy intertidal habitat for numerous other species (National Park Service 2010). Other barrier islands continue in an arc, trending up the Texas coast (Mustang, San Jose, Matagorda, Follets, and Galveston Islands) (Britton and Morton 1998).

3.3.2.4 Hard Shores

Rocky shores include aquatic environments characterized by bedrock, stones, or boulders that singly or in combination cover 75 percent or more of an area that is covered less than 30 percent by vegetation (Cowardin et al. 1979). Water regimes are restricted to irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, and intermittently flooded. Rocky intertidal shores are areas of bedrock that alternate between marine and terrestrial habitats, depending on if the tide is high or low (Menge and Branch 2001). Extensive rocky shorelines can be interspersed with sandy areas, estuaries, or river mouths.

Environmental gradients between hard shorelines and subtidal habitats are determined by wave action, depth, and frequency of tidal inundation, and stability of substrate. Where wave energy is extreme, only rock outcrops may persist. In lower energy areas, a mixture of rock sizes will form the intertidal zone. Boulders scattered in the intertidal and subtidal areas provide substrate for attached macroalgae and sessile invertebrates. Refer to living resource sections for more information on species inhabiting hard shorelines.

Distribution

Most of the rocky coastline of the U.S. Atlantic coast occurs from Massachusetts northward into the Gulf of Maine, in the northern part of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Roman et al. 2000). Glacial terrain made of bedrock, gravel, and sediment typical of the New England coast is unique on the east coast of the United States. On the U.S. Atlantic shore, rocky and gravelly areas do not occur south of New York (National Ocean Service 2011). Rocky coasts in the northern areas give way to sandy shores toward the south. In the Southeast U.S. Continental Shelf Large Marine Ecosystem, sandy beaches predominate. In the Caribbean Sea, rocky bedrock shorelines are mapped along the coast of Puerto Rico and Vieques (National Ocean Service 2011). Very little rock occurs anywhere in the northern Gulf of Mexico.

Rocky shorelines border transit or testing activities originating from the shipyard in Bath, Maine; Portsmouth Naval Shipyard (Kittery, Maine); coastal southern New England waters; and the shipyard and Naval Submarine Base New London (Groton, Connecticut) (National Ocean Service 2011; U.S. Fish and Wildlife Service 2011).

3.3.2.5 Soft Bottoms

Soft bottoms include all wetland and deepwater habitats with at least 25 percent cover of particles smaller than stones (rock fragments larger than 10 in. [25.4 cm]), and a vegetative cover less than 30 percent (Cowardin et al. 1979). Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded. Soft bottom forms the substrate of channels, shoals, subtidal flats, and other features of the bottom. Sandy channels emerge where strong currents connect estuarine and ocean water columns. Shoals or capes form where sand is deposited by sediment-laden currents. Subtidal flats occur between the soft shores and the channels or shoals. The continental shelf extends seaward of the shoals and inlet channels and includes an abundance of coarse-grained, soft bottom habitats. Finer-grained sediments collect off the shelf break, continental slope, and abyssal plain. These areas are inhabited by soft sediment communities of mobile invertebrates fueled by benthic algae production, chemosynthetic microorganisms, and detritus drifting through the water column. Refer to living resources Sections 3.7 and 3.8 (Marine Vegetation and Marine Invertebrates, respectively) for more information on sedentary organisms inhabiting soft bottom substrate.

Distribution

Soft bottoms occupy the largest habitat area in the Study Area and occur in all large marine ecosystems and the open ocean. However, the bottom types vary across the Study Area (Figures 3.3-1 to 3.3-4) and are depicted by at least six studies:

- United States Geological Survey (2000)
- Sheridan and Caldwell (2002)
- Gulf States Marine Fisheries Commission (2008)
- Detailed mapping from acoustic and video surveys in the southeast (U.S. Department of the Navy 2010) and Scotian Shelf Large Marine Ecosystem (Todd and Kostylev 2011)

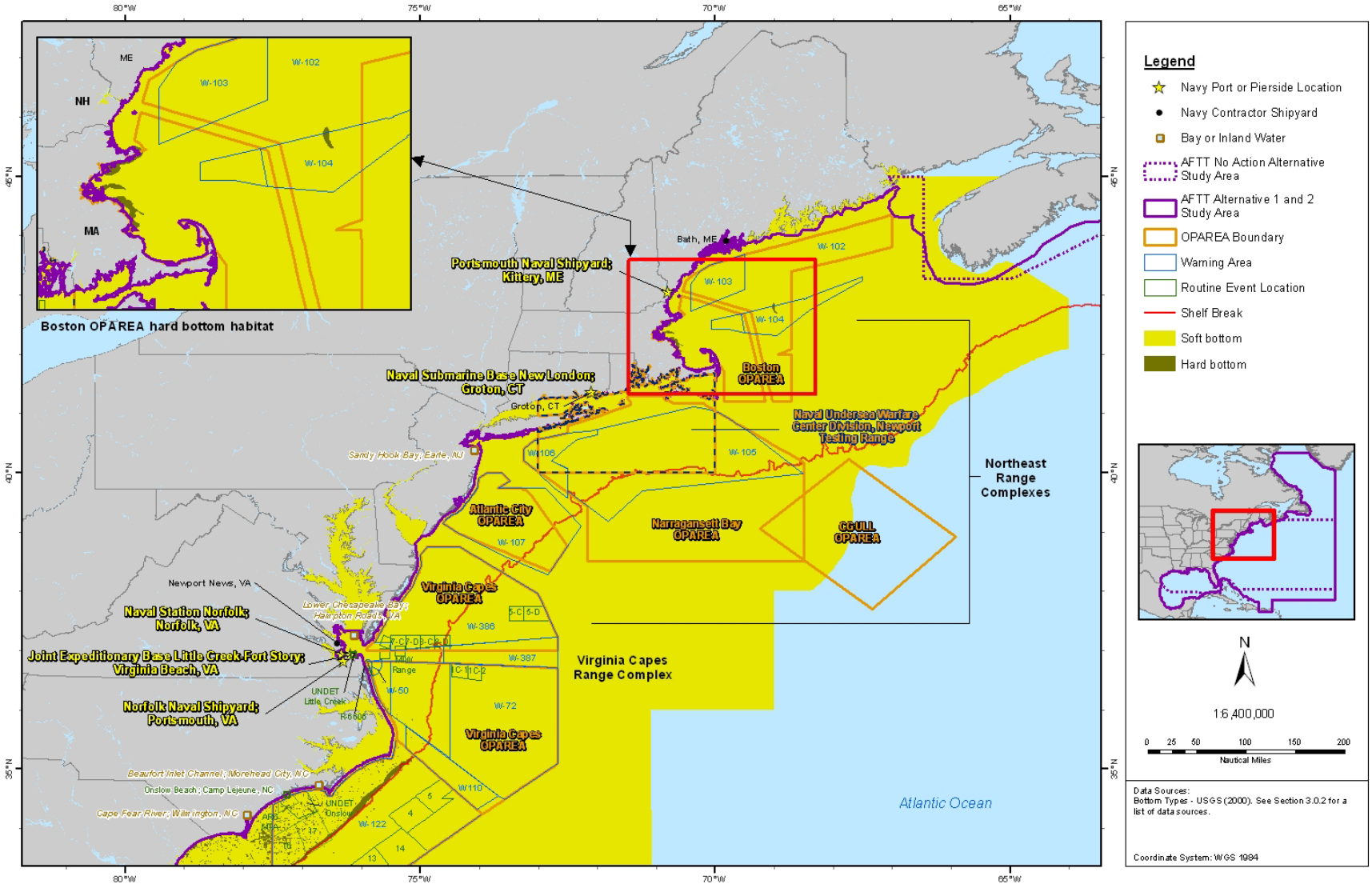

Figure 3.3-1: Bottom Types within the Northeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; MA: Massachusetts; ME: Maine; MIW: Mine Warfare; NH: New Hampshire; NJ: New Jersey; NC: North Carolina; OPAREA: Operating Area; UNDET: Underwater Detonation; USGS: U.S. Geological Survey; VA: Virginia

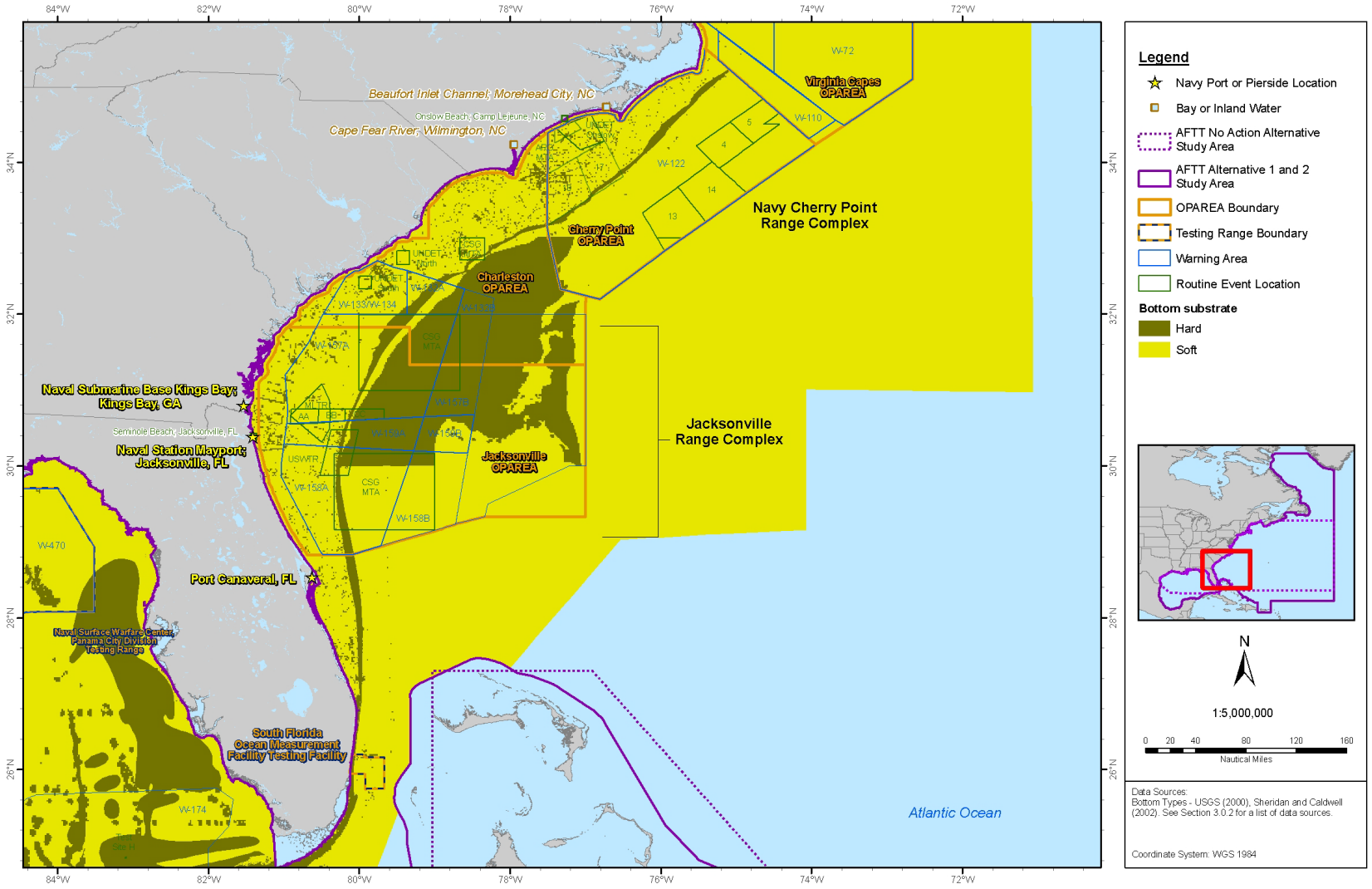

Figure 3.3-2: Bottom Types within the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; NC: North Carolina; OPAREA: Operating Area; UNDET: Underwater Detonation; USGS: U.S. Geological Survey; USWTR: Undersea Warfare Training Range

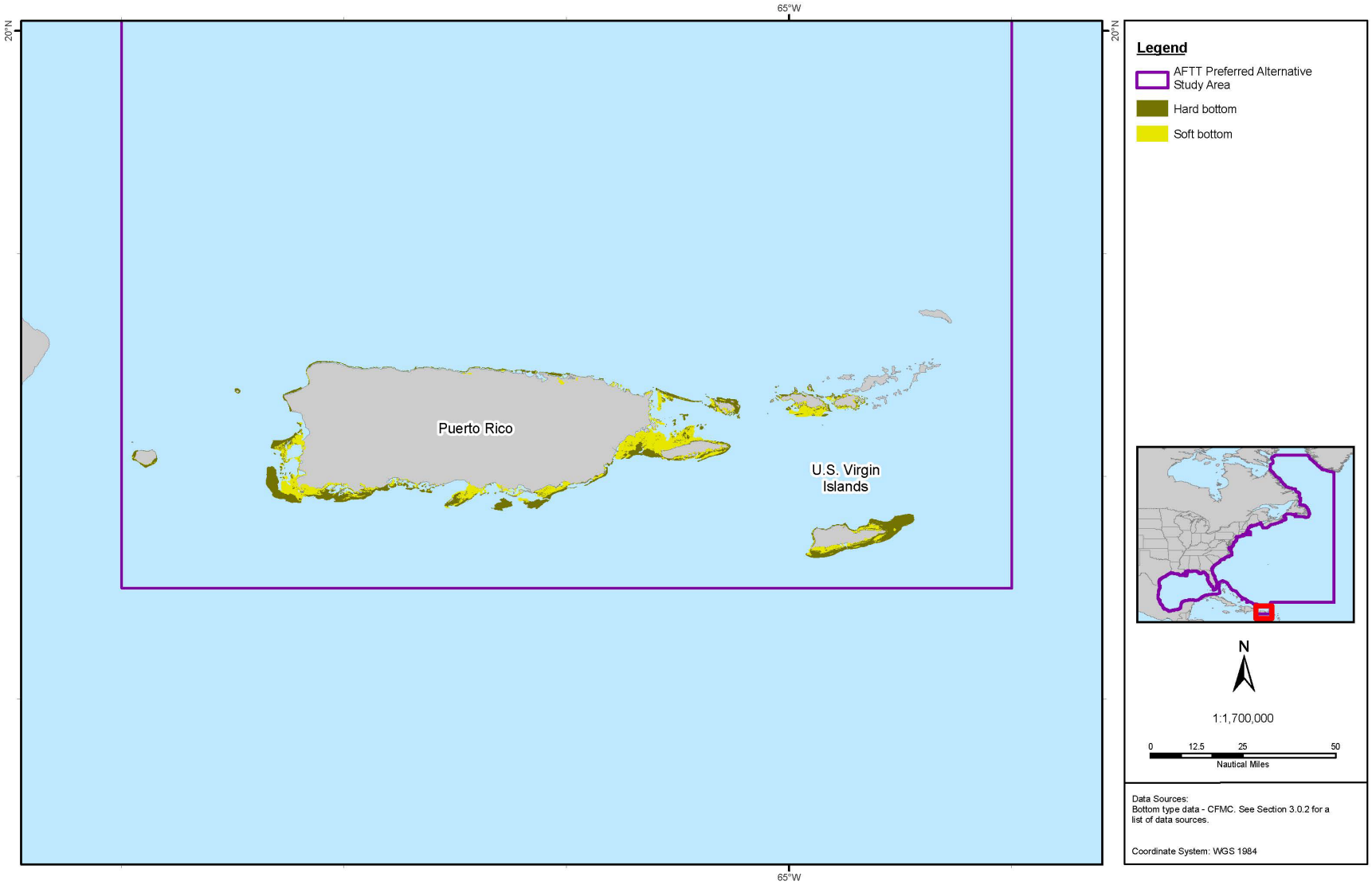

Figure 3.3-3: Bottom Types within the Caribbean Sea Large Marine Ecosystem

AFTT: Atlantic Fleet Training and Testing; CFMC: Caribbean Fishery Management Council; USGS: U.S. Geological Survey

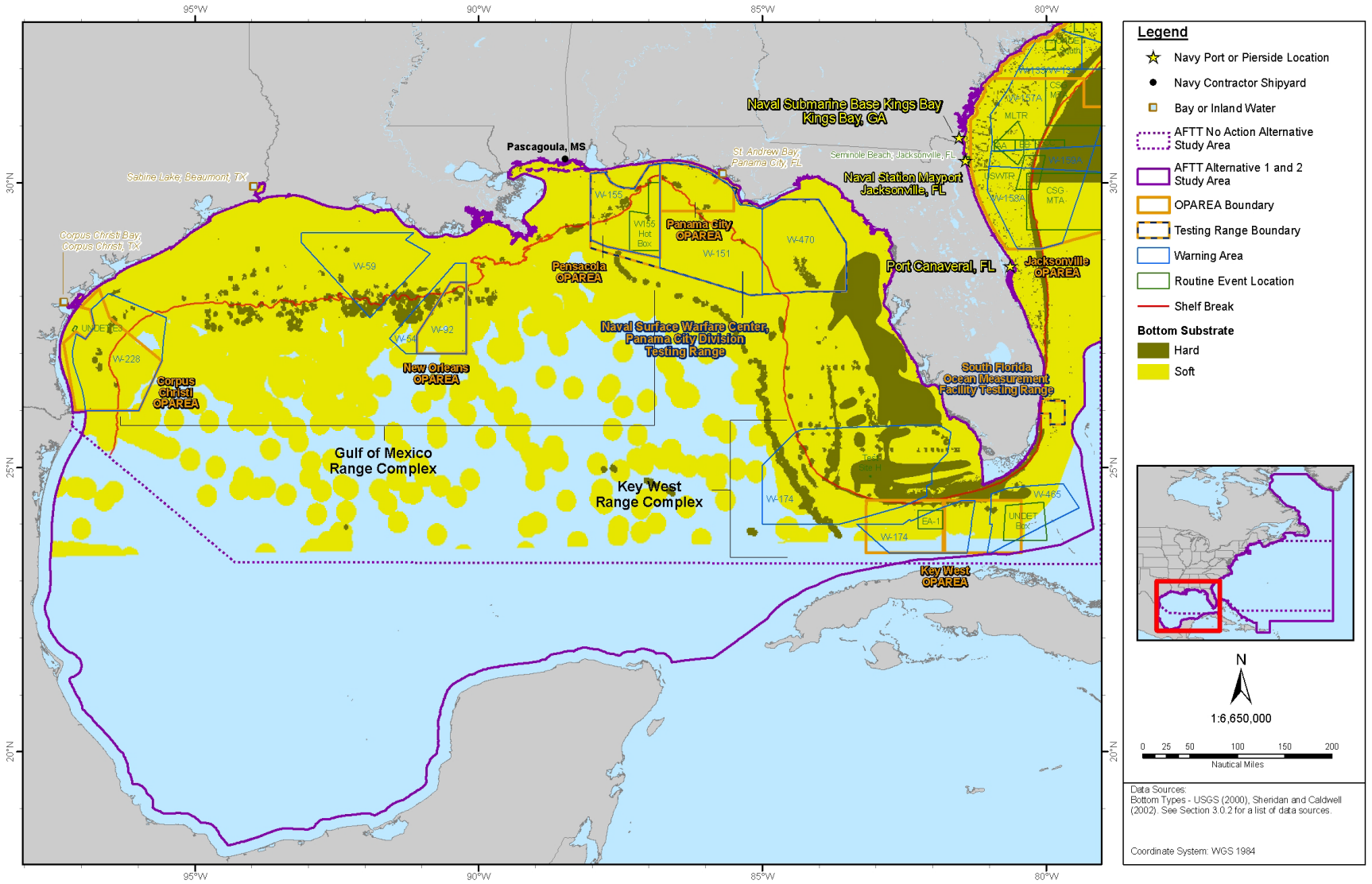

Figure 3.3-4: Bottom Types within the Gulf of Mexico Large Marine Ecosystem

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MS: Mississippi; OPAREA: Operating Area; TX: Texas; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range; USGS: U.S. Geological Survey

These studies show a strikingly different distribution of bottom types in portions of shelf area they cover. There may be far less soft bottom in the Northeast U.S. Continental Shelf Large Marine Ecosystem than the U.S. Geological Survey indicates. The area mapped by Todd and Kostylev (2011) ranges from 30 to 250 m in depth, and is predominantly hard bottom (glacial till and bedrock). (U.S. Geological Survey 2000) classified the same area as predominately sand, sand/gravel, and gravel, suggesting a significant overestimation of soft bottom substrate. Conversely, there may be more soft bottom areas in the Southeast U.S. Continental Shelf Large Marine Ecosystem than the South Atlantic Fishery Management Council suggests. The U.S. Department of the Navy (2010) mapping suggests more soft bottom in the area than indicated on Southeast Area Monitoring and Assessment Program (SEAMAP) –South Atlantic (2001) maps (Figures 3.3-5 and 3.3-6); much of the area classified as "hard bottom" lacks hard substrate classifications (e.g., pavement, rock outcrops). Deepwater hard bottom areas, in particular, could be more accurately classified as mostly soft bottom, in the form of mounds composed of a mix of sediment and gravel to cobble-sized coral fragments.

Soft bottom around Puerto Rico was mapped in Kendell et al. (2001), whereas Gulf of Mexico soft bottom was mapped in geology surveys (Sheridan and Caldwell 2002) similar to United States Geological Survey (2000), and as a compilation of data sources (Gulf States Marine Fisheries Commission 2008).

Lack of detailed distribution information for marine substrate worldwide has prompted research to investigate other means of predicting their distribution. Watts et al. (2011) used slope of the bottom on 250 meter (m) resolution bathymetry data as an accurate indicator of hard bottom distribution of reefs off the southern coast of Australia, with greater slope meaning greater probability of reef occurrence. Conversely, lower slopes correspond to non-reef, soft bottom areas. The same concept applied to the western Atlantic and Gulf of Mexico suggests the dominance of soft bottom substrates landward of the shelf break and across the abyssal plain in open-ocean waters. Sediment types may also be implied from bathymetric contours in estuarine areas of the Study Area, where channels and subtidal beaches are generally coarse-grained, flood/ebb tidal deltas are finer-grained, and sheltered tidal creeks are very fine-grained.

3.3.2.6 Hard Bottoms

Hard, rocky bottom includes all subtidal habitats with substrates having an areal cover of stones, boulders, or bedrock 75 percent or greater and vegetative cover of less than 30 percent (Cowardin et al. 1979). Generic hard bottom could be any naturally occurring material on the bottom that is sufficiently solid and stationary (e.g., hard consolidated mud) to support sedentary, attached macroalgae or invertebrates (e.g., barnacles, anemones, hard corals). As such, hard bottom substrate forms the foundation of attached macroalgae beds (Section 3.7, Marine Vegetation), sedentary invertebrate beds and reefs (Section 3.8, Marine Invertebrates).

Hard bottoms occur as extensions of intertidal rocky shores and as isolated offshore outcrops. The shape and texture of the larger rock assemblage and the fine details of cracks and crevices are determined by the type of rock, the wave energy, and other local variables (Davis 2009). Maintenance of rocky reefs requires wave energy sufficient to sweep sediment away (Lalli 1993) or offshore areas lacking a significant sediment supply; therefore, rocky reefs are rare on broad coastal plains near sediment-laden rivers and are more common on high-energy shores and beneath strong bottom currents, where sediments cannot accumulate. The shape of the rocks determines, in part, the type of community that develops on a rocky bottom (Witman and Dayton 2001). Below a depth of about 20 m on rocky reefs, light is insufficient to support much plant life (Dawes 1998). Rocky reefs in this zone are

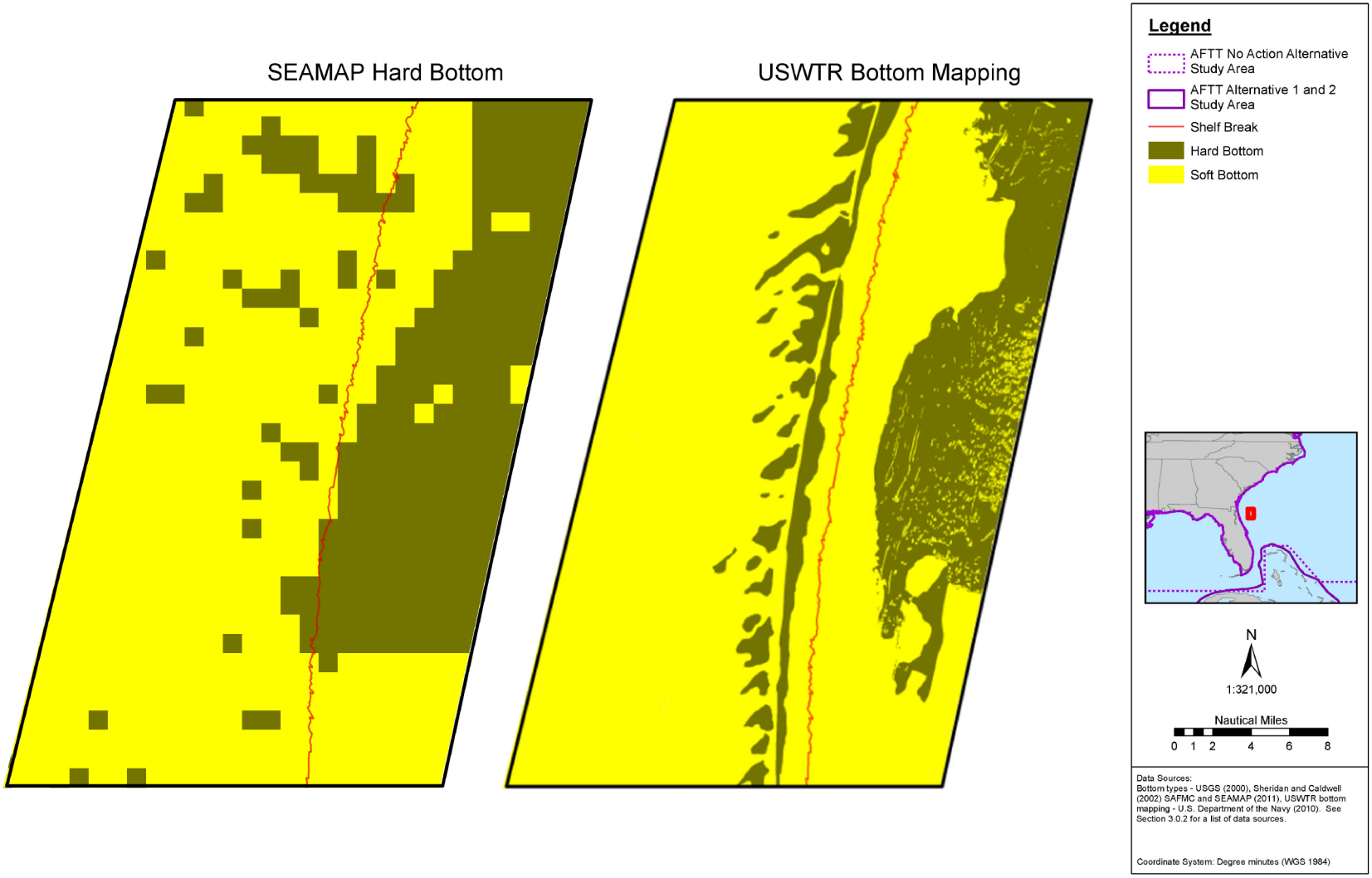

Figure 3.3-5: Comparison of Bottom Types within a Portion of the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas from Different Sources

AFTT: Atlantic Fleet Training and Testing; SAFMC: South Atlantic Fishery Management Council; USGS: U.S. Geological Survey; USWTR: Undersea Warfare Training Range; SEAMAP: Southeast Area Monitoring and Assessment Program

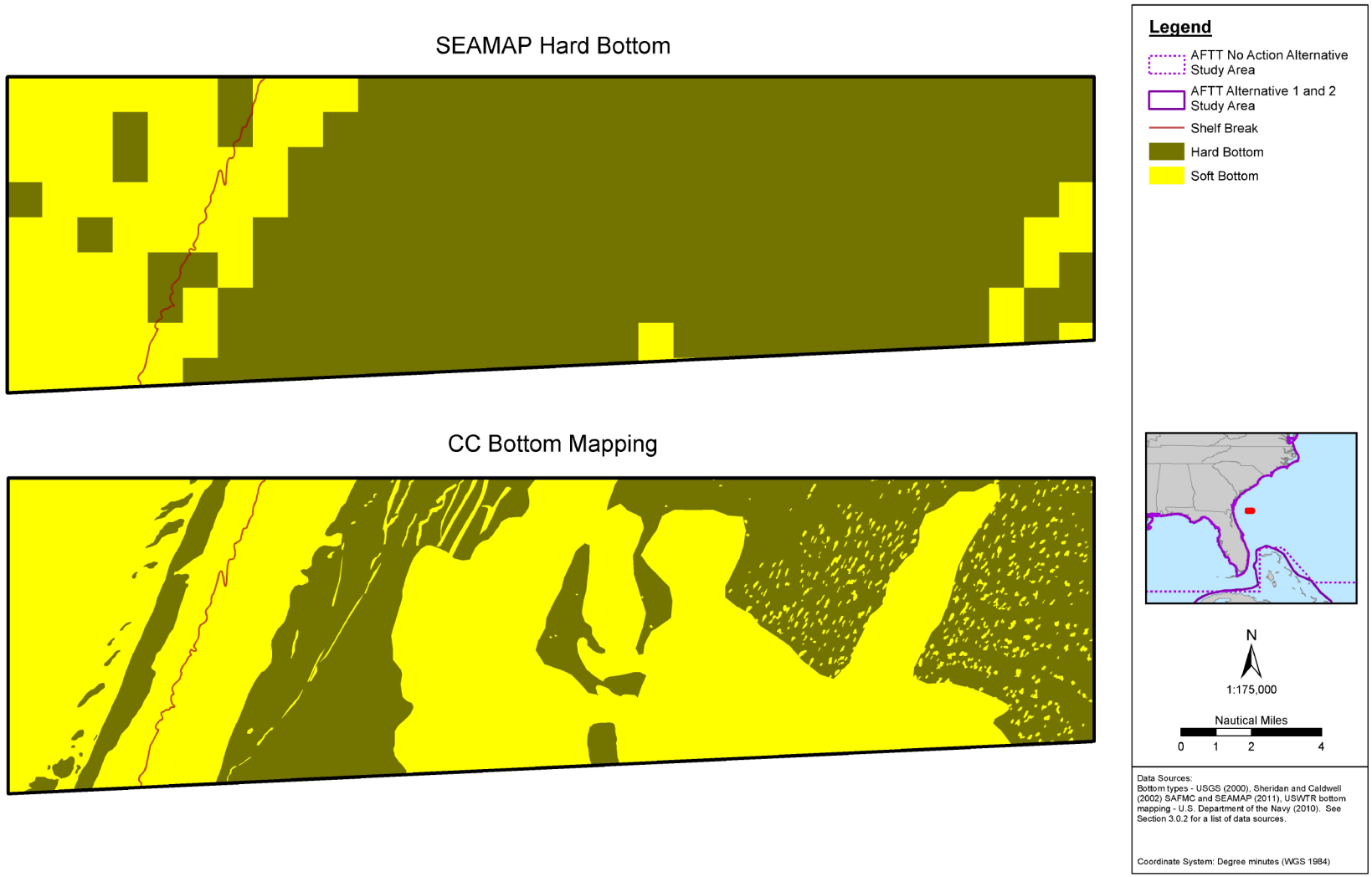

Figure 3.3-6: Comparison of Bottom Types within a Portion of the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas from Different Sources

AFTT: Atlantic Fleet Training and Testing; CC: training range; SAFMC: South Atlantic Fishery Management Council; SEAMAP: Southeast Area Monitoring and Assessment Program; USGS: U.S. Geological Survey

encrusted with invertebrates, including sponges, sea cucumbers, soft corals, and sea whips, which provide food and shelter for many smaller invertebrates.

Distribution

Hard bottoms occur in all large marine ecosystems and the open ocean. However, the bottom types vary across the Study Area (Figures 3.3-1 through 3.3-4) and are depicted by at least seven studies:

- United States Geological Survey (2000)
- Sheridan and Caldwell (2002)
- Southeast Area Monitoring and Assessment Program (SEAMAP) – South Atlantic (2001) and Udouj (2007); mapped presence/absence of hard bottom and possible hard bottom in one-minute grid cells on the continental shelf, based on various data sources and assumptions. The program also mapped hard bottom habitat beyond the continental shelf off North Carolina, South Carolina, Georgia, and Florida (Udouj 2007)
- Gulf of Mexico Fishery Management Council (2005)
- Gulf States Marine Fisheries Commission (2008)
- Detailed mapping from multibeam sonar surveys in the southeast (U.S. Department of the Navy 2010) and Scotian Shelf Large Marine Ecosystem (Todd and Kostylev 2011)
- Hard bottom along the shelf break ridge in the South Atlantic Large Marine Ecosystem was created based on depth occurrence of documented hard bottom features along the shelf break (50-100 m), followed by connection of areas to form a single polygon from Cape Hatteras, NC, to the eastern tip of Florida

The West Greenland Shelf Large Marine Ecosystem has numerous rocky banks, such as the Fyllas Bank (Aquarone and Adams 2009). The Grand Banks and Flemish Cap occur in the eastern part of the Newfoundland-Labrador Large Marine Ecosystem and are important to fisheries (Aquarone and Adams 2009).

Rocky hard bottoms are common in the Gulf of Maine and northern extent of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Mapping of bottom geology by the United States Geological Survey (2000) shows bands of bedrock offshore from areas north of Cape Cod and an area between Georges and German Banks (Figure 3.3-1). Cobble and pebble habitats occur in the subtidal areas around New Hampshire, southern Maine, and southern Nova Scotia (Valentine et al. 2005).

The mapping studies show a strikingly different distribution of bottom types in portions of shelf area they cover. There may be far more hard bottom in the Northeast U.S. Continental Shelf Large Marine Ecosystem than the U.S. Geological Survey indicates. Substrate types on German Bank in the Scotian Shelf Large Marine Ecosystem are also mapped from multibeam sonar surveys (Todd and Kostylev 2011). The mapped area ranges in depth from 30 to 250 m, and is predominantly hard bottom (glacial till and bedrock). United States Geological Survey (2000) classified the same area as predominately sand, sand/gravel, and gravel based on various grab samples and interpolation between samples, suggesting a significant underestimation of hard bottom substrate. Conversely, there may be less hard bottom areas in the Southeast U.S. Continental Shelf Large Marine Ecosystem than the South Atlantic Fishery Management Council suggests. The U.S. Department of the Navy (2010) mapping suggests more soft bottom than indicated on Southeast Area Monitoring and Assessment Program—South Atlantic (2001) maps (Figures 3.3-5 and 3.3-6); much of the area Southeast Area Monitoring and Assessment Program (SEAMAP) –South Atlantic classified as “hard bottom” lacks hard substrate classifications (e.g., pavement, rock outcrop). Deepwater hard bottom areas, in particular, could be more accurately

classified as mostly soft bottom, in the form of mounds composed of a mix of sediment and gravel to cobble-sized coral fragments. While the presence of hard consolidated mud is possible in the mapped area, it would likely be classified with other hard substrate given the acoustic survey method.

Coral reefs and uncolonized bedrock in Puerto Rico were mapped in Kendell et al. (2001). Hard bottom in the Gulf of Mexico was mapped in geology surveys (Sheridan and Caldwell 2002) similar to United States Geological Survey (2000), Essential Fish Habitat designations for managed species in the Gulf of Mexico (Gulf of Mexico Fishery Management Council 2005), and as a compilation of data sources (Gulf States Marine Fisheries Commission 2008).

Lack of detailed distribution information for marine substrate prompted researchers to investigate other means of predicting distribution. Watts et al. (2011) used slope of the bottom on 250 m resolution bathymetry data as an accurate indicator of hard bottom distribution of reefs off the southern coast of Australia, with greater slope meaning greater probability of reef occurrence. The same concept applied to the western Atlantic and Gulf of Mexico, suggesting the dominance of hard bottom on high relief seafloor features, including but not limited to, the continental shelf break, canyons, seamounts, and ridges.

3.3.2.7 Artificial Structures

Artificial habitats are man-made structures that provide habitat for marine organisms. Artificial habitats occur in the marine environment, either by design and intended as habitat (e.g., artificial reefs), by design and intended for a function other than habitat (e.g., oil and gas platforms and floating objects moored at specific locations in the ocean to attract fishes that live in the open ocean), or unintentionally (e.g., shipwrecks). Artificial habitats function as hard bottom by providing structural attachment points for algae and sessile invertebrates, which in turn support a community of mobile organisms that forage, shelter, and reproduce there (National Oceanic and Atmospheric Administration 2007).

Artificial habitats in the Study Area include artificial reefs, shipwrecks, oil and gas platforms, man-made shoreline structures (i.e., piers, wharfs, docks, pilings), and fish-aggregating devices (Macfadyen et al. 2009; Seaman 2007). Artificial reefs are designed and deployed in an attempt to supplement the ecological functions and services provided by coral reefs and rocky bottoms. Artificial reefs range from simple concrete blocks to highly engineered structures. When vessels sink to the seafloor, they are colonized by the encrusting and sessile marine organisms that attach to hard surfaces. Over time, the wrecks become functioning reefs.

Distribution

The distribution of mapped artificial structures in the Study Area is depicted on Figures 3.3-7 through 3.3-10 and the map data sources are listed in Table 3.3-2.

Shipwrecks occur in virtually all navigable waters worldwide. Shipwrecks are a common feature of the Scotian Shelf Large Marine Ecosystem. Thousands of shipwrecks occur off the coasts of Nova Scotia, Newfoundland, and New Brunswick (Northern Maritime Research 2010). In the Northeast U.S. Continental Shelf Large Marine Ecosystem, there are thousands of shipwrecks in the state waters of Maine, Massachusetts, Rhode Island, New York, New Jersey, Maryland, Virginia, and North Carolina (Northern Maritime Research 2010). More than 1,800 shipwrecks are scattered across the floor of the

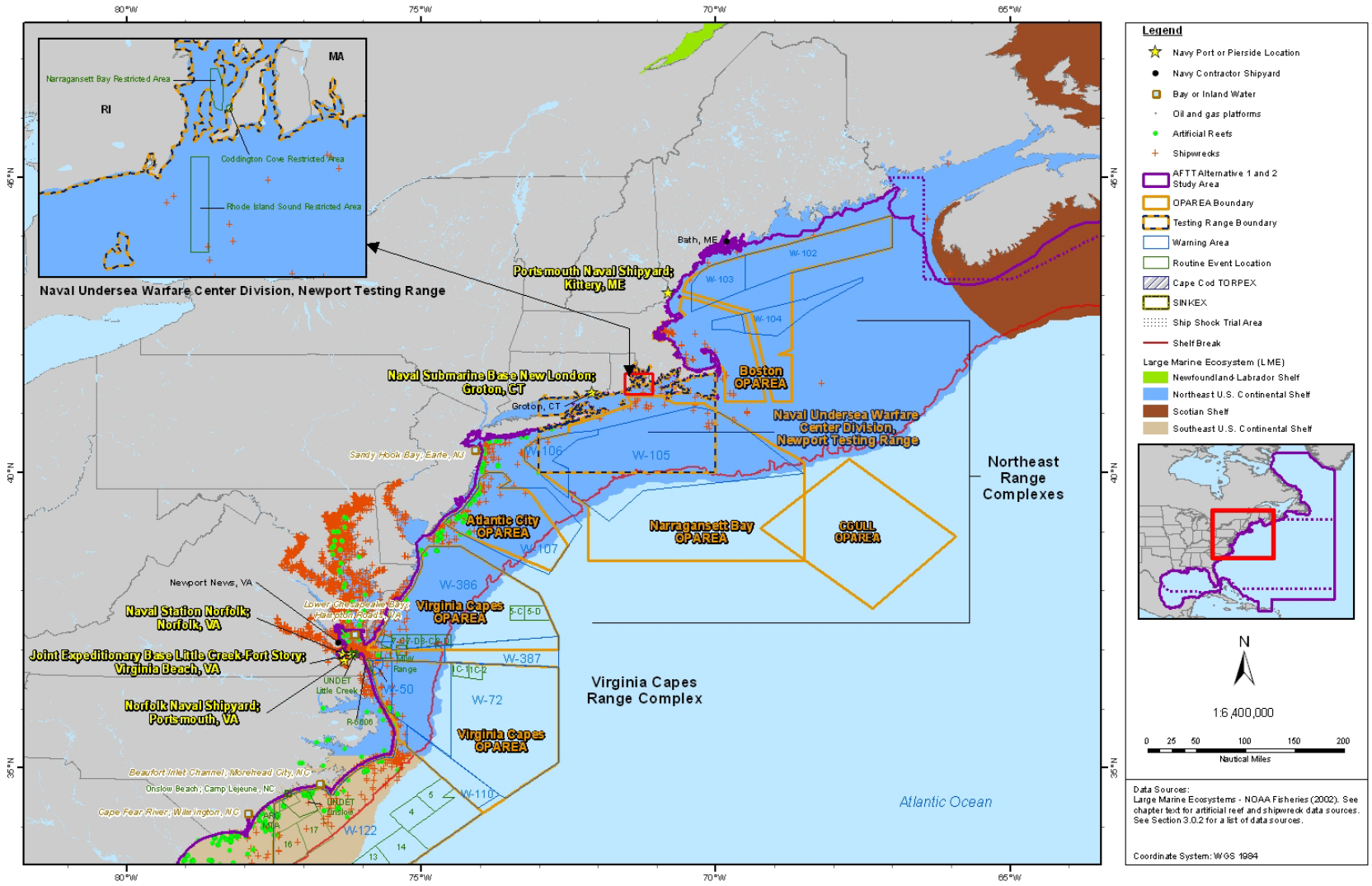

Figure 3.3-7: Map of Artificial Structures within the Northeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; LME: Large Marine Ecosystem; MA: Massachusetts; ME: Maine; MIW: Mine Warfare; NC: North Carolina; NJ: New Jersey; NOAA: National Oceanic and Atmospheric Administration; OPAREA: Operating Area; RI: Rhode Island; SINKEX: Sinking Exercise; TORPEX: Torpedo; UNDET: Underwater Detonation; VA: Virginia

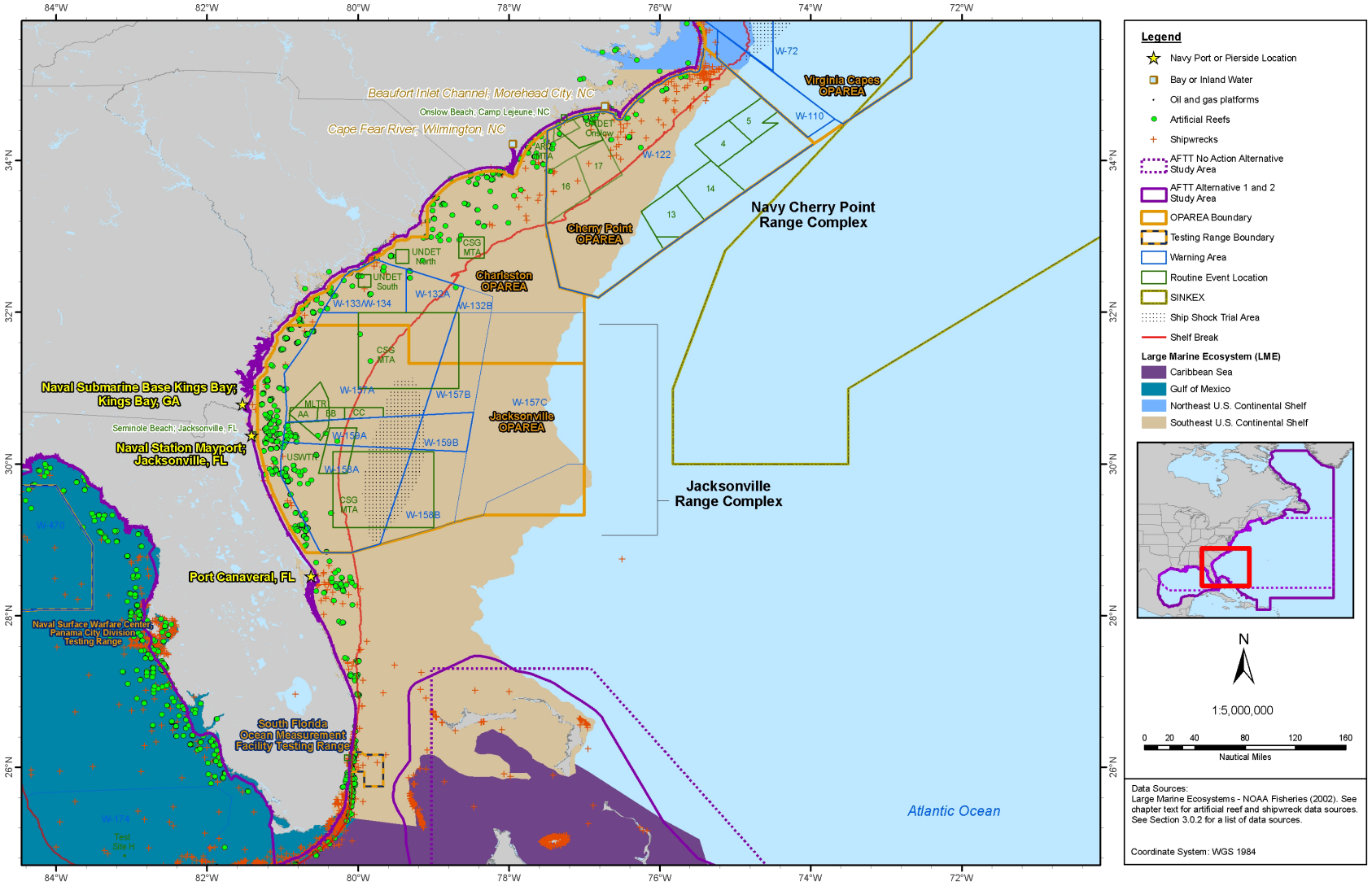

Figure 3.3-8: Map of Artificial Structures within the Southeast U.S. Continental Shelf Large Marine Ecosystem and Open Ocean Areas

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; OPAREA: Operating Area; NC: North Carolina; NOAA: National Oceanic and Atmospheric Administration; SINKEX: Sinking Exercise; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

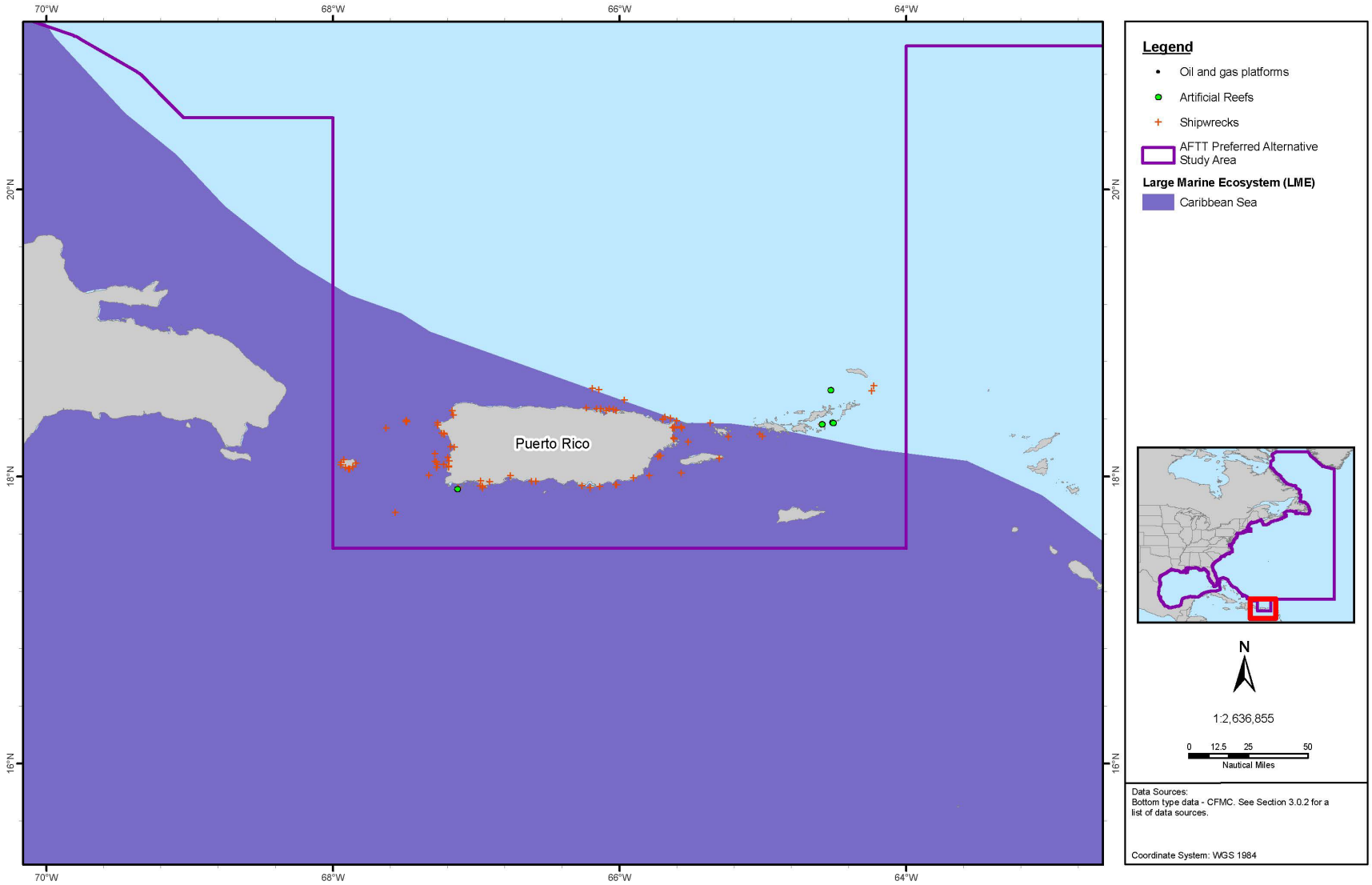

Figure 3.3-9: Map of Artificial Structures within the Southeast U.S. Continental Shelf, Caribbean Sea, and Eastern Portion of the Gulf of Mexico Large Marine Ecosystems

AFTT: Atlantic Fleet Training and Testing; CFMC: Caribbean Fishery Management Council

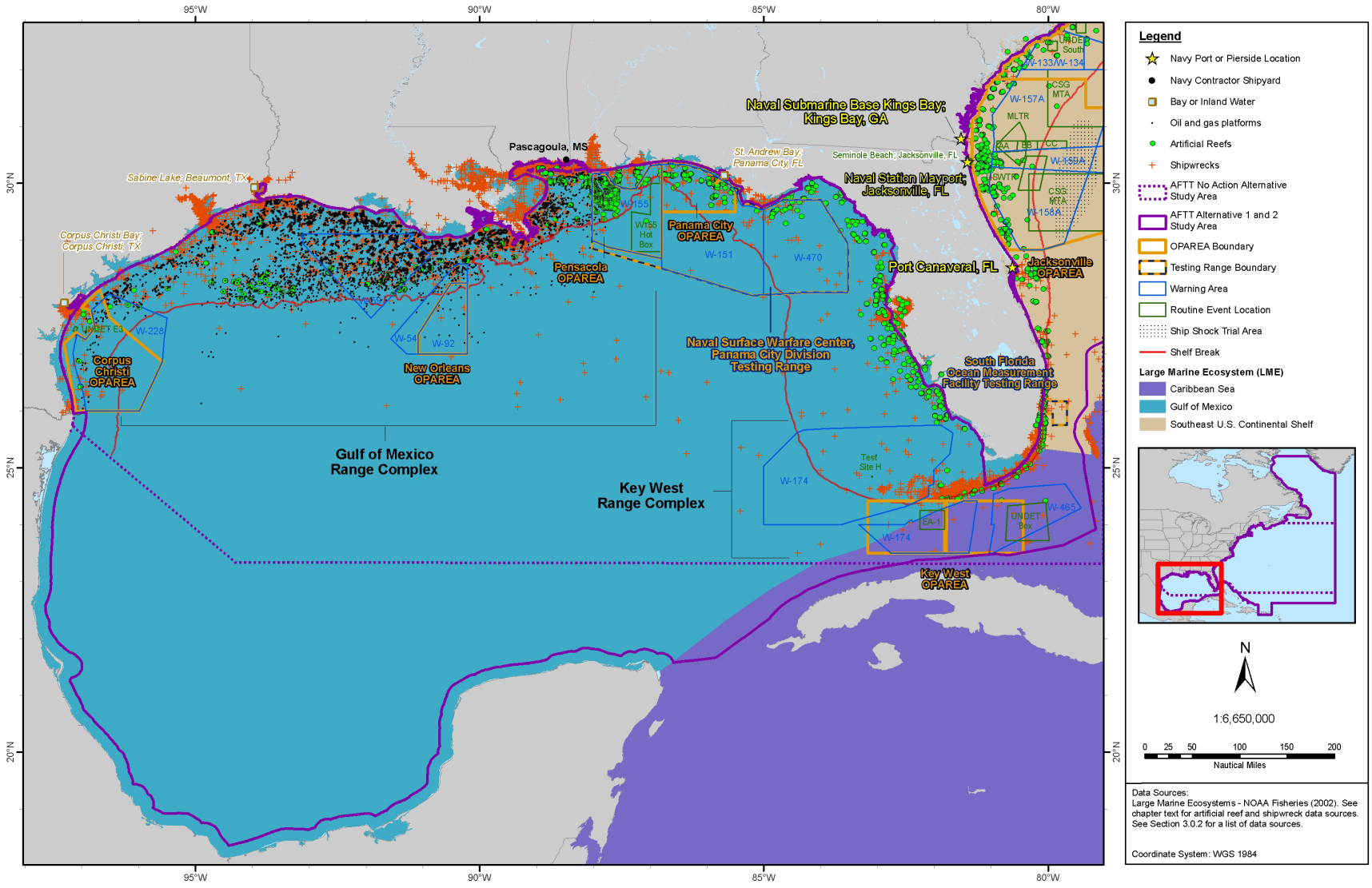

Figure 3.3-10: Map of Artificial Structures within the Western Portion of the Gulf of Mexico Large Marine Ecosystem

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MS: Mississippi; OPAREA: Operating Area; TX: Texas; USWTR: Undersea Warfare Training Range

Table 3.3-2: Geographic Information System Data Sources for Artificial Structures on Figures 3.3-7 to 3.3-10

Large Marine Ecosystems	Spatial Data References
Northeast U.S. Continental Shelf	(Delaware Division of Fish and Wildlife 2002, 2008; Freeman and Walford 1974a, b, c; National Oceanic and Atmospheric Administration 2002; Screamingreel 2003; Treasure Expeditions 2004)
Southeast U.S. Continental Shelf	(Bureau of Land Management 1976; Florida Fish and Wildlife Conservation Commission 2004; Freeman and Walford 1976; Georgia Department of Natural Resources 2001; National Oceanic and Atmospheric Administration 2002; NOAA Coastal Services Center 1998; North Carolina Division of Marine Fisheries 2005; Southeast Area Monitoring and Assessment Program—South Atlantic 2001; Veridian Corporation 2001; Virginia Marine Resources Commission 2005, 2009)
Caribbean Sea	(Berg and Berg 1989; Cerame Vivas 1988; Handler 2001; Simonsen 2000; Waterproof Charts Inc. 1998)
Gulf of Mexico	(Alabama Department of Conservation and Natural Resource Marine Resources Division 2005; Bureau of Ocean Energy Management 2012; Florida Fish and Wildlife Conservation Commission 2004; Mississippi Department of Marine Resources 2001, 2003; National Oceanic and Atmospheric Administration 2002; Texas Parks and Wildlife Department 1999, 2003; Veridian Corporation 2001)

Chesapeake Bay (Chesapeake Bay Program 2009). The concentrations of shipwrecks around North Carolina's cape shoals are known as the "Graveyard of the Atlantic." Over 2,000 shipwrecks are documented in Florida state waters, some dating back to the days of Spanish exploration (Northern Maritime Research 2010). There are also a large number of wrecks in the Gulf of Mexico (Veridian Corporation 2001).

Most artificial reef development in marine waters was implemented and monitored by individual state programs; information published by state government websites on artificial reef programs is summarized in this section. In preparing this document, no information on artificial reefs in the Scotian Shelf, West Greenland, or Newfoundland-Labrador Large Marine Ecosystems was found. In the central part of the Northeast U.S. Continental Shelf Large Marine Ecosystem, artificial reefs occur off the coasts of Massachusetts (Nantucket Sound), Rhode Island (The Nature Conservancy 2010), New York (New York State Department of Environmental Conservation 2010), New Jersey (New Jersey Department of Environmental Protection Division of Fish & Wildlife 2010), Delaware (Delaware Department of Natural Resources and Environmental Control 2010), Maryland (Maryland Department of Natural Resources 2010), and Virginia (Virginia Marine Resources Commission 2009). Delaware, Maryland, and New Jersey are cooperating to develop a 1 square-mile ($mi.^2$) (2.6 square-kilometer [km^2]) regional reef site (Del-Jersey-Land Inshore Site) where retired Navy vessels will be sunk (Delaware Department of Natural Resources and Environmental Control 2010).

Artificial reef programs are active in the Southeast U.S. Continental Shelf Large Marine Ecosystem. North Carolina, South Carolina, Georgia, and the eastern and southern portions of Florida have a growing number of artificial reefs in their coastal and offshore waters (North Carolina Division of Marine Fisheries 2005; South Atlantic Fishery Management Council 2009). Roughly half of these sites are in waters off the east coast of Florida. The largest of the artificial reef complexes in North Carolina is called the Oregon Inlet Reef, composed of two ships, one trawler, numerous pipes, over 60 reef balls (artificial reef modules), and parts of ships (North Carolina Division of Marine Fisheries 2005). More than 790 artificial reefs are documented on Florida's east coast (Florida Fish and Wildlife Conservation

Commission 2010; South Atlantic Fishery Management Council 2009). Many offshore reefs are designated as special management zones (South Atlantic Fishery Management Council 2009).

States in the Gulf of Mexico Large Marine Ecosystem have been active in deploying artificial reefs for more than 50 years. Alabama has more than 800 $mi.^2$ (2,070 km^2) of habitat for deployment of artificial reefs (Alabama Department of Conservation and Natural Resources 2008). Mississippi (Mississippi Department of Marine Resources 2010), Louisiana (Louisiana Department of Wildlife and Fisheries 2009), and Texas (Texas Parks and Wildlife Department 2007) have inshore and offshore artificial reefs. Most of Louisiana's offshore reef sites are made of retired oil and gas platforms. The world's largest artificial reef was established off Grand Isle, Louisiana (Louisiana Department of Wildlife and Fisheries 2009). Like other states, Louisiana also acquired abandoned military equipment to use as artificial reef material.

Oil and gas rigs are found throughout the Gulf of Mexico Large Marine Ecosystem. In 2012, there were 7,089 offshore oil production facilities in federal waters (Bureau of Ocean Energy Management 2012) (Figure 3.3-10). Many of the non-functioning structures were left in place to serve as artificial reefs (National Oceanic and Atmospheric Administration 2007).

3.3.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact marine habitats in the Study Area. Tables 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Each marine habitat stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities. Table F-1 in Appendix F shows the warfare areas and associated stressors that were considered for analysis. Stressors vary in intensity, frequency, duration, and location within the Study Area. The following stressors are applicable to marine habitats in the Study Area and are analyzed because they have the potential to alter the quality or quantity of marine habitats for associated living resources:

- Acoustic (impacts from explosives on or near the bottom)
- Physical disturbance and strike (impacts from military expended materials and seafloor devices)

Non-explosive acoustic sources do not change the substrate type of the bottom, and energy stressors do not change the substrate type by their surface orientation and nature. Entanglement and ingestion stressors do not alter bottom types. In the remainder of this section, marine habitats are referred to as marine substrates to reflect the subset of marine habitats being evaluated.

3.3.3.1 Acoustic Stressors

This section analyzes the potential impacts of explosions on or near the bottom resulting from training and testing activities within the Study Area. Consequences of these impacts are variable among substrate types.

3.3.3.1.1 Impacts from Explosives

An explosive detonated on or near the seafloor could alter the substrate, associated biogenic habitats, and inhabiting biological communities. The potential impact on marine substrate is assessed according to size of charge (net explosive weight, charge radius), height above the bottom, substrate types in the area, and equations linking all these factors.

An explosive charge would produce high energy that would be absorbed and reflected by the bottom. Hard bottom would mostly reflect the charge (Berglind et al. 2009), whereas a crater would be formed in soft bottom (Gorodilov and Sukhotin 1996). For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and substrate type. There is a nonlinear relationship between crater size and depth of water, with relatively small crater sizes in the shallowest water, followed by a spike in size at some intermediate depth, and a decline to an average flat line at greater depth (Gorodilov and Sukhotin 1996; O'Keeffe and Young 1984). Radii of the craters reportedly vary little among unconsolidated substrate types (O'Keeffe and Young 1984). On substrate types with nonadhesive particles (everything except clay), the effects should be temporary, whereas craters in clay may persist for years (O'Keeffe and Young 1984). Soft substrate moves around with the tides and currents and depressions are only short-lived (days – weeks) unless they are maintained.

On hard substrates, energy from bottom detonations is reflected to a greater degree than corresponding detonations on soft bottom (Berglind et al. 2009; Keevin and Hempen 1997). The amount of consolidated substrate (i.e., bedrock) converted to unconsolidated sediment from surface explosions varies according to material types and degree of consolidation (i.e., rubble, bedrock). Due to lack of accurate and specific information on hard bottom types, the worst-case scenario for hard bottom impacted is equal to the area of soft bottom impacted.

3.3.3.1.1.1 No Action Alternative

Training Activities

Relevant training activities under the No Action Alternative include explosives used during mine countermeasures, mine neutralization using remotely operated vehicles, and mine neutralization explosive ordnance disposal (see Table 2.8-1). Specific locations for these activities under the No Action Alternative are listed in Table 3.3-3 and are shown on Figures 3.3-1 through 3.3-10. The intersections of explosives on or near the bottom and surveyed marine substrates are listed below.

- Northeast U.S. Continental Shelf Large Marine Ecosystem (Virginia Capes [VACAPES] Range Complex [W-50]): Sandy soft bottom and artificial reefs around the perimeter. Bottom types are less than 30 m deep.
- Southeast U.S. Continental Shelf Large Marine Ecosystem:
    - Cherry Point Operating Area (OPAREA) (underwater detonation area): Sandy soft bottom, hard bottom, artificial reefs, shipwrecks, and artificial structures around the perimeter. Bottom types are less than 30 m deep.
    - Jacksonville (JAX) Range Complex (underwater detonation areas): Sandy soft bottom and hard bottom, higher concentrations of hard bottom adjacent to boxes. Bottom types are less than 30 m deep.

The determination of impact is based on worst-case scenarios: 5 and 20 lb. (net explosive weight) explosions on the bottom. Realistically, not all charges are placed on the bottom, and mitigation measures help prevent hard bottom impacts (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). The number of bottom explosions modeled is assumed to be approximately half the number of charges.

Table 3.3-3: Explosives on or near the Bottom for Training Activities in the No Action Alternative

Training Area	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (km^2)	Hard Substrate		Soft Substrate		Unknown Substrate	
				km^2	% Impact	km^2	% Impact	km^2	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem									
VACAPES (W-50)	5	15	0.00081	0	0	421	0.0002	0	0
	20	6	0.00081		0		0.0002		0
Total	*na*	*na*	*0.00162*		*0*		*0.0004*		*0*
Southeast U.S. Continental Shelf Large Marine Ecosystem									
Cherry Point (UNDET Area)	20	5	0.000675	217	0.0003	1,414	<0.0001	0	0
JAX (UNDET Areas North and South)	20	3	0.000405	67	0.0006	541	0.0001	0	0
Total	*na*	*na*	*0.00108*	*284*	*0.0004*	*1,955*	*0.0001*	*0*	*0*

Note: Substrate areas depicted on Figures 3.3-1 and 3.3-2.

JAX: Jacksonville Range Complex; km^2: square kilometer; lb.: pound; m^2: square meter; UNDET Area: underwater detonation area; VACAPES: Virginia Capes Range Complex

The depth of mine neutralization areas varies from 10 to 30 m. The depth (h) and radius (R) of the crater are calculated using the charge radius (r_0) multiplied by a number determined from solving for h or R along a nonlinear relationship between [depth of water/r_0] and [h or R/r_0] (Gorodilov and Sukhotin 1996).

Crater diameter = (30 x charge radius) x 2, Crater depth = (5 x charge radius) x 2

The charge radius is calculated by solving for radius in the geometry of a spherical volume (1 lb. per cubic inches [$in.^3$] of trinitrotoluene [TNT] x number of pounds). A 20 lb. (9.07 kg) net explosive weight charge (r_0 = 0.36 ft. or 0.11 m) on a sandy bottom would produce a maximum crater size of approximately 21.5 ft. (6.5 m) in diameter ([30 x 0.36 ft.] x 2) and 1.8 ft. (0.5 m) deep (5 x 0.36 ft.). The crater area of the charge on a sandy bottom would be 364 $ft.^2$ (34 m^2). Displaced sand adds another radius to the sides of the crater (O'Keeffe and Young 1984), yielding a diameter of 43 ft. (13 m) and 1,457 $ft.^2$ (135 m^2) for the total area of impacted substrate. Mine neutralization training activities occur within a small area of the continental shelf (Figures 3.3-1 to 3.3-10). Based on the number of charges and impact area per year, the worst-case scenarios for explosive impacts on or near the bottom is approximately 0.27 acres (ac.) (0.00108 km^2) of the surveyed hard bottom within the Southeast U.S. Continental Shelf Large Marine Ecosystem (Table 3.3-3). No mapped hard bottoms are present to be impacted in the Northeast U.S. Continental Shelf Large Marine Ecosystem.

Testing Activities

Relevant testing activities in the No Action Alternative include airborne mine neutralization systems testing, airborne towed minesweeping test, and Naval Sea Systems Command ordnance operations (Tables 2.8-2 and 2.8-3). General locations for No Action mine neutralization testing activities are listed in Table 3.3-4 and shown on Figures 3.3-1 through 3.3-10. The intersections of explosives on or near the bottom and mapped marine substrates are listed below:

- Northeast U.S. Continental Shelf Large Marine Ecosystem (VACAPES OPAREA [W-50, W-72]): Sandy soft bottom and artificial reefs around the perimeter. Bottom types are less than 30 m deep.
- Gulf of Mexico Large Marine Ecosystem (Naval Surface Warfare Center, Panama City Division Testing Range): Sandy bottoms grading to silt and clay seaward of shelf break, hard bottom areas landward and along the shelf break, most artificial reefs and wrecks landward of shelf break.

The impact areas for 5, 10, 20, 75, 650, and 3,625 lb. net explosive weight charges were calculated using the equation employed for calculating a 20 lb. charge impact (i.e., crater radius = 30 x charge radius). Realistically, not all charges are detonated on the bottom and mitigation measures help prevent hard bottom impacts (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). The number of bottom explosions modeled is assumed to be half the number of charges for all types except line charges. Line charges are placed in the surf zone, so all charges were assumed to be on the bottom; however, there is no potential for these charges to overlap hard bottom. Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom impacts are 0.60 ac. (0.00243 km^2) and 0.18 ac. (0.00074km^2) in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, respectively (Table 3.3-4).

Table 3.3-4: Explosives on or near the Bottom for Testing Activities in the No Action Alternative

Testing Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (km^2)	Hard Substrate		Soft Substrate		Unknown Substrate	
				km^2	% Impact	km^2	% Impact	km^2	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem									
VACAPES (W-50, W-72)	5	45	0.00243	20	0.0121	50,727	<0.0001	0	0
Gulf of Mexico Large Marine Ecosystem									
NSWC PCD	5	20	0.00108	3,610	<0.0001	74,991	<0.0001	0	0
	10	26	0.00221		0.0001		<0.0001		0
	20	2	0.00027		<0.0001		<0.0001		0
	75	2	0.000652		<0.0001		<0.0001		0
	650	12	0.0165		0.0005		<0.0001		0
	3,625	3	0.019971		0*		<0.0001		0
Total	*na*	*na*	*0.040683*		0.0006		0.0001		0

Note: Substrate areas depicted on Figures 3.3-1 and 3.3-4.

km^2: square kilometer; lb.: pound; m^2: square meter; NSWC PCD: Naval Undersea Warfare Center, Panama City Division; OPAREA: Operating Area; VACAPES: Virginia Capes Range Complex

* Hard substrate impacts unlikely due to placement in surf zone (Appendix A).

3.3.3.1.1.2 Alternative 1

Training Activities

Relevant training activities under Alternative 1 are the same as the No Action Alternative, except for the addition of civilian port defense activities. The specific locations for these activities under Alternative 1 are listed in Table 3.3-5 and are shown on Figures 3.3-1 to 3.3-10. The intersections of explosives on or near the bottom and mapped marine substrates are listed below.

- Northeast U.S. Continental Shelf Large Marine Ecosystem (VACAPES): Shelf substrate sandy soft bottom, sparse hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate silt/mixed soft bottom.
- Southeast U.S. Continental Shelf Large Marine Ecosystem:
    - Cherry Point OPAREA: Shelf substrate sandy soft bottom, abundant hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate sand/silt/mixed soft bottom.
    - JAX Range Complex: Shelf substrate sandy soft bottom, abundant hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate sand/silt/mixed soft bottom, and abundant hard bottom.
- Caribbean Sea and Gulf of Mexico Large Marine Ecosystems (Key West Range Complex): Shelf substrate gravel/sand/silt/clay/mixed soft bottom, sparse-abundant hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate gravel/sand/silt/clay/mixed soft bottom and sparse artificial structures.
- Gulf of Mexico Large Marine Ecosystem (Gulf of Mexico [GOMEX] Range Complex): Shelf substrate sand/silt/clay/mixed soft bottom, sparse/patchy hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate sand/silt/clay/mixed soft bottom and sparse artificial structures.

The determination of impact is based on worst-case scenarios: 0.25, 5, 10, 20, 60, and 100 lb. (net explosive weight) explosions on the bottom. In reality, not all charges are detonated on the bottom and mitigation measures help prevent hard bottom impacts (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). The number of bottom explosions modeled is assumed to be approximately half the number of charges, with the exception of 0.25 lb. charges, which were all assumed to occur on the bottom.

The mine neutralization training activities could occur over a larger area, given the added flexibility of conducting activities anywhere within the specified range complexes. Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom impacts are 13.15 ac. (0.05322 km^2), 0.57 ac. (0.00242 km^2), 0.16 ac. (0.00065 km^2), and 0.31 ac. (0.00125 km^2) in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems (Table 3.3-5).

Table 3.3-5: Explosives on or near the Bottom for Training Activities in Alternative 1 and 2

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (km^2)	Hard Substrate		Soft Substrate		Unknown	
				km^2	% Impact	km^2	% Impact	km^2	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem									
Northeast	20	0.4	0.000054	475	<0.0001	161,213	<0.0001	0	<0.0001
VACAPES	0.25	1,440	0.01008	31	0.0330	95,485	<0.0001	0	0
	5	42	0.002268		0.0074		<0.0001		0
	10	2	0.00017		0.0006		<0.0001		0
	20	116.4	0.015714		0.0514		<0.0001		0
	60	78	0.033852		0.1107		<0.0001		0
	100	2	0.00122		0.0040		<0.0001		0
Total	*na*	*na*	*0.063358*	*506*	*0.0105*	*256,698*	<0.0001	*0*	<0.0001
Southeast U.S. Continental Shelf Large Marine Ecosystem									
Cherry Point	10	1	0.000085	4,704	<0.0001	59,516	<0.0001	0	0
	20	1.4	0.000189		<0.0001		<0.0001		0
	60	2	0.000868		<0.0001		<0.0001		0
JAX	10	1	0.000085	67,195	<0.0001	104,602	<0.0001	0	0
	20	2.4	0.000324		<0.0001		<0.0001		0
	60	2	0.000868		<0.0001		<0.0001		0
Total	*na*	*na*	*0.002419*	*71,899*	<0.0001	*161,118*	<0.0001	*0*	0
Caribbean Sea and Gulf of Mexico Large Marine Ecosystems									
Key West	10	1	0.000085	*20,502*	<0.0001	*51,635*	<0.0001	*14,954*	<0.0001
	20	1	0.000135		<0.0001		<0.0001		<0.0001
	60	1	0.000434		<0.0001		<0.0001		<0.0001
Total	*na*	*na*	*0.000654*		<0.0001		<0.0001		<0.0001
Gulf of Mexico Large Marine Ecosystem									
GOMEX	5	10	0.00054	*8,480*	<0.0001	*133,024*	<0.0001	*2,415*	<0.0001
	10	1	0.000085		<0.0001		<0.0001		<0.0001
	20	1.4	0.000189		<0.0001		<0.0001		<0.0001
	60	1	0.000434		<0.0001		<0.0001		<0.0001
Total	*na*	*na*	*0.001248*		<0.0001		<0.0001		<0.0001

Note: Substrate areas depicted on Figures 3.3-1 to 3.3-4.

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; km^2: square kilometer; lb.: pound; m^2: square meter; VACAPES: Virginia Capes Range Complex

Testing Activities

Relevant testing activities in Alternative 1 include airborne mine neutralization systems testing, airborne projectile-based mine clearance systems, airborne towed minesweeping test, mine countermeasure mission package testing, ordnance testing with line charges, and mine countermeasures/neutralization testing. (Tables 2.8-2 and 2.8-3). The general locations for Alternative 1 activities are listed in Table 3.3-6 and shown on Figures 3.3-1 through 3.3-10. The intersections of explosives on or near the bottom and mapped marine substrates are listed below:

- Northeast U.S. Continental Shelf Large Marine Ecosystem (VACAPES): Shelf substrate sandy soft bottom, sparse hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate silt/mixed soft bottom.
- Southeast U.S. Continental Shelf Large Marine Ecosystem (JAX): Shelf substrate sandy soft bottom, abundant hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate sand/silt/mixed soft bottom, and abundant hard bottom.
- Gulf of Mexico Large Marine Ecosystem:
    - Shelf substrate sand/silt/clay/mixed soft bottom, sparse/patchy hard bottom, artificial structures (primarily nearshore), shelf break feature, and open-ocean substrate sand/silt/clay/mixed soft bottom and sparse artificial structures.
    - Naval Surface Warfare Center, Panama City Division Testing Range: Sandy bottoms grading to silt and clay seaward of shelf break, hard bottom areas landward and along the shelf break, most artificial reefs and wrecks landward of shelf break.

Table 3.3-6: Explosives on or near the Bottom for Testing Activities in Alternative 1

Testing Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (km^2)	Hard Substrate		Soft Substrate		Unknown Substrate	
				km^2	% Impact	km^2	% Impact	km^2	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem									
VACAPES	5	63	0.003402	*31*	0.0111	*95,485*	<0.00001	*0*	0
	650	3	0.004125		0.0135		<0.00001		0
Total	*na*	*na*	*0.007527*		*0.0246*		<0.00001		0
Southeast U.S. Continental Shelf Large Marine Ecosystem									
JAX	5	12	0.000648	*67,195*	<0.00001	*104,602*	<0.00001	*0*	0
	10	10	0.00085		<0.00001		<0.00001		0
Total	*na*	*na*	*0.001498*		<0.00001		<0.00001		0
Gulf of Mexico Large Marine Ecosystem									
Gulf of Mexico	5	6	0.000324	74,310	<0.00001	629,178	<0.00001	762,242	<0.00001
	10	10	0.00085		<0.00001		<0.00001		<0.00001
	100	3	0.00183		<0.00001		<0.00001		<0.00001
NSWC PCD	5	81	0.004347	3,610	0.0001	74,991	<0.00001	0	0
	20	3	0.000405		<0.00001		<0.00001		0
	650	8	0.011		0.0003		<0.00001		0
	3,625	3	0.019971		0*		<0.00001		0
Total	*na*	*na*	*0.038727*	*77,920*	<0.00001	*704,169*	*<0.00001*	*762,242*	*<0.00001*

Note: Substrate areas depicted on Figures 3.3-1 to 3.3-4.

JAX: Jacksonville Range Complex; km^2: square kilometer; lb.: pound; m^2: square meter; NSWC PCD: Naval Undersea Warfare Center, Panama City Division; VACAPES: Virginia Capes Range Complex

* Hard substrate impacts unlikely due to placement in surf zone (Appendix A).

The impact areas for 5, 10, 20, 100, 650, and 3,625-lb. charges were calculated using the equation employed for calculating a 20 lb. charge impact (i.e., crater radius = 30 x charge radius). In reality, not all charges are detonated on the bottom and mitigation measures help prevent hard bottom impacts (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). The number of bottom explosions modeled is assumed to be half the number of charges for all types except line charges. Line

charges are placed in the surf zone, so all charges were assumed to be on the bottom; however, there is no potential for these charges to overlap hard bottom. Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom are 1.86 ac. (0.00753 km^2), 0.37 ac. (0.00149 km^2), and 4.63 ac. (0.01876 km^2) in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, respectively (Table 3.3-6).

3.3.3.1.1.3 Alternative 2 (Preferred Alternative)

Training Activities

Relevant training activities for Alternative 2 are the same as Alternative 1. Locations for Alternative 2 activities are expanded to range complexes and are listed in Table 3.3-5 and depicted on Figures 3.3-1 through 3.3-10. The number of charges and intersections of range complexes and mapped marine habitats are the same as Alternative 1. Likewise, the potential impacts from Alternative 2 training are identical to those of Alternative 1.

Testing Activities

Relevant testing activities for Alternative 2 are the same as Alternative 1 (Tables 2.8-2 and 2.8-3). The general locations for Alternative 2 activities are listed in Table 3.3-7 and shown on Figures 3.3-1 through 3.3-10. The intersections of locations and mapped marine habitats are the same as Alternative 1. However, the number of charges has increased relative to Alternative 1.

The impact areas for 5, 10, 20, 75, and 650 lb. charges were calculated using the equation employed for calculating a 20 lb. charge impact (i.e., crater radius = 30 x charge radius). In reality, not all charges are detonated on the bottom and mitigation measures help prevent hard bottom impacts (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). The number of bottom explosions modeled is assumed to be half the number of charges for all types except line charges. Line charges are placed in the surf zone, so all charges were assumed to be on the bottom; however, there is no potential for these charges to overlap hard bottom. Based on the number of charges and impact areas per year, the worst-case scenarios for hard bottom impacts are 1.99 (0.00807 km^2), 0.42 (0.00171 km^2), and 4.83 ac. (0.01955 km^2) in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems (Table 3.3-7).

3.3.3.1.1.4 Substressor Impact on Marine Substrate as Essential Fish Habitat

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that explosive impacts to hard bottom substrate are determined to be permanent and minimal throughout the Study Area (U.S. Department of the Navy 2013). The impacts on soft bottom are determined to be short term and minimal (U.S. Department of the Navy 2013). Mitigation measures should avoid impacts to surveyed hard bottom, as defined in the Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). Impacts on water column as Essential Fish Habitat are summarized in corresponding resource sections (e.g., invertebrates, fish) because they are impacts on the organisms themselves.

Table 3.3-7: Explosives on or near the Bottom for Testing Activities in Alternative 2

Testing Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (km^2)	Hard Substrate		Soft Substrate		Unknown Substrate	
				km^2	% Impact	km^2	% Impact	km^2	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem									
VACAPES	5	73	0.003942	31	0.0129	95,485	<0.0001	0	0
	650	3	0.004125		0.0135		<0.0001		0
Total	*na*	*na*	*0.008067*		0.0264		<0.0001		0
Southeast U.S. Continental Shelf Large Marine Ecosystem									
JAX	5	16	0.000864	67,195	<0.0001	104,602	<0.0001	0	0
	10	10	0.00085		<0.0001		<0.0001		0
Total	*na*	*na*	0.001714		<0.0001		<0.0001		0
Gulf of Mexico Large Marine Ecosystem									
Gulf of Mexico	5	7	0.000378	74,310	<0.0001	629,178	<0.0001	762,242	<0.0001
	10	10	0.00085		<0.0001		<0.0001		<0.0001
	100	4	0.00244		<0.0001		<0.0001		<0.0001
NSWC PCD	5	85.5	0.004617	3,610	0.0001	74,991	<0.0001	0	0
	20	2	0.00027		<0.0001		<0.0001		0
	650	8	0.011		0.0003		<0.0001		0
	3,625	4	0.026628		0*		<0.0001		0
Total	*na*	*na*	*0.046183*	77,920	<0.0001	704,169	<0.0001	762,242	<0.0001

Note: Substrate areas depicted on Figures 3.3-1 to 3.3-4.

JAX: Jacksonville Range Complex; km^2: square kilometer; lb.: pound; m^2: square meter; NSWC PCD: Naval Undersea Warfare Center, Panama City Division; VACAPES: Virginia Capes Range Complex

* Hard substrate impacts unlikely due to placement in surf zone (Appendix A).

3.3.3.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors resulting from the Navy conducting its training and testing activities within the Study Area. Bottom substrates are potentially subject to physical disturbance by military expended materials and seafloor devices associated with Navy training and testing. This analysis includes the potential impacts of (1) military expended materials to include non-explosive practice munitions and fragments from high-explosive munitions, and (2) seafloor devices. Physical disturbances and strikes by vessels and in-water devices are not considered since these types of occurrences would cause damage to the vessel or device and are avoided when possible.

Impacts from physical disturbances or strikes resulting from Navy training and testing activities to biogenic habitats associated with hard bottom (e.g., corals, sponges, tunicates, oysters, mussels, kelp, etc.) and soft bottom (e.g., seagrass, macroalgae, etc.) substrates are discussed in detail within Sections 3.8 (Marine Invertebrates) and 3.7 (Marine Vegetation), respectively. Potential impacts to the underlying substrates (soft, hard, or artificial) are analyzed here.

3.3.3.2.1 Impacts from Military Expended Materials

This section analyzes the potential for physical disturbance to marine substrates from the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, ship

hulks, expendable targets and aircraft stores (fuel tanks, carriages, dispensers, racks, carriages, or similar types of support systems on aircraft that could be expended). Areas expected to have the greatest amount of expended materials are the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, and the Gulf Stream Open Ocean Area (specifically within the VACAPES and JAX Range Complexes). For a discussion of the types of activities that use military expended materials, where they are used, and how many events would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes). Military expended materials have the potential to physically disturb marine substrates to the extent that they impair the substrate's ability to function as a habitat. These disturbances can result from several sources, including the impact of the expended material contacting the seafloor, the covering of the substrate by the expended material, or alteration of the substrate from one type to another.

The potential for military expended materials to physically impact marine substrates as they come into contact with the seafloor depends on several factors. These factors include, but are not limited to, the size, shape, type, mass, and speed of the material through the water column; the amount of the material expended; the frequency of training or testing; water depth, water currents, or other disturbances; and the type of substrate. Most of the kinetic energy of the expended material, however, is dissipated within the first few feet of the object entering the water causing it to slow considerably by the time it reaches the substrate. Because the damage caused by a strike is proportional to the force of the strike, slower speeds may result in lesser impacts. Due to the water depth at which most training and testing events take place, a direct strike on either hard bottom or artificial structures (e.g., artificial reefs and shipwrecks) is unlikely to occur with sufficient force to damage the substrate. Any potential damage would be to a small portion of the structural habitat. The value of these substrates as habitat, however, is not entirely dependent on the precise shape of the structure. An alteration in shape or structure caused by military expended materials would not necessarily reduce the habitat value of either hard bottom or artificial structures. In softer substrates (e.g., sand, mud, silt, clay, and composites), the impact of the expended material coming into contact with the seafloor, if large enough and striking with sufficient momentum, may result in a depression and a localized redistribution of sediments as they are temporarily suspended in the water column. During Navy training and testing, countermeasures such as flares and chaff are introduced into marine habitats. These types of military expended materials are not expected to impact marine habitats as strike stressors, given their size and low velocity when deployed compared to projectiles, bombs, and missiles.

Another potential physical disturbance that military expended materials could have on marine substrates would be to cover them or to alter the type of substrate and, therefore, its function as habitat. The majority of military expended materials that settle on hard bottoms or artificial substrates, while covering the seafloor, will serve a similar habitat function as the substrate it is covering by providing a hard surface on which organisms can attach (Figures 3.3-11 and 3.3-12). An exception would be expended materials, like the parachutes utilized to deploy sonobuoys, lightweight torpedoes, expendable mobile anti-submarine warfare training targets, and other devices from aircraft, that would not provide a hard surface for colonization. In these cases, the hard bottom or artificial substrate covered by the expended material would not be physically damaged, but would have an impaired ability to function as a habitat for colonizing or encrusting organisms.

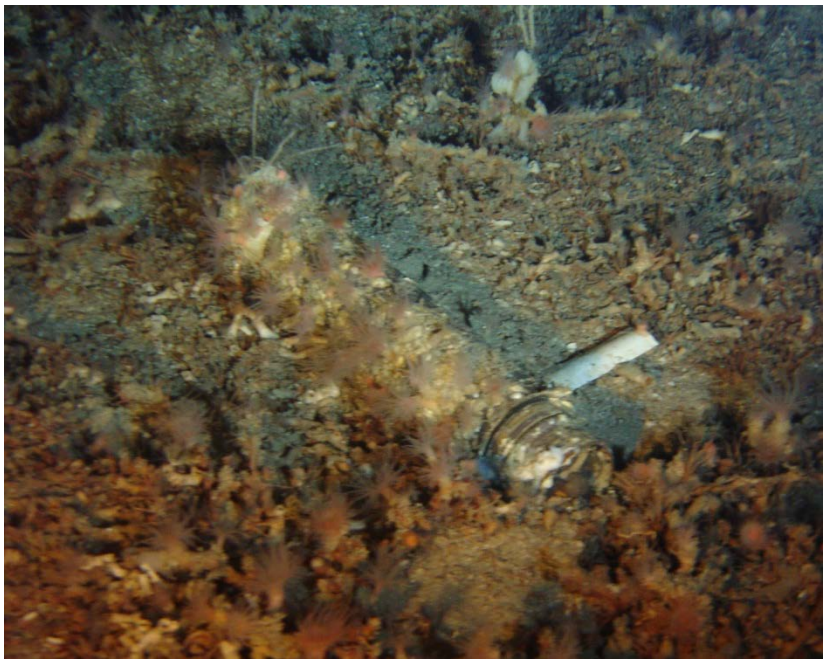

Figure 3.3-11: A MK 58 Smoke Float Observed in an Area Dominated by Coral Rubble on the Continental Slope

Note: Observed at approximately 350 m in depth and 60 nm east of Jacksonville, Florida. Of note is the use of the smoke float as a colonizing substrate for a cluster of sea anemones (U.S. Department of the Navy 2010).

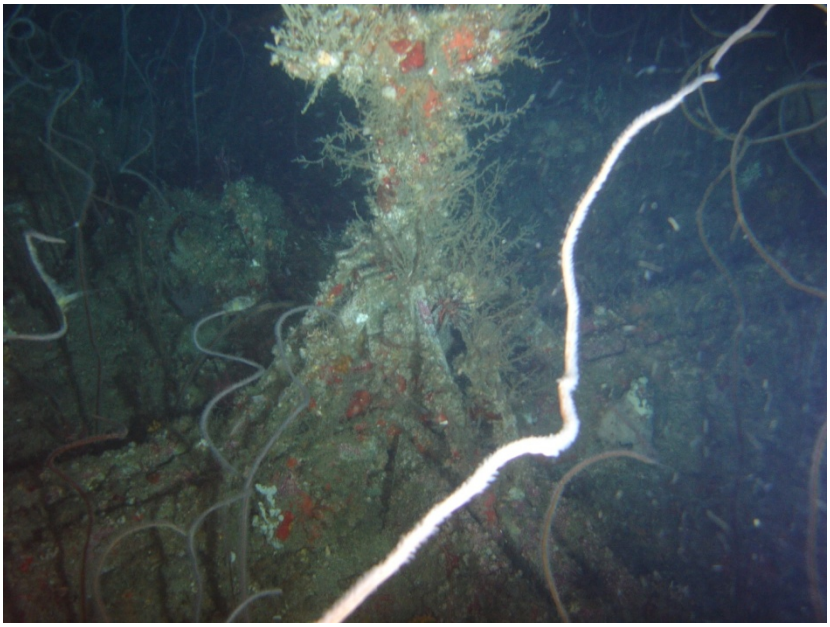

Figure 3.3-12: An Unidentified, Non-Military Structure on Hard Bottom

Note: Observed on the ridge system that runs parallel to the shelf break at approximately 80 m in depth and 55 nm east of Jacksonville, Florida. Of note is that encrusting organisms and benthic invertebrates readily colonize the artificial structure to a similar degree as the surrounding rock outcrop (U.S. Department of the Navy 2010).

Most military expended materials that settle on soft bottom habitats, while not damaging the actual substrate, would inhibit the substrate's ability to function as a habitat by covering it with a hard surface. This would effectively alter the substrate from a soft surface to a hard structure and, therefore, would alter the habitat to be more suitable for organisms more commonly found associated with hard bottom environments (U.S. Department of the Navy 2010, 2011). Expended materials that settle in the shallower, more dynamic environments of the continental shelf would likely be eventually covered over by sediments due to currents and other coastal processes or encrusted by organisms. In the deeper waters of the continental slope and beyond where currents do not play as large of a role, expended materials may remain exposed on the surface of the substrate with minimal change for extended periods (Figure 3.3-13). Softer expended materials, such as parachutes, would also not damage the sediments, but could impair their ability to function as a habitat to some degree.

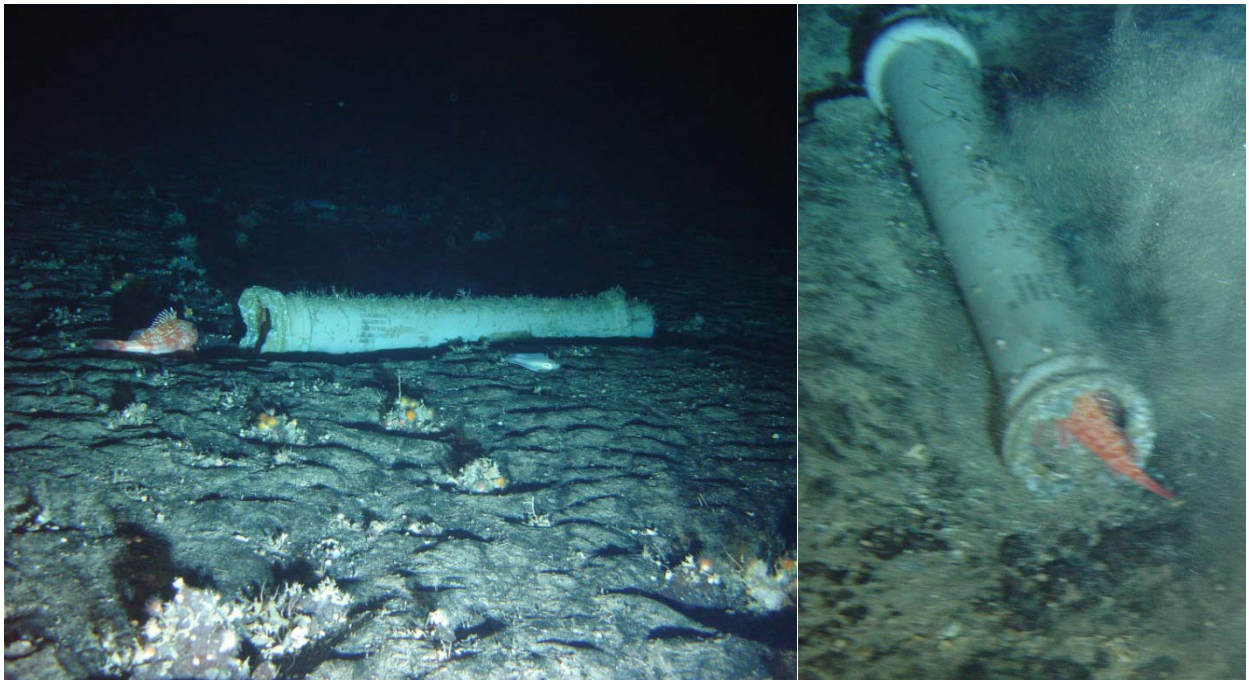

Figure 3.3-13: A 76-millimeter Cartridge Casing on Soft Bottom and a Blackbelly Rosefish (*Helicolenus dactylopterus*) Using the Casing for Protection When Disturbed

Note: The casing was observed in a sandy area on the continental slope approximately 425 m in depth and 70 nm east of Jacksonville, Florida. The casing has not become covered by sediments due to the depth and the relatively calm, current-free environment.

One unique type of military expended material, due to its size, is ship hulks. Sinking exercises involve the use of a target (ship hulk or stationary artificial target) against which explosive and non-explosive munitions are fired; these exercises are conducted in a manner that results in the sinking of the target. The exercise lasts for four to eight hours over one to two days. Sinking exercises would only occur in waters exceeding 3,000 m in depth (Figures 3.3-1 and 3.3-4). The level of potential impact from sinking exercises depends on the amount of munitions and type of weapons used, which are situational and training-need dependent (U.S. Department of the Navy 2005). Potential military expended materials from sinking exercises include the ship hulk and shell fragments. Expended materials that settle to the seafloor would not affect the stability of the seafloor or cause disturbance to natural ocean processes (U.S. Department of the Navy 2005). The level of impact from a ship hulk landing on marine substrates would depend on the size of the ship hulk and the type of substrate it settles upon. Areas of hard

bottom may experience some fragmentation or breaks as the ship settles to the seafloor. While the ship hulk would cover a large portion of the seafloor relative to that covered by other types of expended materials, it would support the same type of communities as the hard substrate it covered and likely provide more complexity and relief, which are important habitat features for hard bottom communities. Areas of unconsolidated sediments would experience a temporarily large increase in turbidity as sediment is suspended in the water column. Settlement of the ship to the seafloor would also likely leave a large depression in the substrate where sediment was displaced. The soft substrates covered by the ship would no longer be able to serve their function in supporting a soft bottom community, having been replaced by a hard structure more suitable for attaching and encrusting organisms.

To determine the potential level of disturbance that military expended materials have on soft and hard bottom substrates, an analysis to determine the impact footprint was conducted for each range complex and testing range for each alternative. Three main assumptions were made that result in the impact footprints calculated being considered overestimates. First, within each category of expended items (e.g., bombs, missiles, rockets, large-caliber projectiles, etc.), the size of the largest item that would be expended was used to represent the sizes of all items in the category. For example, the footprints of missiles used during training exercises range from 1.6 to 37.4 $ft.^2$ (0.15 to 3.5 m^2). For the analyses, all missiles were assumed to be equivalent to the largest in size, or 37.4 $ft.^2$ (3.5 m^2). Second, it was also assumed that the impact of the expended material on the seafloor was twice the size of its actual footprint. This assumption accounts for any displacement of sediments at the time of impact as well as any subsequent movement of the item on the seafloor due to currents or other forces. This should more accurately reflect the potential disturbance to soft bottom habitats, but should overestimate disturbance to hard bottom habitats since no displacement of the substrate would occur. Third, items with casings (e.g., small-, medium-, and large-caliber munitions; flares; sonobuoys; etc.) have their impact footprints doubled to account for both the item and its casing. Items and their casings were assumed to be the same size, even though depending on the munitions, one of them is often smaller than the other.

Once the impact footprints were calculated, two analyses were performed for each range complex: (1) potential impact to the soft bottom habitats in that range complex if all expended materials settled in areas with unconsolidated sediments, and (2) potential impact to the hard bottom habitats in that range complex if all expended materials settled in areas containing hard substrates. During the analyses, the same dimensions were used for high-explosive munitions as were used for non-explosive practice munitions. The total area of the seafloor covered by the expended materials should be similar regardless of whether the item is intact or fragmented, despite the fact that high-explosive munitions will explode in the air, at the surface, or in the water column and only fragments would make it to the substrate. Table 3.3-8 provides the total amount of mapped substrate occurring within each of the range complexes and testing ranges. For the purpose of the analyses, any portions of the seafloor with an unknown substrate type were assumed to be composed of soft sediments based on the low bathymetric relief in these areas (Watts et al. 2011). Tables 3.3-9 through 3.3-13 provide the results of the impact analyses for each training or testing alternative.

Table 3.3-8: Amount of Each Marine Substrate within Each Training and Testing Area in the Study Area

Training and Testing Areas	Marine Substrates (km^2)		
	Hard Substrate	Soft Substrate	Unknown Substrate
Northeast U.S. Continental Shelf Large Marine Ecosystem			
Northeast	475	161,213	0
NUWCDIVNPT	0	36,612	0
VACAPES	30	95,485	0
Southeast U.S. Continental Shelf Large Marine Ecosystem			
Navy Cherry Point	4,704	59,516	0
JAX	67,195	104,602	0
SFOMF	159	1,517	0
Caribbean and Gulf of Mexico Large Marine Ecosystems			
Key West	20,502	51,635	14,954
Gulf of Mexico Large Marine Ecosystem			
GOMEX	8,481	133,024	2,415
NSWC PCD	3,610	74,991	0
Northeast and Southeast U.S. Continental Shelf, Caribbean, and Gulf of Mexico Large Marine Ecosystems			
AFTT Study Area	159,845	1,693,400	9,091,832
Other AFTT Areas	58,298	1,078,633	9,074,463

GOMEX: Gulf of Mexico Range Complex; JAX: Jacksonville Range Complex; km^2: square kilometers; NSWC PCD: Naval Surface Warfare Center, Panama City Division; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes Range Complex

Table 3.3-9: Numbers and Impacts of Military Expended Materials Proposed for Use during Training Exercises as Part of the No Action Alternative

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Range Complex															
			Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		AFTT Study Area		Other AFTT Areas	
			Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)
Bombs																		
Bombs (Explosive)	0.7544	10.4892	0	0	20	210	0	0	0	0	0	0	4	42	0	0	1	10
Bombs (Non-Explosive)	0.7544	10.4892	0	0	555	5,821	811	8,507	696	7,300	0	0	292	3,063	0	0	0	0
Projectiles																		
Small-Caliber (Non-Explosive)	0.0028	0.0113	0	0	1,299,600	14,685	199,240	2,251	502,440	5,678	0	0	39,600	447	0	0	0	0
Medium-Caliber (Explosive)	0.0052	0.0208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium-Caliber (Non-Explosive)	0.0052	0.0208	0	0	226,750	4,716	39,075	813	68,825	1,432	36,000	749	34,880	726	0	0	0	0
Large-Caliber (Explosive)	0.0938	0.3751	0	0	858	322	78	29	390	146	0	0	0	0	0	0	700	263
Large-Caliber (Non-Explosive)	0.0938	0.3751	0	0	3,844	1,442	1,392	522	2,372	890	0	0	1,240	465	0	0	0	0
Missiles (Explosive)	3.4715	6.9430	0	0	178	1,236	44	305	88	611	0	0	0	0	0	0	11	76
Missiles (Non-Explosive)	2.8801	5.7602	0	0	112	645	8	46	15	86	0	0	0	0	0	0	0	0
Rockets (Explosive)	0.0742	0.1484	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rockets (Non-Explosive)	0.0742	0.1484	0	0	3,700	549	0	0	0	0	0	0	0	0	0	0	0	0
Grenades (Explosive)	0.0097	0.0193	0	0	0	0	0	0	80	2	0	0	20	0	0	0	0	0
Countermeasures																		
Chaff (Cartridges)	0.0001	0.0002	0	0	19,978	4	6,164	1	4,684	1	30,000	6	3,764	1	0	0	0	0
Flares	0.1133	0.4532	0	0	676	306	577	261	515	233	4,500	2,039	1,840	834	0	0	0	0
Acoustic Countermeasures	0.0289	0.1155	0	0	14	2	37	4	37	4	0	0	7	1	0	0	0	0
Targets																		
Airborne Targets	3.6270	7.2540	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Targets	0.5344	1.0687	0	0	667	712	187	200	519	555	0	0	67	72	0	0	0	0
Sub-Surface Targets	0.1134	0.2268	272	62	212	48	268	61	820	186	0	0	48	11	0	0	0	0
Mine Shapes	2.3960	4.7920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ship Hulk (Sinking Exercise)	29,370	58,740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	352,440
Other																		
Torpedo (Explosive)	3.0861	6.1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
Lightweight Torpedo Accessories	0.0939	0.1879	5	1	8	2	9	2	31	6	0	0	2	0	0	0	0	0
Heavyweight Torpedo Accessories	0.0150	0.3007	22	7	7	2	10	3	32	10	0	0	1	0	0	0	0	0
AMNS Neutralizer (Explosive)	0.1513	0.3026	0	0	30	9	0	0	0	0	0	0	0	0	0	0	0	0
AMNS Neutralizer (Non-Explosive)	0.1513	0.3026	0	0	180	54	27	8	27	8	0	0	0	0	0	0	0	0
Sonobuoys (Explosive)	0.1134	0.5669	340	193	360	204	360	204	360	204	0	0	351	199	0	0	0	0
Sonobuoys (Non-Explosive)	0.1134	0.5669	2,134	1,210	4,444	2,519	1,472	835	19,837	11,245	0	0	66	37	0	0	428	243
Parachutes – Large	0.8400	1.6800	238	400	173	291	227	381	763	1,282	0	0	12	20	0	0	0	0
Parachutes – Small	0.2642	0.5284	2,747	1,451	5,221	2,759	2,049	1,083	20,767	10,974	0	0	460	243	0	0	428	226
Anchor Blocks	0.5806	1.1613	0	0	12	14	10	12	6	7	0	0	0	0	0	0	0	0
Endcaps and Pistons	0.0004	0.0007	0	0	20,654	14	6,741	5	5,199	4	34,500	24	5,604	4	0	0	0	0
Total			**5,758**	**3,323**	**1,588,253**	**36,568**	**258,786**	**15,533**	**628,503**	**40,863**	**105,000**	**2,818**	**88,257**	**6,165**	**0**	**0**	**1,575**	**353,264**

AFTT: Atlantic Fleet Training and Testing; AMNS: Airborne Mine Neutralization System; GOMEX: Gulf of Mexico; JAX: Jacksonville; m^2: square meters; VACAPES: Virginia Capes

Table 3.3-10: Numbers and Impacts of Military Expended Materials Proposed for Use during Testing Exercises as Part of the No Action Alternative

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Range Complex																	
			Northeast		VACAPES		Navy Cherry Point		JAX		SFOMF		Key West		GOMEX		NSWC PCD		AFTT Study Area		Other AFTT Areas	
			Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)
Bombs																				
Bombs (Explosive)	0.7544	10.4892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bombs (Non-Explosive)	0.7544	10.4892	0	0	655	6,870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Projectiles																				
Small-Caliber (Non-Explosive)	0.0028	0.0113	0	0	800	9	0	0	0	0	0	0	0	0	2,000	23	6,000	68	0	0	0	0
Medium-Caliber (Explosive)	0.0052	0.0208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium-Caliber (Non-Explosive)	0.0052	0.0208	0	0	42,210	878	0	0	16,000	333	0	0	0	0	0	0	5,272	110	0	0	0	0
Large-Caliber (Explosive)	0.0938	0.3751	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large-Caliber (Non-Explosive)	0.0938	0.3751	148	56	0	0	0	0	0	0	0	0	0	0	148	56	300	113	0	0	0	0
Missiles (Explosive)	3.4715	6.9430	0	0	5	35	0	0	5	35	0	0	0	0	0	0	0	0	0	0	0	0
Missiles (Non-Explosive)	2.8801	5.7602	4	23	128	737	0	0	5	29	0	0	0	0	4	23	0	0	0	0	0	0
Rockets (Explosive)	0.0742	0.1484	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rockets (Non-Explosive)	0.0742	0.1484	0	0	264	39	0	0	113	17	0	0	0	0	0	0	0	0	0	0	0	0
Countermeasures																				
Chaff (Cartridges)	0.0001	0.0002	72	0	2,000	0	120	0	120	0	0	0	0	0	672	0	0	0	0	0	0	0
Flares	0.1133	0.4532	0	0	1,852	839	35	16	35	16	0	0	0	0	888	402	0	0	0	0	0	0
Acoustic Countermeasures	0.0289	0.1155	58	7	30	3	0	0	28	3	0	0	0	0	0	0	0	0	0	0	0	0
Targets																				
Airborne Targets	3.6270	7.2540	0	0	110	798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Targets	0.5344	1.0687	2	2	360	385	0	0	40	43	0	0	0	0	2	2	0	0	0	0	2	2
Sub-Surface Targets	0.1134	0.2268	16	4	71	16	7	2	27	6	0	0	0	0	7	2	0	0	0	0	5	1
Mine Shapes	2.3960	4.7920	0	0	42	201	0	0	50	240	0	0	0	0	0	0	112	537	0	0	0	0
Other																				
Torpedo (Explosive)	3.0861	6.1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	49
Torpedo (Non-Explosive)	0.9396	1.8792	0	0	2	4	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0
Lightweight Torpedo Accessories	0.0939	0.1879	9	2	13	2	0	0	17	3	0	0	0	0	0	0	0	0	0	0	12	2
Heavyweight Torpedo Accessories	0.0150	0.3007	34	10	0	0	0	0	25	8	0	0	0	0	0	0	0	0	0	0	17	5
AMNS Neutralizer (Explosive)	0.1513	0.3026	0	0	90	27	0	0	0	0	0	0	0	0	0	0	40	12	0	0	0	0
AMNS Neutralizer (Non-Explosive)	0.1513	0.3026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	24	0	0	0	0
Sonobuoys (Explosive)	0.1134	0.5669	224	127	172	98	112	63	152	86	0	0	0	0	112	63	0	0	0	0	184	104
Sonobuoys (Non-Explosive)	0.1134	0.5669	460	261	1,076	610	224	127	526	298	0	0	0	0	206	117	0	0	0	0	620	351
Parachutes – Large	0.8400	1.6800	458	769	13	22	0	0	8	14	0	0	0	0	0	0	0	0	0	0	0	0
Parachutes – Small	0.2642	0.5284	16	8	1,257	664	231	122	553	292	0	0	0	0	211	111	0	0	0	0	625	330
Anchor Blocks	0.5806	1.1613	0	0	164	190	0	0	50	58	0	0	0	0	0	0	378	439	0	0	0	0
Endcaps and Pistons	0.0004	0.0007	72	0	3,852	3	155	0	155	0	0	0	0	0	1,560	1	0	0	0	0	0	0
Aircraft Stores, Ballast, Weapon Carriages	2.6013	5.2026	0	0	4,830	25,129	0	0	516	2,685	0	0	30	156	75	390	0	0	1,275	6,633	0	0
Total			**1,573**	**1,269**	**59,996**	**37,561**	**884**	**330**	**18,427**	**4,169**	**0**	**0**	**30**	**156**	**5,885**	**1,191**	**12,182**	**1,302**	**1,275**	**6,633**	**1,473**	**846**

AFTT: Atlantic Fleet Training and Testing; AMNS: Airborne Mine Neutralization System; GOMEX: Gulf of Mexico; JAX: Jacksonville; m^2: square meters; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes

Table 3.3-11: Numbers and Impacts of Military Expended Materials Proposed for Use during Training Exercises as Part of Alternatives 1 and 2

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Range Complex															
			Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		AFTT Study Area		Other AFTT Areas	
			Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)
Bombs																		
Bombs (Explosive)	0.7544	10.4892	0	0	64	671	32	336	32	336	0	0	4	42	0	0	1	10
Bombs (Non-Explosive)	0.7544	10.4892	0	0	610	6,398	1,163	12,199	1,261	13,227	0	0	335	3,514	0	0	0	0
Projectiles																		
Small-Caliber (Non-Explosive)	0.0028	0.0113	27,500	311	3,857,600	43,591	543,740	6,144	1,534,500	17,340	0	0	73,200	827	0	0	227,500	2,571
Medium-Caliber (Explosive)	0.0052	0.0208	0	0	49,936	1,039	21,226	442	46,120	959	0	0	6,352	132	0	0	320	7
Medium-Caliber (Non-Explosive)	0.0052	0.0208	700	15	807,810	16,802	215,149	4,475	415,075	8,634	56,000	1,165	24,388	507	0	0	33,520	697
Large-Caliber (Explosive)	0.0938	0.3751	0	0	6,644	2,492	866	325	4,448	1,668	0	0	284	107	0	0	796	299
Large-Caliber (Non-Explosive)	0.0938	0.3751	0	0	1,804	677	934	350	1,832	687	0	0	1,276	479	0	0	537	201
Missiles (Explosive)	3.4715	6.9430	4	28	190	1,319	91	632	178	1,236	8	56	8	56	0	0	11	76
Missiles (Non-Explosive)	2.8801	5.7602	0	0	2	12	0	0	2	12	0	0	0	0	0	0	0	0
Rockets (Explosive)	0.0742	0.1484	0	0	3,800	564	0	0	3,800	564	0	0	380	56	0	0	0	0
Rockets (Non-Explosive)	0.0742	0.1484	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grenades (Explosive)	0.0097	0.0193	52	1	74	1	28	1	24	0	0	0	28	1	0	0	0	0
Countermeasures																		
Chaff (Cartridges)	0.0001	0.0002	0	0	1,792	0	7,304	1	5,788	1	30,000	6	728	0	0	0	0	0
Flares	0.1133	0.4532	6	3	628	285	1,962	889	1,668	756	4,512	2,045	1,852	839	0	0	0	0
Acoustic Countermeasures	0.0289	0.1155	0	0	19	2	37	4	39	5	0	0	9	1	0	0	0	0
Targets																		
Airborne Targets	3.6270	7.2540	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Targets	0.5344	1.0687	11	12	1,538	1,644	364	389	1,067	1,140	0	0	92	98	0	0	44	46
Sub-Surface Targets	0.1134	0.2268	116	26	447	101	125	28	1,492	338	0	0	5	1	0	0	122	28
Mine Shapes	2.3960	4.7920	0	0	48	230	24	115	12	58	0	0	0	0	0	0	0	0
Ship Hulk (Sinking Exercise)	29,370	58,740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	58,740
Other																		
Torpedo (Explosive)	3.0861	6.1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
Lightweight Torpedo Accessories	0.0939	0.1879	1	0	5	1	2	0	25	5	0	0	1	0	0	0	2	0
Heavyweight Torpedo Accessories	0.0150	0.3007	19	6	6	2	1	0	20	6	0	0	0	0	0	0	34	10
AMNS Neutralizer (Explosive)	0.1513	0.3026	0	0	72	22	0	0	0	0	0	0	20	6	0	0	0	0
AMNS Neutralizer (Non-Explosive)	0.1513	0.3026	0	0	570	172	71	21	71	21	0	0	112	34	0	0	0	0
Sonobuoys (Explosive)	0.1134	0.5669	170	96	443	251	183	104	1,113	631	0	0	70	40	0	0	0	0
Sonobuoys (Non-Explosive)	0.1134	0.5669	2,055	1,165	4,501	2,552	1,464	830	20,360	11,542	0	0	149	84	0	0	438	248
Parachutes – Large	0.8400	1.6800	82	138	371	623	99	166	1,271	2,135	0	0	3	5	0	0	122	205
Parachutes – Small	0.2642	0.5284	2,344	1,239	5,295	2,798	1,798	950	22,627	11,956	12	6	163	86	0	0	462	244
Anchor Blocks	0.5806	1.1613	0	0	422	490	20	23	38	44	6	7	36	42	0	0	0	0
Endcaps and Pistons	0.0004	0.0007	6	0	2,420	2	9,266	6	7,456	5	34,512	24	2,580	2	0	0	0	0
Total			**33,066**	**3,039**	**4,747,110**	**82,741**	**805,948**	**28,432**	**2,070,319**	**73,306**	**125,050**	**3,309**	**112,144**	**6,996**	**0**	**0**	**263,911**	**63,390**

AFTT: Atlantic Fleet Training and Testing; AMNS: Airborne Mine Neutralization System; GOMEX: Gulf of Mexico; JAX: Jacksonville; m^2: square meters; VACAPES: Virginia Capes

Table 3.3-12: Numbers and Impacts of Military Expended Materials Proposed for Use during Testing Activities as Part of Alternative 1

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Range Complex																			
			Northeast		VACAPES		Navy Cherry Point		JAX		SFOMF		Key West		GOMEX		NSWC PCD		AFTT Study Area		Other AFTT Areas	
			Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)
Bombs																						
Bombs (Explosive)	0.7544	10.4892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bombs (Non-Explosive)	0.7544	10.4892	0	0	823	8,633	0	0	240	2,517	0	0	0	0	0	0	0	0	0	0	0	0
Projectiles																						
Small-Caliber (Non-Explosive)	0.0028	0.0113	0	0	6,333	72	3,333	38	3,333	38	0	0	0	0	24,000	271	6,000	68	2,000	23	0	0
Medium-Caliber (Explosive)	0.0052	0.0208	0	0	10,200	212	200	4	10,200	212	0	0	0	0	0	0	0	0	2,800	58	0	0
Medium-Caliber (Non-Explosive)	0.0052	0.0208	1,400	29	153,670	3,196	22,200	462	65,600	1,364	0	0	6,000	125	1,400	29	17,030	354	2,800	58	0	0
Large-Caliber (Explosive)	0.0938	0.3751	0	0	1,797	674	0	0	339	127	0	0	339	127	0	0	40	15	3,920	1,470	0	0
Large-Caliber (Non-Explosive)	0.0938	0.3751	296	111	4,611	1,730	0	0	769	288	0	0	561	210	148	56	260	98	6,680	2,506	0	0
Missiles (Explosive)	3.4715	6.9430	8	56	94	649	0	0	36	246	0	0	0	0	4	28	0	0	0	0	0	0
Missiles (Non-Explosive)	2.8801	5.7602	0	0	591	3,401	0	0	57	325	0	0	3	17	8	46	0	0	1	6	0	0
Rockets (Explosive)	0.0742	0.1484	0	0	184	27	0	0	184	27	0	0	0	0	0	0	0	0	0	0	0	0
Rockets (Non-Explosive)	0.0742	0.1484	0	0	1,897	282	0	0	496	74	0	0	0	0	0	0	0	0	0	0	0	0
Countermeasures																						
Chaff (Cartridges)	0.0001	0.0002	144	0	3,592	1	1,200	0	1,452	0	0	0	0	0	4,272	1	0	0	0	0	0	0
Flares	0.1133	0.4532	0	0	3,000	1,360	200	91	200	91	0	0	0	0	4,000	1,813	0	0	0	0	0	0
Acoustic Countermeasures	0.0289	0.1155	108	12	62	7	0	0	184	21	0	0	0	0	28	3	0	0	40	5	0	0
Targets																						
Airborne Targets	3.6270	7.2540	0	0	110	798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Targets	0.5344	1.0687	4	4	850	908	0	0	273	292	0	0	0	0	10	11	0	0	3	3	0	0
Sub-Surface Targets	0.1134	0.2268	111	25	428	97	5	1	181	41	0	0	0	0	33	7	0	0	0	0	8	2
Mine Shapes	2.3960	4.7920	0	0	98	470	0	0	108	518	0	0	0	0	6	29	395	1,893	0	0	0	0
Other																						
Torpedo (Explosive)	3.0861	6.1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	49	0	0
Torpedo (Non-Explosive)	0.9396	1.8792	0	0	28	53	0	0	6	11	0	0	0	0	0	0	0	0	0	0	0	0
Lightweight Torpedo Accessories	0.0939	0.1879	127	24	227	43	0	0	166	31	0	0	0	0	12	2	0	0	20	4	0	0
Heavyweight Torpedo Accessories	0.0150	0.3007	122	37	41	12	0	0	222	67	0	0	0	0	44	13	0	0	28	8	0	0
AMNS Neutralizer (Explosive)	0.1513	0.3026	0	0	126	38	0	0	24	7	0	0	0	0	12	4	161	49	0	0	0	0
AMNS Neutralizer (Non-Explosive)	0.1513	0.3026	0	0	24	7	0	0	24	7	0	0	0	0	0	0	120	36	0	0	0	0
Sonobuoys (Explosive)	0.1134	0.5669	320	181	796	451	112	63	152	86	0	0	1,312	744	112	63	0	0	0	0	184	104
Sonobuoys (Non-Explosive)	0.1134	0.5669	1,549	878	5,292	3,000	200	113	2,313	1,311	0	0	2,640	1,497	524	297	0	0	420	238	320	181
Parachutes – Large	0.8400	1.6800	1,604	2,695	209	351	0	0	86	145	0	0	0	0	0	0	0	0	12	20	0	0
Parachutes – Small	0.2642	0.5284	48	25	5,841	3,086	205	108	2,440	1,289	0	0	2,640	1,395	555	293	0	0	420	222	328	173
Anchor Blocks	0.5806	1.1613	0	0	203	236	0	0	53	62	52	60	0	0	0	0	1,079	1,253	0	0	0	0
Endcaps and Pistons	0.0004	0.0007	144	0	6,592	5	1,400	1	1,652	1	0	0	0	0	8,272	6	0	0	0	0	0	0
Aircraft Stores, Ballast, Weapon Carriages	2.6013	5.2026	0	0	6,330	32,932	0	0	516	2,685	0	0	30	156	75	390	0	0	1,275	6,633	0	0
Total			**5,985**	**4,078**	**214,048**	**62,730**	**29,055**	**882**	**91,306**	**11,886**	**52**	**60**	**13,525**	**4,271**	**43,515**	**3,362**	**25,085**	**3,765**	**20,427**	**11,304**	**840**	**461**

AFTT: Atlantic Fleet Training and Testing; AMNS: Airborne Mine Neutralization System; GOMEX: Gulf of Mexico; JAX: Jacksonville; m^2: square meters; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes

Table 3.3-13: Numbers and Impacts of Military Expended Materials Proposed for Use during Testing Activities as Part of Alternative 2

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Range Complex																			
			Northeast		VACAPES		Navy Cherry Point		JAX		SFOMF		Key West		GOMEX		NSWC PCD		AFTT Study Area		Other AFTT Areas	
			Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)	Number	Impact (m^2)
Bombs																						
Bombs (Explosive)	0.7544	10.4892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bombs (Non-Explosive)	0.7544	10.4892	0	0	905	9,493	0	0	240	2,517	0	0	0	0	0	0	0	0	0	0	0	0
Projectiles																						
Small-Caliber (Non-Explosive)	0.0028	0.0113	0	0	7,633	86	3,333	38	3,333	38	0	0	0	0	28,000	316	7,000	79	2,500	28	0	0
Medium-Caliber (Explosive)	0.0052	0.0208	0	0	11,200	233	200	4	11,200	233	0	0	0	0	0	0	0	0	3,500	73	0	0
Medium-Caliber (Non-Explosive)	0.0052	0.0208	1,400	29	162,590	3,382	22,200	462	68,600	1,427	0	0	6,000	125	1,400	29	18,718	389	3,500	73	0	0
Large-Caliber (Explosive)	0.0938	0.3751	0	0	1,797	674	0	0	339	127	0	0	339	127	0	0	50	19	4,900	1,838	0	0
Large-Caliber (Non-Explosive)	0.0938	0.3751	296	111	4,811	1,805	0	0	769	288	0	0	561	210	148	56	280	105	7,100	2,663	0	0
Missiles (Explosive)	3.4715	6.9430	8	56	98	677	0	0	39	267	0	0	0	0	4	28	0	0	0	0	0	0
Missiles (Non-Explosive)	2.8801	5.7602	0	0	658	3,787	0	0	62	354	0	0	3	17	10	58	0	0	1	6	0	0
Rockets (Explosive)	0.0742	0.1484	0	0	202	30	0	0	202	30	0	0	0	0	0	0	0	0	0	0	0	0
Rockets (Non-Explosive)	0.0742	0.1484	0	0	2,087	310	0	0	546	81	0	0	0	0	0	0	0	0	0	0	0	0
Countermeasures																						
Chaff (Cartridges)	0.0001	0.0002	144	0	3,872	1	1,345	0	1,597	0	0	0	0	0	4,692	1	0	0	0	0	0	0
Flares	0.1133	0.4532	0	0	3,300	1,496	220	100	220	100	0	0	0	0	4,400	1,994	0	0	0	0	0	0
Acoustic Countermeasures	0.0289	0.1155	118	14	86	10	0	0	232	27	0	0	0	0	28	3	0	0	50	6	0	0
Targets																						
Airborne Targets	3.6270	7.2540	0	0	121	878	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Targets	0.5344	1.0687	4	4	936	1,000	0	0	287	307	0	0	0	0	12	13	0	0	3	3	0	0
Sub-Surface Targets	0.1134	0.2268	128	29	471	107	9	2	199	45	0	0	0	0	39	9	0	0	0	0	16	4
Mine Shapes	2.3960	4.7920	0	0	114	546	0	0	118	565	0	0	0	0	7	34	435	2,085	0	0	0	0
Other																						
Torpedo (Explosive)	3.0861	6.1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	49	0	0
Torpedo (Non-Explosive)	0.9396	1.8792	0	0	30	56	0	0	7	13	0	0	0	0	0	0	0	0	0	0	0	0
Lightweight Torpedo Accessories	0.0939	0.1879	127	24	249	47	0	0	185	35	0	0	0	0	12	2	0	0	20	4	0	0
Heavyweight Torpedo Accessories	0.0150	0.3007	122	37	54	16	0	0	271	81	0	0	0	0	44	13	0	0	28	8	0	0
AMNS Neutralizer (Explosive)	0.1513	0.3026	0	0	145	44	0	0	32	10	0	0	0	0	14	4	171	52	0	0	0	0
AMNS Neutralizer (Non-Explosive)	0.1513	0.3026	0	0	77	23	0	0	32	10	0	0	0	0	0	0	140	42	0	0	0	0
Sonobuoys (Explosive)	0.1134	0.5669	514	291	950	539	204	116	244	138	0	0	1,512	857	204	116	0	0	0	0	368	209
Sonobuoys (Non-Explosive)	0.1134	0.5669	1,977	1,121	5,923	3,358	360	204	2,647	1,501	0	0	3,120	1,769	708	401	0	0	420	238	640	363
Parachutes – Large	0.8400	1.6800	2,049	3,442	227	381	0	0	91	153	0	0	0	0	0	0	0	0	12	20	0	0
Parachutes – Small	0.2642	0.5284	48	25	6,529	3,450	369	195	2,792	1,475	0	0	3,120	1,649	745	394	0	0	420	222	656	347
Anchor Blocks	0.5806	1.1613	0	0	230	267	0	0	64	74	67	78	0	0	0	0	1,203	1,397	0	0	0	0
Endcaps and pistons	0.0004	0.0007	144	0	7,172	5	1,565	1	1,817	1	0	0	0	0	9,092	6	0	0	0	0	0	0
Aircraft Stores, Ballast, Weapon Carriages	2.6013	5.2026	0	0	6,576	34,212	0	0	567	2,950	0	0	36	187	84	437	0	0	1,404	7,304	0	0
Total			**7,079**	**5,183**	**229,042**	**66,912**	**29,805**	**1,121**	**96,731**	**12,848**	**67**	**78**	**14,691**	**4,941**	**48,643**	**3,914**	**27,997**	**4,168**	**23,866**	**12,536**	**1,680**	**922**

AFTT: Atlantic Fleet Training and Testing; GOMEX: Gulf of Mexico; JAX: Jacksonville; m^2: square meters; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes

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3.3.3.2.1.1 No Action Alternative

Training Activities

Training activities involving military expended materials (Section 3.0.5.3.3.3, Military Expended Material Strikes) would have the potential to impact the marine substrates within the areas where the training is occurring. Each training area was evaluated to determine what level of impact could be expected under the No Action Alternative.

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, areas where military materials are expected to be expended include the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes, and in Other AFTT Areas. However, the largest potential impacted area from military expended materials occurs in Other AFTT Areas (sinking exercises) (Tables 3.3-9).

To determine the percentage of the total soft bottom or hard bottom substrate potentially impacted within a range complex, the total impacted area for each range complex from Table 3.3-9 was divided by the total amount of that particular substrate type within the same range complex as provided in Table 3.3-8. Results of this analysis are provided in Table 3.3-14.

Table 3.3-14: Potential Impact of Military Expended Materials from Training Activities on Soft and Hard Bottom Substrates Annually within Each Range Complex

Training Areas	Percent Impact to Soft Bottom		Percent Impact to Hard Bottom	
	No Action Alternative	Alternatives 1 and 2	No Action Alternative	Alternatives 1 and 2
Northeast U.S. Continental Shelf Large Marine Ecosystem				
Northeast	0.0000021	0.0000019	0.0006996	0.0006397
VACAPES	0.0000383	0.0000867	0.1218923	0.2758042
Southeast U.S. Continental Shelf Large Marine Ecosystem				
Navy Cherry Point	0.0000261	0.0000478	0.0003302	0.0006044
JAX	0.0000391	0.0000701	0.0000608	0.0001091
Caribbean and Gulf of Mexico Large Marine Ecosystems				
Key West	0.0000042	0.0000050	0.0000137	0.0000161
Gulf of Mexico Large Marine Ecosystem				
GOMEX	0.0000046	0.0000052	0.0000727	0.0000825
Northeast and Southeast U.S. Continental Shelf, Caribbean, and Gulf of Mexico Large Marine Ecosystems				
AFTT Study Area	0.0000000	0.0000000	0.0000000	0.0000000
Other AFTT Areas	0.0000035	0.0000006	0.0006060	0.0001087

GOMEX: Gulf of Mexico; JAX: Jacksonville; VACAPES: Virginia Capes

Military expended materials related to training exercises under a worst-case scenario would not impact more than 0.00009 percent of the available soft bottom habitat annually within any of the range complexes. Likewise, with the exception of VACAPES, the potential impact of the worst-case scenario on hard bottom habitats within each range complex does not exceed 0.0007 percent of the total available hard bottom. VACAPES had a higher percentage, not exceeding 0.13 percent, due to the relatively small amount of hard bottom habitat (30 km^2) that has been documented in that range complex. Given that these worst-case scenarios are highly unlikely to occur, the actual impact of military expended materials

within each range complex under the No Action Alternative on either hard or soft bottom substrates will be even less than provided in Table 3.3-14. Impacts are further reduced in areas where shallow coral reefs are documented to occur with mitigation measures designed to prevent some military expended materials from impacting shallow coral reefs and their associated hard substrate foundations (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Testing Activities

Testing activities involving military expended materials (Section 3.0.5.3.3.3, Military Expended Material Strikes) would have the potential to impact the marine substrates within the areas where the testing is occurring. As with training activities, each testing range was evaluated to determine what level of impact may be expected under the No Action Alternative.

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, areas involving the use of expended materials are expected to be the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and the Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the South Florida Ocean Measurement Facility Testing Range; Naval Surface Warfare Center, Panama City Division Testing Range; Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; and in Other AFTT Areas. However, the largest potential impacted area from military expended materials occurs in the VACAPES Range Complex (Table 3.3-10).

To determine the percentage of the total soft bottom or hard bottom substrate potentially impacted within a testing range, the total impacted area for each testing range from Table 3.3-10 was divided by the total amount of that particular substrate type within the same testing range as provided in Table 3.3-8. Results of this analysis are provided in Table 3.3-15.

Table 3.3-15: Potential Impact of Military Expended Materials from Testing Activities on Soft and Hard Bottom Substrates Annually within Each Range Complex

Testing Areas	Percent Impact to Soft Bottom			Percent Impact to Hard Bottom		
	No Action Alternative	Alternative 1	Alternative 2	No Action Alternative	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem						
Northeast	0.0000008	0.0000025	0.0000032	0.0002671	0.0008585	0.0010912
VACAPES	0.0000393	0.0000657	0.0000701	0.1252018	0.2091006	0.2230407
Southeast U.S. Continental Shelf Large Marine Ecosystem						
Navy Cherry Point	0.0000006	0.0000015	0.0000019	0.0000070	0.0000187	0.0000238
JAX	0.0000040	0.0000114	0.0000123	0.0000062	0.0000177	0.0000191
SFOMF	0.0000027	0.0000040	0.0000051	0.0000000	0.0000380	0.0000489
Caribbean and Gulf of Mexico Large Marine Ecosystems						
Key West	0.0000002	0.0000064	0.0000074	0.0000008	0.0000208	0.0000241
Gulf of Mexico Large Marine Ecosystem						
GOMEX	0.0000009	0.0000025	0.0000029	0.0000140	0.0000396	0.0000461
NSWC PCD	0.0000017	0.0000050	0.0000056	0.0000361	0.0001043	0.0001155
Northeast and Southeast U.S. Continental Shelf, Caribbean, and Gulf of Mexico Large Marine Ecosystems						
AFTT Study Area	0.0000001	0.0000001	0.0000001	0.0000041	0.0000071	0.0000078
Other AFTT Areas	0.0000000	0.0000000	0.0000000	0.0000015	0.0000008	0.0000016

GOMEX: Gulf of Mexico; JAX: Jacksonville; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; VACAPES: Virginia Capes

Military expended materials related to testing activities under a worst-case scenario would not impact more than 0.00004 percent of the available soft bottom habitat annually within any of the range complexes or testing ranges. Likewise, with the exception of VACAPES, the potential impact of the worst-case scenario on hard bottom habitats within each testing range does not exceed 0.0003 percent of the total available hard bottom. VACAPES had a higher percentage, not exceeding 0.13 percent, due to the relatively small amount of hard bottom habitat (30 km^2) that has been documented in that range complex. Given that the likelihood of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under the No Action Alternative on either hard or soft bottom substrates will be even less than provided in Table 3.3-15. Impacts are further reduced in areas where shallow coral reefs are documented to occur with mitigation measures designed to prevent some military expended materials from impacting shallow coral reefs and their associated hard substrate foundations (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

3.3.3.2.1.2 Alternative 1

Training Activities

Training activities involving military expended materials (Section 3.0.5.3.3.3, Military Expended Material Strikes and Appendix A, Navy Activities Descriptions) would have the potential to impact the marine substrates within the areas in which the training is occurring. As with the No Action Alternative, each range complex was evaluated to determine what level of impact could be expected under Alternative 1.

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1 the total amount of military expended materials is greater than the number expended in the No Action Alternative. However, the overall combined footprint of military expended materials actually declines from the No Action Alternative due to a reduction in ship hulks used in sinking exercise (Table 3.3-11). The activities under Alternative 1 would occur in the same geographic locations with the same types of expended materials in the same relative dimensions (excluding sinking exercises) as the No Action Alternative.

To determine the percentage of the total soft bottom or hard bottom substrate within a range complex that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each range complex from Table 3.3-11 was divided by the total amount of that particular substrate type within the same range complex as provided in Table 3.3-8. Results of this analysis are provided in Table 3.3-14.

Military expended materials related to training exercises under a worst-case scenario would not impact more than 0.00009 percent of the available soft bottom habitat annually within any of the range complexes. Likewise, with the exception of VACAPES, the potential impact of the worst-case scenario on hard bottom habitats within each range complex does not exceed 0.0007 percent of the total available hard bottom. VACAPES had a higher percentage, not exceeding 0.28 percent, due to the relatively small amount of hard bottom habitat (29 km^2) that has been documented in that range complex. Given that the likelihood of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under the No Action Alternative on either hard or soft bottom substrates will be even less than provided in Table 3.3-14. Impacts are further reduced in areas where shallow coral reefs are documented to occur with mitigation measures designed to prevent some military expended materials from impacting shallow coral reefs and their associated hard substrate foundations (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Testing Activities

Testing activities involving military expended materials (Section 3.0.5.3.3.3, Military Expended Material Strikes and Appendix A, Navy Activities Descriptions) would have the potential to impact the marine substrates within the areas the testing is occurring. Each testing range was evaluated to determine what level of impact could be expected under Alternative 1.

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1 the total amount of military expended materials is greater than the amount expended in the No Action Alternative. Activities under Alternative 1 would occur in the same geographic locations using the same types of military expended materials as the No Action Alternative. Based on the total dimensions of military expended materials, there is a decline in the VACAPES Range Complex and corresponding increase in the JAX and Navy Cherry Point Range Complexes (Table 3.3-12), compared to the No Action Alternative.

To determine the percentage of the total soft bottom or hard bottom substrate within a testing range that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each testing range from Table 3.3-12 was divided by the total amount of that particular substrate type within the same testing range as provided in Table 3.3-8. Results of this analysis are provided in Table 3.3-15.

Military expended materials related to testing activities under a worst-case scenario would not impact more than 0.00007 percent of the available soft bottom habitat annually within any of the testing ranges. Likewise, with the exception of VACAPES, the potential impact of the worst-case scenario on hard bottom habitats within each testing range does not exceed 0.0009 percent of the total available hard bottom. VACAPES had a higher percentage, not exceeding 0.21 percent, due to the relatively small amount of hard bottom habitat (29 km^2) that has been documented in that range complex. Given that the likelihood of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under Alternative 1 on either hard or soft bottom substrates will be even less than provided in Table 3.3-15. Impacts are further reduced in areas where shallow coral reefs are documented to occur with mitigation measures designed to prevent some military expended materials from impacting shallow coral reefs and their associated hard substrate foundations (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

3.3.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

Training activities involving military expended materials under Alternative 2 are exactly the same as under Alternative 1 and potential impacts would likewise be the same.

Testing Activities

Testing activities involving military expended materials (Section 3.0.5.3.3.3, Military Expended Material Strikes and Appendix A, Navy Activities Descriptions) would have the potential to impact the marine substrates within the areas the testing is occurring. Each range complex was evaluated to determine what the level of impact could be expected under Alternative 2.

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2 the total number of military expended materials is greater than the amount expended in Alternative 1. Activities under Alternative 2 would occur in the same geographic locations using the same types of military expended materials and the same relative dimensions as Alternative 1 (Table 3.3-13).

To determine the percentage of the total soft bottom or hard bottom substrate within a testing range that may potentially be impacted by military expended materials under a worst case scenario for each of the alternatives, the total impacted area for each testing range from Table 3.3-13 was divided by the total amount of that particular substrate type within the same testing range as provided in Table 3.3-8. Results of this analysis are provided in Table 3.3-15.

Military expended materials related to testing activities under a worst-case scenario would not impact more than 0.00007 percent of the available soft bottom habitat annually within any of the testing ranges. Likewise, with the exception of VACAPES, the potential impact of the worst-case scenario on hard bottom habitats within each testing range does not exceed 0.001 percent of the total available hard bottom. VACAPES had a higher percentage, not exceeding 0.23 percent, due to the relatively small amount of hard bottom habitat (29 km^2) that has been documented in that range complex. Given that the likelihood of these worst case scenarios occurring is highly unlikely, the actual impact of military expended materials within each range complex under Alternative 2 on either hard or soft bottom substrates will be even less than provided in Table 3.3-15. Impacts are further reduced in areas where shallow coral reefs are documented to occur with mitigation measures designed to prevent some military expended materials from impacting shallow coral reefs and their associated hard substrate foundations (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

3.3.3.2.1.4 Substressor Impact on Marine Substrate as Essential Fish Habitat

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that military expended material impacts to both soft and hard bottom substrates would be minimal with a duration period of long term to permanent within the Study Area (U.S. Department of the Navy 2013).

3.3.3.2.2 Impacts from Seafloor Devices

Seafloor devices represent any item used during training or testing activities that intentionally comes into contact with the seafloor, but are later recovered. These items include moored mine shapes, anchors, and robotic vehicles referred to as “crawlers.”

Mine shapes are typically deployed via surface vessels or fixed-wing aircraft. Most moored mines deployed from surface vessels are typically secured with up to a 2,700 lb. (1,225 kg) concrete mooring block (approximately 30 in. [76.2 cm] to a side). Moored mines deployed from fixed-wing aircraft enter the water and impact the bottom, becoming semi-submerged. Upon impact, the mine casing separates and the semi-buoyant mine floats through the water column until it reaches the end of the mooring line. Bottom mines are typically positioned manually and are allowed to free sink to the bottom to rest. Mine shapes are normally deployed over soft sediments and are recovered within 7 to 30 days following the completion of the training or testing events. As mine shapes are primarily deployed over soft bottom substrates, hard bottom and artificial structures should not be impacted. As a result of their temporary nature, mine shapes do not permanently impact the substrate on which they are placed, but will temporarily impair the ability of the substrate to function as a habitat for as long as the mine shape is in place.

Precision anchoring training exercises involve releasing of anchors in designated locations. The intent of these training exercises is to practice anchoring the vessel within 100 yards of the planned anchorage

location. These training activities typically occur within predetermined shallow water anchorage locations near ports with seafloors consisting of soft bottom substrate. The level of impact to the soft sediments would depend on the size of the anchor used, which would vary according to vessel type. As most of these activities occur in areas subject to constant wave action and cycles of erosion and deposition, disturbed areas would likely be reworked by waves and tides shortly after the disturbance.

Crawlers are fully autonomous, battery-powered amphibious vehicles used for functions such as reconnaissance missions in territorial waters. These devices are used to classify and map underwater mines in shallow water areas. The crawler is capable of traveling 2 ft. (0.61 m) per second along the seafloor and can avoid obstacles. The crawlers are equipped with various sonar sensors and communication equipment that enable these devices to locate and classify underwater objects and mines while rejecting miscellaneous clutter that would not pose a threat. Crawlers are used in the Gulf of Mexico testing ranges for the Naval Surface Warfare Center, Panama City Division Testing Range; the east coast of Florida at the South Florida Ocean Measurement Facility Testing Range; and in the northeast in Narragansett Bay and waters used for testing by the Naval Undersea Warfare Center Division, Newport Testing Range. In the South Florida Ocean Measurement Facility Testing Range, crawler use would be restricted to the Port Everglades Restricted Anchorage Area (see Section 2.1.6.2, Sea and Undersea Space) which covers depths from shore out to 200 m and contains extensive areas of hard bottom substrate. Crawlers move over the surface of the seafloor and would not harm or alter any hard substrates encountered; therefore the hard bottom habitat would not be impaired. In soft substrates, crawlers may leave a trackline of depressed sediments approximately 24 in. (62 cm) wide (the width of the device) in their wake. However, since these crawlers operate in shallow water, any disturbed sediments would be redistributed by wave and tidal action shortly (days to weeks) following the disturbance. Any disturbance to the soft sediments would not impair their ability to function as a habitat.

As none of the seafloor devices described would have any lasting impact on either soft or hard substrates, nor permanently impair their ability to function as a habitat, no further discussion is necessary.

3.3.3.2.2.1 Substressor Impact on Marine Substrate as Essential Fish Habitat

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training and testing activities may have an adverse effect on soft bottom substrates that constitute Essential Fish Habitat (U.S. Department of the Navy 2013). These potential impacts to soft bottom substrates would be minimal in size and temporary (recovery in days to weeks) to short term (recovery in weeks up to three years) in duration (U.S. Department of the Navy 2013). Hard bottom substrates and artificial structures should not be adversely affected by the use of seafloor devices.

3.3.4 Summary of Impacts on Marine Substrates

3.3.4.1 Combined Impacts of All Stressors

Of all the potential stressors, only explosives on or near the bottom and military expended materials have any measureable potential to impact marine habitats as a substrate for biological communities. The impact area for underwater explosions and military expended materials were all much less than one percent of the total area of documented soft bottom or hard bottom in their respective training or testing areas. The percentages are even lower for substrate impacts in the large marine ecosystems as a whole. Even multiplying by five years, the impacts are all less than one percent of the surveyed hard

bottom substrate with very unlikely worst-case scenarios. Such a low percentage of bottom habitat impacted suggests there would be little impact on the ability of marine habitats to serve as substrate for biological communities from either individual stressors or combined stressors.

Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) describes standard operating procedures, mitigation measures, and monitoring proposed to help reduce the potential impacts of explosives on or near the bottom and military expended materials on marine substrates and associated biogenic habitats.

3.3.4.1.1 No Action Alternative

The combined impact area of acoustic and physical disturbance and strike stressors proposed for training and testing events in the No Action Alternative would have minimal impact on the ability of soft shores, soft bottoms, hard shores, hard bottoms, or artificial substrates to serve their function as habitat (Table 3.3-16). The total area of mapped hard bottom (Figures 3.3-1 and 3.3-4) in the Study Area is over 39,498,559 ac. (159,845 km^2), which greatly exceeds the estimated 133 ac. (0.5378 km^2) of potential impacts given very unlikely worst case scenarios in addition to mitigation measures designed to avoid "surveyed" hard bottom or shallow coral reefs (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Table 3.3-16: Combined Impact on Marine Substrates for the No Action Alternative

Large Marine Ecosystems	Impact Footprints (km^2)		
	Explosives On or Near Bottom	Military Expended Materials	Total
Northeast U.S. Continental Shelf	0.0041	0.0787	0.0827
Southeast U.S. Continental Shelf	0.0011	0.0609	0.0619
Caribbean Sea/Gulf of Mexico (Key West)	0.0000	0.0030	0.0030
Gulf of Mexico	0.0207	0.0087	0.0294
Other AFTT Areas	0.0000	0.3541	0.3541
AFTT Study Area	0.0000	0.0066	0.0066
Total	**0.0258**	**0.5120**	**0.5378**

AFTT: Atlantic Fleet Training and Testing; km: kilometer

3.3.4.1.2 Alternative 1

The combined impact area of impulsive stressors, physical disturbances, and strike stressors proposed for training and testing events in Alternative 1 would have minimal impact on the ability of soft shores, soft bottoms, hard shores, hard bottoms, or artificial substrates to serve their function as habitat (Table 3.3-17). The total area of mapped hard bottom (Figures 3.3-1 and 3.3-4) in the Study Area is over 39,498,559 ac. (159,845 km^2), which dwarfs the estimated 114 ac. (0.4594 km^2) of potential impacts given very unlikely worst case scenarios in addition to mitigation measures designed to avoid "surveyed" hard bottom or shallow coral reefs (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Table 3.3-17: Combined Impact on Marine Substrates for Alternative 1

Large Marine Ecosystems	Impact Footprints (km^2)		
	Explosives On or Near Bottom	Military Expended Materials	Total
Northeast U.S. Continental Shelf	0.0709	0.1526	0.2235
Southeast U.S. Continental Shelf	0.0039	0.1145	0.1184
Caribbean Sea/Gulf of Mexico (Key West)	0.0007	0.0076	0.0083
Gulf of Mexico	0.0200	0.0141	0.0341
Other AFTT Areas	0.0000	0.0639	0.0639
AFTT Study Area	0.0000	0.0113	0.0113
Total	**0.0955**	**0.3640**	**0.4594**

AFTT: Atlantic Fleet Training and Testing; km: kilometer

3.3.4.1.3 Alternative 2 (Preferred Alternative)

The combined impact area of impulsive stressors, physical disturbances, and strike stressors proposed for training and testing events in Alternative 2 would have minimal impact on the ability of soft shores, soft bottoms, hard shores, hard bottoms, or artificial substrates to serve their function as habitat (Table 3.3-18). The total area of mapped hard bottom (Figures 3.3-1 and 3.3-4) in the Study Area is over 39,498,559 ac. (159,845 km^2), which dwarfs the estimated 127 ac. (0.5155 km^2) of potential impacts given very unlikely worst case scenarios in addition to mitigation measures designed to avoid "surveyed" hard bottom or shallow coral reefs (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Table 3.3-18: Combined Impact on Marine Substrates for Alternative 2

Large Marine Ecosystems	Impact Footprints (km^2)		
	Explosives On or Near bottom	Military Expended Materials	Total
Northeast U.S. Continental Shelf	0.0714	0.1579	0.2293
Southeast U.S. Continental Shelf	0.0041	0.1157	0.1198
Caribbean Sea/Gulf of Mexico (Key West)	0.0007	0.0530	0.0536
Gulf of Mexico	0.0208	0.0151	0.0359
Other AFTT Areas	0.0000	0.0643	0.0643
AFTT Study Area	0.0000	0.0125	0.0125
Total	**0.0970**	**0.4185**	**0.5155**

AFTT: Atlantic Fleet Training and Testing; km: kilometer

3.3.4.2 Essential Fish Habitat Determinations

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives on or near the bottom, vessel movement, military expended materials, and seafloor devices may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of non-living substrates that constitute Essential Fish Habitat and Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that individual stressor impacts to non-living substrates were all either no effect or minimal and

ranged in duration from temporary to permanent, depending on the habitat impacted (U.S. Department of the Navy 2013).

- Explosives could have a minimal and short term (soft bottom) to permanent (hard bottom) adverse effect on abiotic substrates
- Military expended material could have a minimal and long term to permanent adverse effect on both soft and hard bottom habitats
- Seafloor devices could have a minimal and temporary to short term adverse effect on abiotic soft substrates.

Mitigation measures should avoid impacts to surveyed hard bottom, as defined in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring. Impacts on water column as Essential Fish Habitat are summarized in corresponding resource sections (e.g., invertebrates, fish) because they are impacts on the organisms themselves.

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Atlantic Fleet Training and Testing
Final Environmental Impact Statement / Overseas Environmental Impact Statement

Volume 2
August 2013

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Department of the Navy

Cooperating Agency
National Marine Fisheries Service

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United States Fleet Forces
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3.4 MARINE MAMMALS

MARINE MAMMALS SYNOPSIS

The Navy considered all potential stressors and analyzed the following for marine mammals:

- Acoustic (sonar and other active acoustic sources; explosives; pile driving; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; aircraft noise)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance and strike (vessels; in-water devices; military expended materials; seafloor devices)
- Entanglement (fiber optic cables and guidance wires; parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (explosives and byproducts, metals, chemicals, and transmission of disease and parasites)

Preferred Alternative (Alternative 2)

- Acoustic: Pursuant to the Marine Mammal Protection Act (MMPA), the use of sonar and other active acoustic sources may result in Level A or Level B harassment of certain marine mammals; the use of explosives may result in mortality, Level A or Level B harassment of certain marine mammals; pile driving is not expected to result in mortality but may result in Level A or Level B harassment of bottlenose dolphins; the use of swimmer defense airguns, weapons firing, vessel noise, and aircraft noise are not expected to result in mortality, Level A or Level B harassment of any marine mammals. Pursuant to the Endangered Species Act (ESA), sonar and other active acoustic sources and explosives may affect and are likely to adversely affect certain ESA-listed marine mammals; pile driving, swimmer defense airguns, weapons firing, vessel noise, and aircraft noise may affect but are not likely to adversely affect certain ESA-listed marine mammals; and all acoustic sources will have no effect on marine mammal critical habitats.

- Energy: Pursuant to the MMPA, the use of electromagnetic devices and high energy lasers is not expected to result in mortality, Level A or Level B harassment of any marine mammals. Pursuant to the ESA, the use of electromagnetic devices may affect but are not likely to adversely affect certain ESA-listed marine mammals and will have no effect on marine mammal critical habitats. Pursuant to the ESA, the use of high energy lasers will have no effect on any ESA-listed marine mammal and will have no effect on marine mammal critical habitats.

- Physical Disturbance and Strike: Pursuant to the MMPA, the use of vessels may result in mortality or Level A harassment of certain marine mammal species but is not expected to result in Level B harassment of any marine mammal. The use of in-water devices, military expended materials, and seafloor devices are not expected to result in mortality, Level A or Level B harassment of any marine mammal. Pursuant to the ESA, vessel use may affect and is likely to adversely affect certain ESA-listed species. The use of in-water devices and military expended materials may affect but is not likely to adversely affect certain marine mammal species. The use of seafloor devices will have no effect on any ESA-listed marine mammal. The use of vessels, in-water devices, military expended materials, and seafloor devices will have no effect on marine mammal critical habitats.

- Entanglement: Pursuant to the MMPA, the use of fiber optic cables, guidance wires, and parachutes is not expected to result in mortality, Level A or Level B harassment of any marine mammal. Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect certain ESA-listed marine mammals.

- Ingestion: Pursuant to the MMPA, the potential for ingestion of all military expended materials is not expected to result in mortality, Level A or Level B harassment of any marine mammal. Pursuant to the ESA, the potential for ingestion of all military expended materials may affect but is not likely to adversely affect certain ESA-listed species.

- Secondary: Pursuant to the MMPA, secondary stressors are not expected to result in mortality, Level A or Level B harassment of any marine mammal. Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect certain ESA-listed marine mammals and will have no effect on marine mammal critical habitats.

The use of sonar and active acoustic sources are not expected to result in mortality, although the potential for beaked whale mortality coincident with use of sonar and other active acoustic sources is considered. The Navy has requested 10 beaked whale mortality takes under the MMPA as part of all training activities combined to account for any unforeseen potential impacts.

3.4.1 INTRODUCTION AND METHODS

Marine mammals are a diverse group of approximately 130 species. Most live predominantly in the marine habitat, although some species, such as seals, spend time in terrestrial habitats or, in freshwater environments, such as manatees and certain freshwater dolphins (Jefferson et al. 2008b; Rice 1998). The exact number of formally recognized marine mammal species changes periodically with new scientific understanding or findings (Rice 1998). For a list of current species classification, see the formal list *Marine Mammal Species and Subspecies* maintained by the Society for Marine Mammalogy.

All marine mammals in the United States are protected under the Marine Mammal Protection Act (MMPA), and some species receive additional protection under the Endangered Species Act (ESA). Section 3.0.1 (Regulatory Framework) discusses the regulatory framework. Within the framework of the MMPA, a marine mammal "stock" is defined as "a group of marine mammals of the same species or smaller taxon (subspecies) in a common spatial arrangement that interbreed when mature" (16 United States Code [U.S.C.] § 1362). For management under the MMPA, a stock is considered an isolated population or group of individuals within a whole species that is found in the same area. However, in practice, recognized management stocks may fall short of this ideal because of a lack of information or other reasons and in some cases may even include multiple species, as with certain beaked whales (Carretta et al. 2010).

There are 48 marine mammal species known to exist in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area). Among these species are 93 stocks managed by the National Marine Fisheries Service (NMFS) or the United States (U.S.) Fish and Wildlife Service in the U.S. Exclusive Economic Zone. These species and stocks are presented in Table 3.4-1, and relevant information on their status, distribution, abundance, and ecology is presented in Section 3.4.2 (Affected Environment). Some material contained in this chapter was summarized from the book *Marine Mammals of the World: A Comprehensive Guide to Their Identification* (Jefferson et al. 2008b). In addition, portions of text for individual species were excerpted directly from 2010 and 2012 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Waring et al. 2010). Table 3.0-2 relates Navy activity areas to the appropriate large marine ecosystem, open ocean area, bay, sound, or estuary.

For summaries of the general biology and ecology of marine mammals beyond the scope of this section, see Rice (1998), Reynolds and Rommel (1999), Twiss and Reeves (1999), Hoelzel (2002), Berta et al. (2006), Jefferson et al. (2008b), and Perrin et al. (2008b). Additional species profiles and information on the biology, life history, species distribution and conservation of marine mammals can also be found on the following websites:

- National Marine Fisheries Service Office of Protected Resources (includes species distribution maps)
- Ocean Biogeographic Information System-Spatial Ecological Analysis of Megavertebrate Populations species profiles
- International Whaling Commission
- International Union for Conservation of Nature, Cetacean Specialist Group
- The Marine Mammal Commission
- Society for Marine Mammalogy

Table 3.4-1: Marine Mammal Occurrence within the Atlantic Fleet Training and Testing Study Area

Common Name	Scientific Name[1]	ESA/MMPA Status[2]	Stock[3]	Stock Abundance[3] Best (CV) / Min	Occurrence in Study Area[4]		
					Open Ocean	Large Marine Ecosystems	Bays, Rivers, and Estuaries
Order Cetacea							
Suborder Mysticeti (baleen whales)							
Family Balaenidae (right whales)							
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered, Strategic, Depleted	Western North Atlantic	444 (0) / 444	Gulf Stream, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Bowhead Whale	*Balaena mysticetus*	Endangered, Strategic, Depleted	West Greenland	1,230[5] / 490–2,940	Labrador Current	Newfoundland-Labrador Shelf, West Greenland Shelf	–
Family Balaenopteridae (rorquals)							
Humpback Whale	*Megaptera novaeangliae*	Endangered, Strategic, Depleted	Gulf of Maine	823 (0) / 823	Gulf Stream, North Atlantic Gyre, Labrador Current	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Minke Whale	*Balaenoptera acutorostrata*		Canadian east coast	20,741 (0.30) / 16,199	Gulf Stream, North Atlantic Gyre, Labrador Current	Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Bryde's Whale	*Balaenoptera brydei/edeni*		Gulf of Mexico Oceanic	33 (1.07) / 16	Gulf Stream, North Atlantic Gyre	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf	–
Sei Whale	*Balaenoptera borealis*	Endangered, Strategic, Depleted	Nova Scotia	357 (0.52) / 236	Gulf Stream, North Atlantic Gyre, Labrador Current	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Fin Whale	*Balaenoptera physalus*	Endangered, Strategic, Depleted	Western North Atlantic	3,522 (0.27) / 2718	Gulf Stream, North Atlantic Gyre, Labrador Current	Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Blue Whale	*Balaenoptera musculus*	Endangered, Strategic, Depleted	Western North Atlantic	NA / 440[6]	Gulf Stream, North Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Suborder Odontoceti (toothed whales)							
Family Physeteridae (sperm whale)							
Sperm Whale	*Physeter macrocephalus*	Endangered, Strategic, Depleted	North Atlantic	1,593 (0.56) / 1,187	Gulf Stream, North Atlantic Gyre, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
		Endangered, Strategic, Depleted	Gulf of Mexico Oceanic	763 (0.38) / 560	–	Gulf of Mexico	–
		Endangered, Strategic, Depleted	Puerto Rico and U.S. Virgin Islands	unknown	North Atlantic Gyre	Caribbean Sea	–
Family Kogiidae (sperm whales)							
Pygmy Sperm Whale	*Kogia breviceps*	Strategic	Western North Atlantic	741 (0.) / 535	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico Oceanic	186(1.04) / 90[7]	–	Gulf of Mexico, Caribbean Sea	–
Dwarf Sperm Whale	*Kogia sima*		Western North Atlantic	1042 (0.65) / 632	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf	–
			Gulf of Mexico Oceanic	186(1.04) / 90[7]	–	Gulf of Mexico, Caribbean Sea	–

[1] Taxonomy follows Perrin 2009.

[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, are declining and are likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.

[3] Coefficient of variation (CV) is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2012 Stock Assessment Reports (Waring et al. 2010).

[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems— West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, Gulf of Mexico, and inland waters of Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay (Table 3.0-2 and Figure 3.0-1 in Section 3.0.3, Ecological Characterization of the Study Area).

[5] The bowhead whale population off the west coast of Greenland is not managed by NMFS and therefore does not have an associated Stock Assessment Report. Abundance and 95 percent confidence interval are provided by the International Whaling Commission.

[6] Photo identification catalogue count of 440 recognizable blue whale individuals from the Gulf of St. Lawrence is considered a minimum population estimate for the western North Atlantic stock.

[7] Estimate may include both the pygmy and dwarf sperm whales

Table 3.4-1: Marine Mammal Occurrence within the Atlantic Fleet Training and Testing Study Area (Continued)

Common Name	Scientific Name[1]	ESA/MMPA Status[2]	Stock[3]	Stock Abundance[3] Best (CV) / Min	Occurrence in Study Area[4]		
					Open Ocean	Large Marine Ecosystems	Bays, Rivers, and Estuaries
Family Monodontidae (beluga whale and narwhal)							
Beluga Whale	*Delphinapterus leucas*		NA[8]	NA[8]		Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Narwhal	*Monodon monoceros*		NA[9]	NA[9]		Newfoundland-Labrador Shelf, West Greenland Shelf	–
Family Ziphiidae (beaked whales)							
Cuvier's Beaked Whale	*Ziphius cavirostris*		Western North Atlantic	4,962 (0.37) / 3,670	Gulf Stream, North Atlantic Gyre, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico Oceanic	74 (1.04) / 36		Gulf of Mexico, Caribbean Sea	–
			Puerto Rico and U.S. Virgin Islands	Unknown	–	Caribbean Sea	
True's Beaked Whale	*Mesoplodon mirus*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Gervais' Beaked Whale	*Mesoplodon europaeus*		Western North Atlantic	1,847 (0.96) / 935	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast United States Continental Shelf	–
			Gulf of Mexico Oceanic	149 (.91) / 77[11]	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf	–
Sowerby's Beaked whale	*Mesoplodon bidens*		Western North Atlantic	3,653 (0.69) / 2,160[10]	Gulf Stream, North Atlantic Gyre	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Blainville's Beaked Whale	*Mesoplodon densirostris*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico Oceanic	149 (.91) / 77[11]	–	Gulf of Mexico, Caribbean Sea	–
Northern Bottlenose Whale	*Hyperoodon ampullatus*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Family Delphinidae (dolphins)							
Rough-Toothed Dolphin	*Steno bredanensis*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre	Caribbean Sea, Southeast U.S. Continental Shelf	–
			Gulf of Mexico (Outer continental shelf and Oceanic)	624 (0.99) / 311	–	Gulf of Mexico, Caribbean Sea	–
Bottlenose Dolphin	*Tursiops truncatus*	Strategic, Depleted	Western North Atlantic, offshore[12]	81,588 (0.17) / 70,775	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf	–
		Strategic, Depleted	Western North Atlantic, coastal, northern migratory	9,604 (0.36) / 7,147	–	Southeast U.S. Continental Shelf	Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River
		Strategic, Depleted	Western North Atlantic, coastal, southern migratory	12,482 (0.32) / 9,591	–	Southeast U.S. Continental Shelf	Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River
		Strategic, Depleted	Western North Atlantic, coastal, South Carolina/ Georgia	7,738 (0.23) / 6,399	–	Southeast U.S. Continental Shelf	Kings Bay, St. Johns River
		Strategic, Depleted	Western North Atlantic, coastal, Northern Florida	3,064 (0.24) / 2,511	–	Southeast U.S. Continental Shelf	Kings Bay, St. Johns River

[1] Taxonomy follows Perrin 2009.

[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, are declining and are likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.

[3] Coefficient of variation (CV) is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2012 Stock Assessment Reports (Waring et al. 2010).

[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems— West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, Gulf of Mexico, and inland waters of Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay (Table 3.0-2 and Figure 3.0-1 in Section 3.0.3, Ecological Characterization of the Study Area).

[8] Beluga whales in the Atlantic are not managed by NMFS and have no associated Stock Assessment Report.

[9] Narwhals in the Atlantic are not managed by NMFS and have no associated Stock Assessment Report.

[10] Estimate includes Cuvier's beaked whales and undifferentiated *Mesoplodon* species.

[11] Estimate includes Gervais' and Blainville's beaked whales

[12] Estimate may include sightings of the coastal form.

Table 3.4-1: Marine Mammal Occurrence within the Atlantic Fleet Training and Testing Study Area (Continued)

Common Name	Scientific Name[1]	ESA/MMPA Status[2]	Stock[3]	Stock Abundance[3] Best (CV) / Min	Occurrence in Study Area[4]		
					Open Ocean	Large Marine Ecosystems	Bays, Rivers, and Estuaries
		Strategic	Western North Atlantic, coastal, Central Florida	6,318 (0.26) / 5,094	–	Southeast U.S. Continental Shelf	Port Canaveral
		Strategic	Northern North Carolina Estuarine System	950 (0.23) / 785	–	Southeast U.S. Continental Shelf	Beaufort Inlet, Cape Fear River
		Strategic	Southern North Carolina Estuarine System	2,454 (0.53) / 1,614	–	Southeast U.S. Continental Shelf	Beaufort Inlet, Cape Fear River
		Strategic	Charleston Estuarine System	Unknown	–	Southeast U.S. Continental Shelf	–
		Strategic	Northern Georgia/ Southern South Carolina Estuarine System	Unknown	–	Southeast U.S. Continental Shelf	–
		Strategic	Southern Georgia Estuarine System	Unknown	–	Southeast U.S. Continental Shelf	Kings Bay, St. Johns River
		Strategic	Jacksonville Estuarine System	Unknown	–	Southeast U.S. Continental Shelf	Kings Bay, St. Johns River
		Strategic	Indian River Lagoon Estuarine System	Unknown	–	Southeast U.S. Continental Shelf	Port Canaveral
		Strategic	Biscayne Bay	Unknown	–	Southeast U.S. Continental Shelf	–
			Florida Bay	514 (0.17) / 447	–	Gulf of Mexico	–
			Gulf of Mexico Continental Shelf	Unknown	–	Gulf of Mexico	–
			Gulf of Mexico, eastern coastal	7,702 (0.19) / 6,551	–	Gulf of Mexico	–
			Gulf of Mexico, northern coastal	2,473 (0.25) / 2,004	–	Gulf of Mexico	St. Andrew Bay, Pascagoula River
		Strategic	Gulf of Mexico, western coastal	Unknown	–	Gulf of Mexico	Corpus Christi Bay, Galveston Bay
			Gulf of Mexico Oceanic	5,806 (0.39) / 4,230	–	Gulf of Mexico	–
		Strategic	Gulf of Mexico bay, sound, and estuarine (29 stocks)	Unknown	–	Gulf of Mexico	St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay
			Barataria Bay	Unknown	–	Gulf of Mexico	–
			St. Joseph Bay	146 (0.18) / 126	–	Gulf of Mexico	–
			Choctawhatchee Bay	179 (0.04) / 173	–	Gulf of Mexico	–
			Puerto Rico and U.S. Virgin Islands	Unknown	–	Caribbean Sea	–
Pantropical Spotted Dolphin	*Stenella attenuata*		Western North Atlantic	4,439 (0.49) / 3,010	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	50,880 (0.27) / 40,699	–	Gulf of Mexico, Caribbean Sea	–
Atlantic Spotted Dolphin	*Stenella frontalis*		Western North Atlantic	26,798 (0.66) / 16,151	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico (Continental shelf and Oceanic)	Unknown	–	Gulf of Mexico, Caribbean Sea	–
Spinner Dolphin	*Stenella longirostris*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	11,441 (0.83) / 6,221	–	Gulf of Mexico, Caribbean Sea	–
			Puerto Rico and U.S. Virgin Islands	Unknown	–	Caribbean Sea	–

[1] Taxonomy follows Perrin 2009.

[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, are declining and are likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.

[3] Coefficient of variation (CV) is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2012 Stock Assessment Reports (Waring et al. 2010).

[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems— West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, Gulf of Mexico, and inland waters of Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay Table 3.0-2 and Figure 3.0-1 in Section 3.0.3, Ecological Characterization of the Study Area).

Table 3.4-1: Marine Mammal Occurrence within the Atlantic Fleet Training and Testing Study Area (Continued)

Common Name	Scientific Name[1]	ESA/MMPA Status[2]	Stock[3]	Stock Abundance[3] Best (CV) / Min	Occurrence in Study Area[4]		
					Open Ocean	Large Marine Ecosystems	Bays, Rivers, and Estuaries
Clymene Dolphin	*Stenella clymene*		Western North Atlantic	Unknown	Gulf Stream	Southeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	129 (1.0) / 64	–	Gulf of Mexico, Caribbean Sea	–
Striped Dolphin	*Stenella coeruleoalba*		Western North Atlantic	46,882 (0.33) / 35,763	Gulf Stream	-	–
			Gulf of Mexico Oceanic	1,849 (0.77) / 1,041	–	Gulf of Mexico, Caribbean Sea	–
Fraser's Dolphin	*Lagenodelphis hosei*		Western North Atlantic	Unknown	North Atlantic Gyre	Southeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	Unknown	–	Gulf of Mexico, Caribbean Sea	–
Risso's Dolphin	*Grampus griseus*		Western North Atlantic	20,479 (0.59) / 12,920	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico Oceanic	2,442 (0.57) / 1,563	–	Gulf of Mexico, Caribbean Sea	–
Atlantic White-Sided Dolphin	*Lagenorhynchus acutus*		Western North Atlantic	23,390 (0.23) / 19,019	Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
White-Beaked Dolphin	*Lagenorhynchus albirostris*		Western North Atlantic	2,003 (0.94) / 1,023	Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Long-Beaked Common Dolphin	*Delphinus capensis*		NA[13]	Unknown[13]	–	Caribbean Sea[13]	–
Short-Beaked Common Dolphin	*Delphinus delphis*		Western North Atlantic	67,191 (0.29) / 52,893	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Melon-Headed Whale	*Peponocephala electra*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	2,235 (0.75) / 1,274	–	Gulf of Mexico, Caribbean Sea	–
Pygmy Killer Whale	*Feresa attenuata*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre	Southeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	152 (1.02) / 75	–	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf	–
False Killer Whale	*Pseudorca crassidens*		Gulf of Mexico Oceanic	Unknown	Gulf Stream, North Atlantic Gyre	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf	–
Killer Whale	*Orcinus orca*		Western North Atlantic	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current	Southeast U.S. Continental Shelf, Northeast U.S. Continental shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
			Gulf of Mexico Oceanic	28 (1.02) / 14	–	Gulf of Mexico, Caribbean Sea	–
Long-Finned Pilot Whale	*Globicephala melas*		Western North Atlantic	12,619 (0.37) / 9,333	Gulf Stream	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Short-Finned Pilot Whale	*Globicephala macrorhynchus*		Western North Atlantic	24,674 (0.45) / 17,190	Gulf Stream	Northeast Continental Shelf, Southeast U.S. Continental Shelf	–
			Gulf of Mexico Oceanic	2,415 (0.66) / 1456	–	Gulf of Mexico, Caribbean Sea	–
			Puerto Rico and U.S. Virgin Islands	Unknown	–	Caribbean Sea	–
Family Phocoenidae (porpoises)							
Harbor Porpoise	*Phocoena phocoena*		Gulf of Maine/Bay of Fundy	89,054 (0.47) / 60,970	–	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebec River

[1] Taxonomy follows Perrin 2009.

[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, are declining and are likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.

[3] Coefficient of variation (CV) is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2012 Stock Assessment Reports (Waring et al. 2010).

[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems— West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, Gulf of Mexico, and inland waters of Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay (Table 3.0-2 and Figure 3.0-1 in Section 3.0.3, Ecological Characterization of the Study Area).

[13] Long-beaked common dolphins are only known in the western Atlantic from a discrete population off the east coast of South America.

[14] Polar bears are managed by the U.S. Fish and Wildlife Service but do not occur in the Atlantic U.S. Exclusive Economic Zone and therefore have no associated Stock Assessment Reports.

Table 3.4-1: Marine Mammal Occurrence within the Atlantic Fleet Training and Testing Study Area (Continued)

Common Name	Scientific Name[1]	ESA/MMPA Status[2]	Stock[3]	Stock Abundance[3] Best (CV) / Min	Occurrence in Study Area[4]		
					Open Ocean	Large Marine Ecosystems	Bays, Rivers, and Estuaries
Order Carnivora							
Family Ursidae (bears)							
Polar Bear	*Ursus maritimus*	Threatened	NA[14]	Unknown	–	Newfoundland-Labrador Shelf, West Greenland Shelf	–
Suborder Pinnipedia							
Family Phocidae (true seals)							
Ringed Seal	*Pusa hispida*	Threatened	NA[15]	Unknown	–	Newfoundland-Labrador Shelf, West Greenland Shelf	–
Bearded Seal	*Erignathus barbatus*		NA[15]	Unknown	–	Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	
Hooded Seal	*Cystophora cristata*		Western North Atlantic	Unknown	–	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebec River
Harp Seal	*Pagophilus groenlandicus*		Western North Atlantic	Unknown	–	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	–
Gray Seal	*Halichoerus grypus*		Western North Atlantic	Unknown	–	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebeck River
Harbor Seal	*Phoca vitulina*		Western North Atlantic	Unknown	–	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebeck River
Family Odobenidae (walrus)							
Walrus	*Odobenus rosmarus*		NA[16]	NA[16]	–	Newfoundland-Labrador Shelf, West Greenland Shelf	–
Order Sirenia							
Family Trichechidae (manatees)							
West Indian Manatee	*Trichechus manatus*[17]	Endangered, Strategic	Florida, Antillean	4,840[18]	–	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean	Cape Fear River, Bogue Sound, St. Johns River, Kings Bay, Port Canaveral, Pascagoula River, St. Andrew Bay, Corpus Christi Bay, Sabine Lake, and Galveston Bay

[1] Taxonomy follows Perrin 2009.

[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, are declining and are likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.

[3] Coefficient of variation (CV) is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2012 Stock Assessment Reports (Waring et al. 2010).

[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems— West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, Gulf of Mexico, and inland waters of Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay (Table 3.0-2 and Figure 3.0-1 in Section 3.0.3, Ecological Characterization of the Study Area).

[15] These species do not occur within the Atlantic U.S. Exclusive Economic Zone and therefore are not managed by NMFS and have no associated Stock Assessment Reports. See the appropriate subsections below for details of populations that may be found within the Study Area.

[16] Walruses are managed by the U.S. Fish and Wildlife Services in the Atlantic U.S. Exclusive Economic Zone and therefore have no associated Stock Assessment Report. The North Atlantic Marine Mammal Commission identifies eight putative stocks in the Atlantic ranging from under 500 to 6,000 individuals each, although they note that the quality ratings of these estimates are only fair to poor.

[17] The West Indian manatee is divided into the Florida (*Trichechus manatus latirostris*) and Antillean (*Trichechus manatus manatus*) subspecies

[18] The West Indian manatee is managed by the U.S. Fish and Wildlife Service. Actual count is based on a single synoptic survey of warm-water refuges in January 2011 (Florida Fish and Wildlife Conservation Commission 2011)

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3.4.2 AFFECTED ENVIRONMENT

Four main types of marine mammals are generally recognized: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), sirenians (manatees, dugongs, and sea cows), and other marine carnivores (sea otters, marine otters, and polar bears) (Jefferson et al. 2008b; Rice 1998). The order Cetacea is divided into two suborders – Odontoceti and Mysticeti. The toothed whales, dolphins, and porpoises (suborder Odontoceti) range in size from slightly longer than 3.3 ft. (1 m) to more than 60 ft. (18 m) and have teeth, which they use to capture and consume individual prey. The baleen whales (suborder Mysticeti) are universally large (more than 15 ft. [5 m] as adults). They are called baleen whales because, instead of teeth, they have a fibrous structure made of keratin, a type of protein like that found in human fingernails, in their mouths, which enables them to filter or extract food from the water for feeding. They are batch feeders that use this baleen instead of teeth to engulf, suck, or skim large numbers of prey, such as small schooling fish, shrimp, or microscopic sea animals (i.e., plankton) from the water or out of ocean floor sediments (Heithaus and Dill 2008). The baleen whales are further divided into two families—right whales and rorquals. Rorquals have a series of longitudinal folds of skin, often referred to as throat grooves, running from below the mouth back toward the navel. Rorquals are slender and streamlined in shape, compared with their relatives the right whales, and most have narrow, elongated flippers. Detailed reviews of the different groups of cetaceans can be found in Perrin et al. (2009).

Most pinnipeds can be divided into two families: phocids (true seals) and the otariids (fur seals and sea lions). Another family of pinnipeds contains a single species, the walrus, which in many ways is an intermediate between the true seals and sea lions (Berta et al. 2006). The order Sirenia (sirenians) includes one species of manatee found in the Study Area, the West Indian manatee (*Trichechus manatus*), a slow-moving plant-eater that inhabits shallow coastal and inland waters. Finally, the polar bear is a marine carnivore that is usually classified as a marine mammal found in the Study Area.

Cetaceans inhabit virtually every marine environment in the Study Area. Marine mammals in the Study Area occur from coastal and inland waters to the open Atlantic Ocean. Their distribution is influenced by many factors, primarily patterns of major ocean currents, which in turn affect prey productivity. The continuous movement of water from the ocean bottom to the surface creates a nutrient-rich, highly productive environment for marine mammal prey (Jefferson et al. 2008b). For most cetaceans, prey distribution, abundance, and quality largely determine where they occur at any specific time (Heithaus and Dill 2008). Most of the baleen whales are migratory, but many of the toothed whales do not migrate in the strictest sense. Instead, they undergo seasonal dispersal or shifts in density. Pinnipeds occur mostly in coastal habitats or within those regions over the continental shelf, while manatees, otters, and polar bears are the most coastal groups of marine mammals. All require land or shallow coastal waters as habitat for reproducing, resting, and, in some cases, feeding.

3.4.2.1 Group Size

Many species of marine mammals, particularly odontocetes (toothed whales), are highly social animals that spend much of their lives living in groups or pods ranging from several to several thousand individuals. Similarly, aggregations of baleen whales may form during particular breeding or foraging seasons, although they do not persist through time as a social unit. Group or podding behavior in marine mammals is important because it enhances an observer's ability to detect them for mitigation and monitoring. Group size characteristics were also incorporated into the acoustic effects modeling to represent a more realistic patchy distribution for the given density. A comprehensive and systematic review of relevant literature and data was conducted for available published and unpublished literature

including journals, books, technical reports, survey cruise reports, raw data from cruises, theses, and dissertations. The results of this review were compiled into a technical report (Watwood and Buonantony 2012), including tables of group size information by species along with relevant citations.

3.4.2.2 Diving

Some species of marine mammals have developed specialized adaptations to allow them to make deep dives lasting over an hour, primarily for foraging on deep-water prey such as squid. Other species spend the majority of their lives close to the surface and make relatively shallow dives. The diving behavior of a particular species or individual has implications for an observer's ability to detect them for mitigation and monitoring. In addition, their relative distribution through the water column is an important consideration when conducting acoustic exposure analyses. Information and data on diving behavior for each species of marine mammal was compiled and summarized in a technical report (Watwood and Buonantony 2012) that provides the detailed summary of time at depth used for distributing animals through the water column within the acoustic exposure model.

3.4.2.3 Vocalization and Hearing of Marine Mammals

All marine mammals studied can use sound to forage, orient, socially interact with others, and detect and respond to predators. Measurements of marine mammal sound production and hearing capabilities provide some basis for assessment of whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically.

Marine mammal hearing abilities are quantified using live animals by either behavioral audiometry or electrophysiology. Behavioral audiograms, which are plots of animals' exhibited hearing threshold versus frequency, are obtained from captive, trained live animals using standard testing procedures with appropriate controls and are considered to be a more accurate representation of a subject's hearing abilities. Behavioral audiograms of marine mammals are difficult to obtain because many species are too large, too rare, and too difficult to acquire and maintain. Consequently, our understanding of a species' hearing ability may be based on the behavioral audiogram of a single individual or small group of animals. In addition, captive animals may be exposed to local ambient sounds and other environmental factors that could affect their hearing abilities and may not accurately reflect the hearing abilities of free-swimming animals. For animals not available in captive or stranded settings (including large whales and rare species) estimates of hearing capabilities are made based on physiological structures, vocal characteristics, and extrapolations from related species.

In comparison, electrophysiological audiometry measures small electrical voltages produced by neural activity when the auditory system is stimulated by sound. The technique is relatively fast, does not require a conscious response, and is routinely used to assess the hearing of newborn humans. Hearing response in relation to frequency for both methods of evaluating hearing ability is depicted as a U-shaped curve showing the frequency range of best sensitivity (lowest hearing threshold) and frequencies above and below with higher threshold values.

Direct measurements of hearing sensitivity exist for approximately 25 of the nearly 130 species of marine mammals. Table 3.4-2 summarizes sound production and hearing capabilities for marine mammal species in the Study Area. For this analysis, marine mammals are arranged into the following functional hearing groups based on their generalized hearing sensitivities: high-frequency cetaceans, mid-frequency cetaceans, low-frequency cetaceans (mysticetes), phocid pinnipeds (true seals), odobenid pinnipeds (walrus), polar bears, mustelids (sea otters), and sirenians (manatees). Note that frequency ranges for high-, mid-, and low-frequency cetacean hearing differ from the frequency ranges

Table 3.4-2: Hearing and Vocalization Ranges for All Marine Mammal Functional Hearing Groups and Species Potentially Occurring within the Study Area

Functional Hearing Group (FHG)	Species which may be present in the Study Area	FHG Sound Production[1]		FHG Hearing Ability Frequency Range[1]
		Frequency Range	Source Level (dB re 1 µPa at 1 m)	
High-Frequency Cetaceans	Harbor porpoise, *Kogia* species (dwarf and pygmy sperm whales)	100 Hz to 200 kHz [e,m,q]	120 to 205	200 Hz to 180 kHz [d,v]
Mid-Frequency Cetaceans	Sperm whale, Blainville's beaked whale, True's beaked whale, Gervais' beaked whale, Cuvier's beaked whale, northern bottlenose whale, Sowerby's beaked whale, bottlenose dolphin, Clymene dolphin, short-beaked common dolphin, long-beaked common dolphin, Fraser's dolphin, killer whale, false killer whale, pygmy killer whale, melon-headed whale, short-finned pilot whale, long-finned pilot whale, Risso's dolphin, rough-toothed dolphin, spinner dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, striped dolphin, white-beaked dolphin, Atlantic white-sided dolphin, narwhal, beluga whale	100 Hz to >100 kHz [e,h,j,l,m]	118 to 236	150 Hz to 160 kHz [v]
Low-Frequency Cetaceans	Bowhead whale, North Atlantic right whale, blue whale, Bryde's whale, fin whale, humpback whale, minke whale, sei whale	10 Hz to 20 kHz [a,m,r]	129 to 195	7 Hz to 22 kHz [v]
Phocidae	Ringed seal, bearded seal, hooded seal, gray seal, harbor seal, harp seal	100 Hz to 12 kHz [b,m,n,o]	103 to 180	In-water: 75 Hz to 75 kHz In-air: 75 Hz to 30 kHz [t,u,v]
Otariidae and Odobenidae	Walrus	30 Hz to 10 kHz [c,m,o,p]	120 - 196	In-water: 50 Hz to 50 kHz In-air: 50 Hz to 75 kHz [t,u,v]
Mustelidae	None present	Primarily 4 kHz to 8 kHz [f,l,k,m]	In-air: up to 113	In-water: unknown In-air: 125 Hz to 35 kHz; peak sensitivity at 16 kHz [s,v]
Sirenians	West Indian manatee	500 Hz to 16 kHz [g,m]	91 to 150	75 Hz to 75 kHz [v]
Polar Bear	Polar bear	–	–	In-water: 50 Hz to 50 kHz In-air: 50 Hz to 35 kHz [v]

[1]Sound production levels and ranges and functional hearing ranges are generalized composites for all members of the functional hearing groups, regardless of their presence in this Study Area.

Sound production data adapted and derived from: [a]Aburto, et al. 1997; [b]Hanggi & Schusterman, 1994; [c]Hughes et al. 2011; [d]Kastelein et al., 2002; [e]Marten 2000; [f]McShane et al. 1995; [g]Miksis-Olds & Tyack 2009; [h]Møhl et al. 2003; [i]O'Shea & Poché Jr. 2006; [j]Philips et al. 2003; [k]Phillips et al. 2004; [l]Rasmussen et al. 2006; [m]Richardson et al. 1995; [n]Rossong & Terhune 2009; [o]Schusterman et al. 1970; [p]Verboom & Kastelein 1995; [q]Villadsgaard et al. 2007; [r]Würsig et al. 1980.

Hearing data adapted and derived from: [s]Ghoul & Reichmuth 2012; [t]Hemila et al. 2006; [d]Kastelein et al. 2002; [u]Schusterman1981; [v]Southall et al. 2007

These frequency ranges and source levels include social sounds for all groups and echolocation sounds for mid- and high-frequency groups. In-air vocalizations were not included for pinniped groups. Vocalization parameters for Mustelidae were measured from in-air vocalizations; no underwater data are available for this group. Energy and harmonics are present in their calls above 10 kHz to 60 kHz although the behavioral functionality is unknown.

dB re 1 µPa @ 1 m: decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) at 1 meter; Hz: Hertz; kHz: kilohertz

defined in similar terms to describe active sonar systems. For discussion of all marine mammal functional hearing groups and their derivation see Finneran and Jenkins (2012).

3.4.2.3.1 High-Frequency Cetaceans

Marine mammals within the high-frequency cetacean functional hearing group are all odontocetes (toothed whales, suborder Odontoceti) and include eight species and subspecies of porpoises (family Phocoenidae), dwarf and pygmy sperm whales (family Kogiidae), six species and subspecies of river dolphins, and four species of *Cephalorynchus*. Only the following members of the high-frequency cetacean group are present in the Study Area: harbor porpoise, dwarf sperm whale, and pygmy sperm whale. Functional hearing in high-frequency cetaceans occurs between approximately 200 Hertz (Hz) and 180 kilohertz (kHz)(Southall et al. 2007).

Sounds produced by high-frequency cetaceans range from approximately 100 Hz to 200 kHz with source levels of 120 to 205 dB referenced to (re) 1 micro (µ) Pascal (Pa) at 1 meter (m) (Madsen et al. 2005; Richardson et al. 1995; Verboom and Kastelein 2003; Villadsgaard et al. 2007). Recordings of sounds produced by dwarf and pygmy sperm whales consist almost entirely of the click/pulse type. Porpoises, unlike most other odontocetes, do not produce whistles or do not whistle often (Awbrey et al. 1979; Bassett et al. 2009; Houck and Jefferson 1999; Richardson et al. 1995; Verboom and Kastelein 2003). High-frequency cetaceans also generate specialized clicks used in biosonar (echolocation) at frequencies above 100 kHz that are used to detect, localize, and characterize underwater objects such as prey (Richardson et al. 1995).

An auditory brainstem response study on a stranded pygmy sperm whale indicated best sensitivity between 90 to 150 kHz (Ridgway and Carder 2001). From a harbor porpoise audiogram using behavioral methods, detection thresholds were estimated from 250 Hz to 180 kHz, with the range of best hearing from 16 to 140 kHz and maximum sensitivity between 100 to 140 kHz (Kastelein et al. 2002b). While no empirical data on the hearing ability for Dall's porpoise are available, data on the morphology of the cochlea allow for estimation of the upper hearing threshold at about 170 to 200 kHz (Awbrey et al. 1979).

3.4.2.3.2 Mid-Frequency Cetaceans

Marine mammals within the mid-frequency cetacean functional hearing group are all odontocetes, and include the sperm whale (family Physeteridae); 32 species and subspecies of dolphins (family Delphinidae), the beluga and narwhal (family Monodontidae), and 19 species of beaked and bottlenose whales (family: Ziphiidae). The following members of the mid-frequency cetacean group are present or have a reasonable likelihood of being present in the Study Area: sperm whale, beaked whales (*Hyperoodon*, *Mesoplodon*, and *Ziphius* species), bottlenose dolphin, clymene dolphin, short-beaked common dolphin, long-beaked common dolphin, Fraser's dolphin, killer whale, false killer whale, pygmy killer whale, melon-headed whale, short-finned pilot whale, long-finned pilot whale, Risso's dolphin, rough-toothed dolphin, spinner dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, striped dolphin, white-beaked dolphin, Atlantic white-sided dolphin, narwhal, and beluga whale. Functional hearing in mid-frequency cetaceans is conservatively estimated to be between approximately 150 Hz and 160 kHz (Southall et al. 2007).

Hearing studies on cetaceans have focused primarily on odontocete species (see Kastelein et al. 2002b; Nachtigall et al. 2005; Szymanski et al. 1999; Yuen et al. 2005). Hearing sensitivity has been directly measured for a number of mid-frequency cetaceans, including Atlantic bottlenose dolphins (Johnson 1967), belugas (Finneran et al. 2005b; White et al. 1977), Indo-Pacific bottlenose dolphins (Houser et al.

2008), Black Sea bottlenose dolphins (Popov et al. 2007), striped dolphins (Kastelein et al. 2003), white-beaked dolphins (Nachtigall et al. 2008), Risso's dolphins (Nachtigall et al. 2005), killer whales (Szymanski et al. 1999), false killer whales (Yuen et al. 2005), common dolphins (Houser et al. 2010), Atlantic white-sided dolphins (Houser et al. 2010), Gervais' beaked whales (Finneran et al. 2009), and Blainville's beaked whales (Pacini et al. 2011). All audiograms exhibit the same general U-shape, with a functional hearing range between approximately 150 Hz and 160 kHz.

In general, odontocetes (including mid-frequency cetaceans) produce sounds across the widest band of frequencies. Their social vocalizations range from a few hundreds of Hz to tens of kHz (Southall et al. 2007) with source levels in the range of 100 to 170 dB re 1 µPa at 1 m (Richardson et al. 1995). As mentioned earlier, they also generate specialized clicks used in biosonar (echolocation) at frequencies above 100 kHz to detect, localize, and characterize underwater objects such as prey (Au 1993). Echolocation clicks have source levels that can be as high as 229 dB re 1 µPa peak-to-peak at 1 m (Au et al. 1974).

3.4.2.3.3 Low-Frequency Cetaceans

Marine mammals within the low-frequency functional hearing group are all mysticetes. This group comprises 13 species and subspecies of mysticete whales in five genera: *Balaena, Caperea, Eschrichtius, Megaptera,* and *Balaenoptera*. The following members of the low-frequency cetacean group (mysticetes) are present or have a reasonable likelihood of being present in the Study Area: bowhead whale, North Atlantic right whale, blue whale, Bryde's whale, fin whale, humpback whale, minke whale, and sei whale. Functional hearing in low-frequency cetaceans is conservatively estimated to be between about 7 Hz and 22 kHz (Southall et al. 2007).

Because of animal size and the availability of specimens, direct measurements of mysticete whale hearing are unavailable, although there was one effort to measure hearing thresholds in a stranded gray whale (Ridgway and Carder 2001). Because hearing ability has not been directly measured in these species, it is inferred from vocalizations, ear structure, and field observations. Vocalizations are audible somewhere in the frequency range of production, but the exact range cannot be inferred (Southall et al. 2007).

Mysticete cetaceans produce low-frequency sounds that range in the tens of Hz to several kHz that most likely serve social functions such as reproduction but may serve an orientation function as well (Green 1994; Green et al. 1994). Humpback whales are the notable exception within the mysticetes, with some calls exceeding 10 kHz. These sounds can be generally categorized as low-frequency moans; bursts or pulses; or more complex songs (Edds-Walton 1997). Source levels of most mysticete cetacean sounds range from 150 to 190 dB re 1 µPa at 1m (Richardson et al. 1995).

3.4.2.3.4 Pinnipeds

Pinnipeds are divided into three functional hearing groups: otariids (sea lions and fur seals), phocid seals (true seals), and odobenids (walrus) with different in-air and in-water hearing ranges. The Study Area only contains phocid seals and walrus. Otariid pinnipeds (sea lions and fur seals) are notably absent from the North Atlantic Ocean. Measurements of hearing sensitivity have been conducted on species representing all of the families of pinnipeds (Phocidae, Otariidae, Odobenidae)(Kastelein et al. 2002a; Kastelein et al. 2012a; Kastelein et al. 2005b; Moore and Schusterman 1987; Schusterman et al. 1972; Terhune 1988; Thomas et al. 1990a; Turnbull and Terhune 1990; Wolski et al. 2003).

Pinnipeds produce sounds both in air and water that range in frequency from approximately 100 Hz to 12 kHz, and it is believed that these sounds only serve social functions (Miller 1991) such as mother-pup recognition and reproduction. Source levels for pinniped vocalizations range from approximately 95 to 190 dB re 1 µPa at 1 m (Richardson et al. 1995).

3.4.2.3.4.1 Phocid Seals

Phocid seals (true seals) present or which have a reasonable likelihood of being present in the Study Area include the ringed seal, bearded seal, hooded seal, harp seal, gray seal, and harbor seal. Hearing in phocids has been tested in the following species: gray seals (Ridgway et al. 1975); harbor seals (Kastak and Schusterman 1998; Kastelein et al. 2012a; Kastelein et al. 2009a; Richardson et al. 1995; Southall et al. 2007; Terhune and Turnbull 1995; Wolski et al. 2003); harp seals (Terhune and Ronald 1971, 1972); Hawaiian monk seals (Thomas et al. 1990a); northern elephant seal (Kastak and Schusterman 1998; Kastak and Schusterman 1999); and ringed seals (Terhune and Ronald 1975, 1976).

Phocid functional hearing limits are estimated to be 75 Hz to 30 kHz in air and 75 Hz to 75 kHz in water (Kastak and Schusterman 1999; Kastelein et al. 2009a; Kastelein et al. 2009b; Møhl 1968a, b; Reichmuth 2008; Terhune and Ronald 1971, 1972).

3.4.2.3.4.2 Odobenids

The walrus is the only extant odobenid pinniped and may be found within the Study Area. The walrus is adapted to low-frequency sound with a range of best hearing underwater from 1 to 12 kHz and maximum hearing sensitivity around 12 kHz; its hearing ability falls off sharply at frequencies above 14 kHz (Kastelein et al. 2002c; Kastelein et al. 1996). The walrus hearing sensitivity is most similar to otariids, and therefore the walrus is assigned the same functional hearing range as for otariids (sea lions and fur seals) for this analysis. Functional hearing limits are conservatively estimated to be 50 Hz to 35 kHz in air and 50 Hz to 50 kHz in water (Southall et al. 2007).

Walruses make a wide variety of high-amplitude aerial and underwater sounds that range in frequency from 200 Hz to 10 kHz, including “bellows,” “barks,” “roars,” “bells,” clicks or pulses, grunts, and whistles (Kastelein et al. 2002c). Many of these vocalizations have social functions, while whistles are often produced during the mating season, and males use some for establishing territories and for courtship (Ray and Watkins 1975; Stirling et al. 1987; Verboom and Kastelein 1995).

3.4.2.3.5 Sirenians

The sirenian functional hearing group includes the manatees and dugong. The West Indian manatee is the only sirenian present in the Study Area. Behavioral data on manatees indicate they have an underwater hearing range of approximately 400 Hz to 76 kHz (Gerstein et al. 2008; Gerstein et al. 1999; Mann et al. 2009). Gerstein et al. (1999) obtained behavioral audiograms for two West Indian manatees and found an underwater hearing range of approximately 400 Hz to 76 kHz, with best sensitivity around 16 to 18 kHz. Mann et al. (2009) obtained masked behavioral audiograms from two manatees; sensitivity was shown to range from 250 Hz to 90 kHz, although the detection level at 90 kHz was 80 dB above the manatee’s frequency of lowest sensitivity (16 kHz). This audible frequency range is similar to that of phocids (Gerstein et al. 1999; Southall et al. 2007), and therefore manatees are assigned the same functional hearing range as that of phocid seals for this analysis.

Sirenians (manatees and dugongs) make underwater social sounds that range in frequency from 0.6 to 16 kHz, with West Indian manatees making sounds at lower frequencies than Amazonian manatees (Evans and Hearld 1970; Schevill and Watkins 1965). Source levels for manatee vocalizations have been

recorded between 91 and 150 dB re 1 µPa at 1 m (Miksis-Olds and Tyack 2009; Nowacek et al. 2003; Phillips et al. 2004).

3.4.2.3.6 Polar Bear

Airborne hearing threshold measurements of polar bears have shown best hearing sensitivity between 8 and 14 kHz, with a rapid decline in sensitivity below 125 Hz and above 20 kHz (Bowles et al. 2008; Nachtigall et al. 2007; Owen and Bowles 2011). Like the pinnipeds, polar bears are amphibious mammals in the order Carnivora. Additionally, the otariid ear is very similar to the ear of other carnivores (Nummela 2008a; Nummela 2008b). Polar bear hearing sensitivity is most similar to otariids, and therefore polar bears are assigned the same functional hearing range as for otariids (sea lions and fur seals) for this analysis. Hearing limits are 50 Hz to 35 kHz in air and 50 Hz to 50 kHz in water (Southall et al. 2007).

3.4.2.4 General Threats to Marine Mammals

Marine mammal populations can be influenced by various natural factors and human activities. These factors affect marine mammal populations directly by injuring or inducing mortality outright, or indirectly by reducing survival or lowering reproductive success of individuals. Twiss and Reeves (1999) provide a general discussion of marine mammal conservation.

Marine mammals are influenced by natural phenomena such as storms and other extreme weather patterns. Generally, not much is known about how large storms and other weather patterns affect marine mammals, other than that mass strandings (when marine mammals swim or float into shore and become "beached" or stuck in shallow water) sometimes coincide with hurricanes, typhoons, and other tropical storms (Marsh 1989; Rosel and Watts 2008). The global climate is changing and is having very real impacts on some populations of marine mammals (Salvadeo et al. 2010; Simmonds and Eliott 2009). Climate change can affect marine mammal species directly through habitat loss (especially for species that depend on ice) and indirectly via impacts on prey, changing prey distributions and locations, and changes in water temperature. Changes in prey can impact marine mammal foraging success, which in turn affects reproduction success and survival. Climate change also may influence marine mammals through effects on human behavior, such as increased shipping and oil and gas extraction, which benefit from sea ice loss (Alter et al. 2010).

Mass die-offs of some marine mammal species have been linked to consumption of toxic plankton or other organisms, such as die-offs of California sea lions and northern fur seals because of poisoning caused by the diatom *Pseudo-nitzschia* spp. (Doucette et al. 2006; Fire et al. 2008; Lefebvre 2010; Thomas et al. 2010; Torres de la Riva et al. 2009). All marine mammals have parasites that, under normal circumstances, probably do little overall harm, but under certain conditions, can cause serious health problems or even death (Bull et al. 2006; Fauquier et al. 2009). Disease affects some individuals, especially older animals, and occasionally disease epidemics can injure or kill a large percentage of the population (Keck et al. 2010; Paniz-Mondolfi and Sander-Hoffmann 2009).

Human impacts on marine mammals have received much attention in recent decades and include hunting (both commercial and native practices), fisheries interactions (such as gear entanglement, shootings by fishermen, or bycatch [accidental or indirect catch]), ship strikes, noise and chemical pollution, and general habitat deterioration or destruction.

Direct hunting, as in whaling and sealing operations, provided the original impetus for marine mammal management and has driven much of the early research on cetaceans and pinnipeds (Twiss and Reeves

1999). However, bycatch of animals in fishing nets and gear is likely an even bigger problem today and may account for the deaths of more marine mammals than any other cause (Hamer et al. 2010; Northridge 2008; Read 2008). In 1994, the MMPA was amended to formally address bycatch. At least in part as a result of the amendment, development of a take reduction plan is required when a bycatch exceeds a level considered unsustainable by the marine mammal population. Estimates of bycatch in the Atlantic declined by a total of 59 percent from 1994 to 2006 (Geijer and Read 2013). Cetacean bycatch declined by 44 percent from 3,153 in 1994 to 1,764 in 2006, and pinniped bycatch declined from 81 percent from 2,210 to 476 over the same time period. Ship strikes are also a growing issue for most marine mammals, such as North Atlantic right whales (Huntington 2009; Knowlton and Kraus 2001). Ship strikes may negatively impact the population of a species, particularly in small populations and possibly on larger scales (Laist et al. 2001; Van Waerebeek et al. 2007; Vanderlaan et al. 2009).

Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, avoiding predators, and communicating with other individuals. Noise can cause behavioral disturbances, mask other sounds including their own vocalizations, and may even result in injury and in some cases, may lead to death (Tyack 2009; Würsig and Richardson 2008). Human-caused noises in the marine environment come from shipping, seismic and geologic exploration, military activity, and other types of pulses produced by government, commercial, industry, and private sources. In addition, noise from whale-watching vessels in the vicinity of marine mammals has recently received a great deal of attention (Wartzok 2009).

Chemical pollution is also of great concern, although for the most part, its effects on marine mammals are just starting to be understood (Reijnders et al. 2008). Recently, the 5.5-year expedition of the *Odyssey* collected 955 biopsy samples from sperm whales around the world to provide a consistent baseline database of ocean contamination against which to measure future effects (Ocean Alliance 2010). Chemical pollutants and pesticides flow into the marine environment from human use on land and are absorbed into the bodies of marine mammals, accumulating in their blubber (this process is often called bioaccumulation) or transferring to the young via mothers' milk (Fair et al. 2010). Important factors that determine the levels of pesticides and industrial pollutants that accumulate in marine mammals are gender (i.e., adult males have no way to transfer pesticides whereas females may pass pollutants to their calves through milk), habitat, and diet. Living closer to the source of pollutants and feeding on higher-level organisms increase the potential to accumulate toxins (Moon et al. 2010). The buildup of human-made persistent compounds in marine mammals not only increases their likelihood of contracting diseases or developing tumors but also compromises the function of their reproductive systems (Fair et al. 2010). The risk of negative health effects is particularly high when contaminants are transferred to a calf through its mother's milk (Fair et al. 2010).

Oil and other chemical spills are a specific type of ocean contamination known to have negative effects on some marine mammal species (Matkin et al. 2008). In April 2010, the *Deepwater Horizon* offshore drill rig, 41 miles (mi. [66 kilometers {km}]) (Nowacek et al. 2004b) southeast of the Louisiana coast, exploded and sank during exploratory well drilling. The effects of this disaster are just beginning to be studied, and it will likely be many years before impacts are understood. Although information on effects of oil spills on marine mammals is limited, they can be affected both directly by the oil and indirectly by activities during the containment and cleanup phases and through impacts on prey and habitat. Marine mammals can be impacted by the changes in habitat from the presence of chemicals and dispersants in their habitat, by oil introduction, and from increased human presence in the environment. Any of these factors may trigger changes in prey distribution, water quality, noise levels, and other environmental variables.

Potential behavioral responses to spills include displacement from primary habitat and the disruption of social structure, changes in prey availability and in feeding activities and success, effects on reproductive behavior, and changes to migration. Potential physical/physiological effects are irritation, inflammation, necrosis (premature death of living tissue), and chemical burns of skin, eyes, and nose areas, and inhalation of toxic fumes with potential long-term respiratory effects, such as inflammation, pulmonary emphysema, and infection (Engelhardt 1983; Marine Mammal Commission 2010). Ingestion of oil and dispersants directly or through feeding on contaminated prey (such as krill [very small shrimp-like animals] and squid), which have eaten dispersants, can lead to short or longer-term effects from inflammation, ulcers, bleeding, and possible damage to liver, kidney, and brain tissues (Engelhardt 1983; Marine Mammal Commission 2010). After the *Exxon Valdez* spill of 1987 in Prince William Sound, Alaska, pulmonary emphysema was a relatively common finding in sea otters exposed to toxic fumes, and brain lesions were observed in harbor seals (Marine Mammal Commission 2010). Two of the resident killer whale pods found in Prince William Sound before the spill declined by 33 and 40 percent after the spill. One of those pods has not reproduced successfully since, and the other pod has not fully recovered (Marine Mammal Commission 2010).

In addition to the direct effects of oil and dispersants, cleanup and containment operations also may have an effect on marine mammals. Cleanup includes containing oil in booms, skimming oil at the ocean surface, and burning. Cleanup also involves a large number of vessels and aircraft in the coastal and offshore habitats bringing increased noise levels and human presence into marine mammal habitats. These activities could stress and disturb marine mammals, potentially displacing them from important feeding or breeding grounds and disrupting normal behavior (Marine Mammal Commission 2010).

General habitat deterioration and loss is a major factor for almost all coastal and inshore species of marine mammals, especially those that live in rivers or estuaries, and it may include such factors as depleting a habitat's prey base and the complete loss of habitat (Kemp 1996; Smith et al. 2009).

Marine mammals as a whole are subject to the various influences and factors delineated in this section. If additional specific threats to individual species within the Study Area are known, those threats are described below in the descriptive accounts of those species.

3.4.2.5 North Atlantic Right Whale (*Eubalaena glacialis*)

Right whales in the North Atlantic and North Pacific were once classified together as a single species, the northern right whale. However, genetic data have now determined them to represent two separate species: the North Atlantic right whale (*Eubalaena glacialis*) and the North Pacific right whale (*Eubalaena japonica*) (Rosenbaum et al. 2000).

3.4.2.5.1 Status and Management (Excerpts from Waring et al. (2013))

The North Atlantic right whale population is considered one of the most critically endangered populations of large whales in the world (Clapham et al. 1999). The size of this stock is considered extremely low relative to the Optimum Sustainable Population in the U.S. Atlantic Exclusive Economic Zone, and this species is listed as endangered under the ESA. A recovery plan for the North Atlantic right whale is in effect (U.S. Department of Commerce 2005). The North Atlantic right whale was also protected from commercial whaling by the International Whaling Commission since 1927. An NMFS ESA status review in 1996 concluded that the western North Atlantic stock remains endangered. This conclusion was reinforced by the International Whaling Commission (Best et al. 2003), which expressed grave concern regarding the status of this stock. Relative to populations of southern right whales, there are also concerns about growth rate, percentage of reproductive females, and calving intervals in the

North Atlantic right whale population. The total level of human-caused mortality and serious injury is unknown, but reported human-caused mortality was a minimum of three right whales per year from 2006 through 2010. Any mortality or serious injury for this stock should be considered significant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds potential biological removal and because the North Atlantic right whale is an endangered species.

Three critical habitats—Cape Cod Bay/Massachusetts Bay/Stellwagen Bank, Great South Channel, and the coastal waters of Georgia and Florida in the southeastern United States—were designated by NMFS in 1994 (FR 59: 28805, June 3, 1994) (Figure 3.4-1). Two additional critical habitat areas in Canadian waters, Grand Manan Basin and Roseway Basin, were identified in Canada's final recovery strategy for the North Atlantic right whale (Brown et al. 2009). A 12-month finding from NMFS on a 2002 petition to revise right whale critical habitat stated "a review of scientific information suggests that physical and biological features essential to the conservation of right whales may include, but are not necessarily limited to, the occurrence of copepods and the features that concentrate them in the water off of the northeast United States, as well as sea surface temperature and possibly bathymetry in the waters off of the southeast United States. In a more recent 12-month finding on a 2009 petition, NMFS stated they agree that revision of critical habitat is appropriate and that they would continue the ongoing rulemaking process (FR 75 (193): 61690-61691, October 6, 2010).

3.4.2.5.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

The western North Atlantic right whale population ranges primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. Knowlton et al. (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, recent resightings of photographically identified individuals were made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton et al. 2007), and northern Norway (Jacobsen et al. 2004). The September 1999 Norwegian sighting represents one of only two published sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. The few published records from the Gulf of Mexico (Moore and Clark 1963; Schmidly et al. 1972; Ward-Geiger et al. 2011) represent either distributional anomalies, normal wanderings of occasional animals, or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. Whatever the case, the location of much of the population is unknown during the winter.

Research results suggest the existence of six major habitats or congregation areas for western North Atlantic right whales: winter breeding grounds in the coastal waters of the southeastern United States within the Southeast U.S. Continental Shelf Large Marine Ecosystem and summer feeding grounds within the Northeast U.S. Continental Shelf Large Marine Ecosystem–Great South Channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Scotian Shelf.

However, movements within and between habitats are extensive. In 2000, one whale was photographed in Florida waters on 12 January, then again 11 days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March, effectively making the round-trip migration to the southeast and back at least twice during the winter (Brown and Marx 2000). Results from satellite tags clearly indicate that sightings separated by perhaps two weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data show rather lengthy and

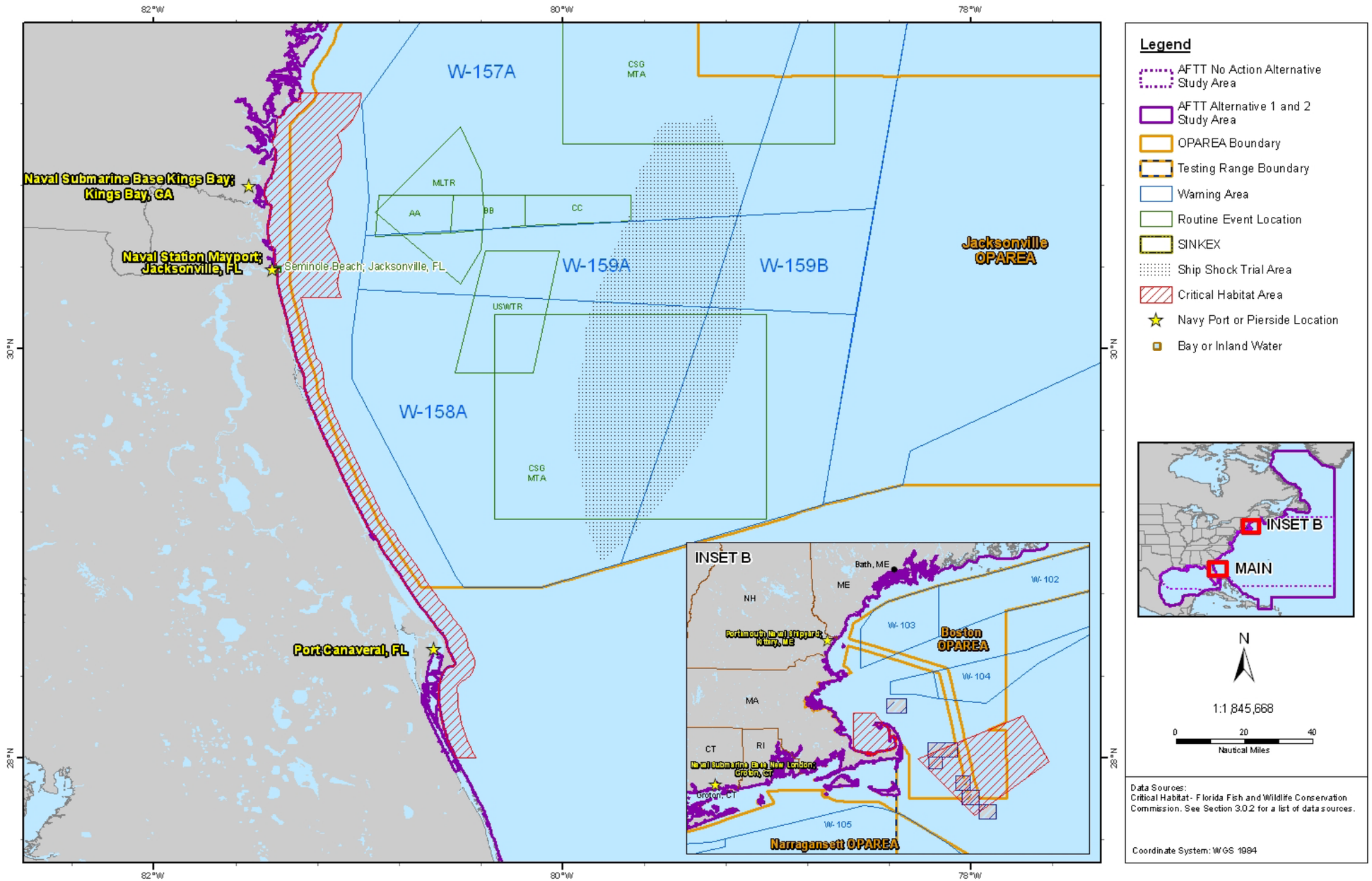

Figure 3.4-1: Designated Critical Habitat Areas for North Atlantic Right Whale in the Study Area

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; CT: Connecticut; FL: Florida; GA: Georgia; MA: Massachusetts; MLTR: Missile Laser Training Range; ME: Maine; NH: New Hampshire; OPAREA: Operating Area; RI: Rhode Island; SINKEX: Sinking Exercise; USWTR: Undersea Warfare Training Range

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somewhat distant excursions, including into deep water off the continental shelf (Baumgartner and Mate 2005; Mate et al. 1997). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted eight calves, suggesting the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the cows photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan et al. 2004).

Three right whale observations (four individuals) were recorded during aerial surveys sponsored by the Navy approximately 50 mi. (80 km) offshore of Jacksonville, Florida, in 2009 and 2010, including a female that was observed giving birth (Foley et al. 2011). These sightings occurred well outside existing critical habitat for the right whale and suggest that the calving area may be broader than currently assumed (Foley et al. 2011; U.S. Department of the Navy 2010). Offshore (greater than 30 mi. [48.3 km]) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 documented 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000, and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). Several of the years that offshore surveys were flown were some of the lowest count years for calves and for numbers of right whales in the southeast recorded since comprehensive surveys in the calving grounds were initiated. Therefore, the frequency with which right whales occur in offshore waters in the southeastern United States remains unclear.

Since 2004, consistent aerial survey efforts have been conducted during the migration and calving season (15 November to 15 April) in coastal areas of Georgia and South Carolina, to the north of currently defined critical habitat (Glass and Taylor 2006; Khan and Taylor 2007; Sayre and Taylor 2008; Schulte and Taylor 2010). Results suggest that this region may not only be part of the migratory route but also a seasonal residency area. Results from an analysis by Schick et al. (2009) suggest that the migratory corridor of North Atlantic right whales is broader than initially estimated and that suitable habitat exists beyond the 20 nautical mile (nm) coastal buffer presumed to represent the primary migratory pathway (National Marine Fisheries Service 2008b). Results were based on data modeled from two females tagged with satellite-monitored radio tags as part of a previous study.

New England waters are an important feeding habitat for right whales, which feed primarily on copepods in this area (largely of the genera *Calanus* and *Pseudocalanus*). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney et al. 1986; Kenney et al. 1995). While feeding in the coastal waters off Massachusetts has been better studied than in other areas, right whale feeding has also been observed on the margins of Georges Bank, in the Great South Channel, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are beginning to emerge (Baumgartner and Mate 2003; Baumgartner and Mate 2005). NMFS and Provincetown Center for Coastal Studies aerial surveys during springs of 1999–2006 found right whales along the northern edge of Georges Bank, in the Great South Channel, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank, and Wilkinson Basin. The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats.

3.4.2.5.3 Population and Abundance (Excerpts from Waring et al. (2013))

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. Review of the photo-identification recapture database as it existed in

21 October 2011 indicated that 425 individually recognized whales in the catalog were known to be alive during 2009. Whales catalogued by this date included 20 of the 39 calves born during that year. Adding the 19 calves not yet catalogued brings the minimum number alive in 2009 to 444. This value is a minimum and does not include animals alive prior to 2008, but not recorded in the individual sightings database as seen from 1 December 2008 to 21 October 2011 (note that matching of photos taken during 2010-2011 was not complete at the time the data were received). This estimate has no associated coefficient of variation. In 2010, the best estimate of catalogued North Atlantic right whales was 490 individuals (Hamilton et al. 2011). This estimate does not include potentially unphotographed whales and is an estimate of the cataloged population only.

The population growth rate reported for the period 1986–1992 by Knowlton et al. (1994) was 2.5 percent (CV=0.12), suggesting that the stock was showing signs of slow recovery. However, subsequent work suggested that survival declined from about 0.99 in the early 1980s to about 0.94 in the late 1990s (Best et al. 2001; Caswell et al. 1999; Clapham 2002). Recent mortalities, including those in the first half of 2005, suggest an increase in the annual mortality rate (Kraus et al. 2005). Despite the preceding, examination of the minimum number alive population index calculated from the individual sightings database (as it existed on 21 October 2011) for 1990–2009 suggests a positive trend in numbers. These data reveal a significant increase in the number of catalogued whales alive during this period with a mean growth of 2.6 percent.

3.4.2.5.4 Predator/Prey Interactions

The North Atlantic right whale preys primarily on the copepod *Calanus finmarchicus* (a type of zooplankton) and on other copepods and small invertebrates, such as krill and larval barnacles (Jefferson et al. 2008b). Right whales are skim feeders and are known to feed below or at the surface (Kenney et al. 2001) or within a few meters of the seafloor on near-bottom aggregations of copepods (Baumgartner 2009; Baumgartner et al. 2009; Warren 2009). The copepod *Calanus finmarchicus* is one of the most common species of prey found throughout the North Atlantic right whale's range (Baumgartner and Mate 2003; Jefferson et al. 2008b).

The North Atlantic right whale is preyed on by killer whales and large sharks. Calves and juveniles are known to be the primary target of killer whales, and analysis of scars on some individuals suggests that they are also attacked by false killer whales (Kenney 2008).

3.4.2.5.5 Species-Specific Threats (Excerpts from Waring et al. (2013))

Primary sources of human-caused serious injury and mortality include entanglement in fishing gear and ship strikes. Entanglement records from 1990 through 2007 maintained by NMFS Northeast Regional Office included 46 confirmed right whale entanglements, including right whales in weirs (stationary nets fixed in place), gillnets, and trailing line and buoys. Because whales often free themselves of gear following an entanglement event, scarring may be a better indicator of fisheries interaction than entanglement records. In an analysis of the scarification of right whales, 338 of 447 (75.6 percent) whales examined during 1980–2002 were scarred at least once by fishing gear (Knowlton et al. 2005). Ship strikes pose a particularly serious threat to the North Atlantic right whale. Vessel speed as well as angle of approach can determine the severity of ship strikes (Silber et al. 2010). Research shows that the probability of right whales dying after being struck by a ship is more than 80 percent when a vessel is traveling at 15 knots or more; when speeds are reduced to 10 knots or less, the chance of mortality drops to just above 20 percent. To reduce the number of ship strikes, NMFS has established regulations (FR 73 (198): 60173-60191, October 10, 2008) imposing speed restrictions in seasonal management areas for commercial ships 65 ft. or longer. In addition, the Navy has adopted standard operating

procedures for protecting right whales from ship strikes (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). For additional detail on ship strikes and right whales, refer to Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices).

3.4.2.6 Bowhead Whale (*Balaena mysticetus*)

Bowhead whales are the northernmost of all whales, inhabiting only arctic and subarctic regions, often close to the ice edge.

3.4.2.6.1 Status and Management

The bowhead whale is listed as endangered under the ESA and is designated as depleted under the MMPA. Three geographically distinct bowhead whale stocks are recognized in the Atlantic – the Spitsbergen, Baffin Bay-Davis Straight, and Hudson Bay-Fox Basin stocks (Allen and Angliss 2010; Rugh et al. 2003; Wiig et al. 2007). Because these stocks do not occur within U.S. Atlantic waters, they are not managed under NMFS jurisdiction.

3.4.2.6.2 Habitat and Geographic Range

Bowhead whales are found in arctic and subarctic regions of the Atlantic and Pacific oceans (55° N to 85° N). They are also found in the Bering, Beaufort, Chukchi, and Okhotsk Seas, as well as in the northern parts of Hudson Bay (Wiig et al. 2007). Their range can expand and contract depending on access through ice-filled Arctic straits (Rugh et al. 2003). Habitat selection varies seasonally, although this is clearly the most polar species of whale. Bowheads are found in continental slope waters during spring and summer while feeding on abundant zooplankton (Wiig et al. 2007).

Migration occurs within the Arctic and is associated with ice edge movements. Bowheads reside in the high Arctic during summer and move south in fall as the ice edge grows, spending their winters in lower-latitude areas (Jefferson et al. 2008b). The Davis Strait stock spends winters from Labrador across to West Greenland and moves north to spend summers in the Canadian High Arctic and around Baffin Island (Heide-Jorgensen et al. 2003). Whales in the Beaufort Sea were observed changing their migratory routes in response to noise associated with oil production (Huntington 2009).

Newfoundland-Labrador Shelf and West Greenland Shelf Large Marine Ecosystem. The southernmost portion of the bowhead range includes the shelf areas of west Greenland and northern Labrador. Bowheads were sighted in the continental slope waters of west Greenland during April (Ledwell et al. 2007). From May 2002 to December 2003, satellite-tracked bowheads departed from west Greenland and moved northwest toward Lancaster Sound. Individuals remained within the Canadian High Arctic or along the east coast of Baffin Island in summer and early fall. By the end of October, whales moved rapidly south along the east coast of Baffin Island and entered Hudson Strait (Heide-Jorgensen et al. 2006). Two bowhead whales were stranded on Newfoundland in 1998 and 2007, from 45° N to 47° N and 52° W to 56° W, representing the southernmost records of this species in the western North Atlantic (Ledwell et al. 2007).

3.4.2.6.3 Population and Abundance

Aerial surveys were used to estimate the Davis Strait stock of bowheads (Wiig et al. 2007). The combined Davis Strait-Hudson Bay stocks are now thought to number at least 7,000 (Cosens et al. 2006). The International Whaling Commission estimates the bowhead stock off west Greenland at 490–2,940 individuals (95 percent confidence interval).

3.4.2.6.4 Predator/Prey Interactions

Bowheads feed by skimming the surface or sometimes near the seafloor (Rugh and Shelden 2009). Preferred prey are various species of copepods and euphausiids (Budge et al. 2008; Rugh and Shelden 2009; Wiig et al. 2007). Killer whales are the primary natural predator of the bowhead whale (George et al. 1994). Scars from killer whale attacks are observed on some individuals (Jefferson et al. 2008b; Rugh and Shelden 2009).

3.4.2.6.5 Species-Specific Threats

Threats to bowhead whales include ship strikes, entanglement in fishing gear, contaminants, and anthropogenic noise, especially from offshore oil drilling. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.7 Humpback Whale (*Megaptera novaeangliae*)

The humpback whale may be the best known and most recognizable of all the great whales (a descriptive term referring to the larger baleen whales and the sperm whale). It is the focus of many whale-watching operations worldwide.

3.4.2.7.1 Status and Management

Humpback whales are listed as endangered under the ESA and depleted under the MMPA. Critical habitat has not been designated for humpback whales. Based on overall evidence of population recovery in many areas, the species is being considered by NMFS for removal or down-listing from the ESA (FR 74 (154): 40568, August 12, 2009).

Although the western North Atlantic population was once treated as a single management stock, the Gulf of Maine stock is now considered separate based on strong fidelity of humpbacks to that region (Waring et al. 2010). The Gulf of Maine stock is the only stock of humpbacks in the Atlantic managed under NMFS jurisdiction.

3.4.2.7.2 Habitat and Geographic Range

Humpback whales are distributed worldwide in all major oceans and most seas. They typically are found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts, where calving occurs. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel through deep oceanic waters during migration (Calambokidis et al. 2001; Clapham and Mattila 1990). Their primary range in the Atlantic includes the nearshore waters of the Northeast U.S. Continental Shelf, Scotian Shelf, and Newfoundland-Labrador Shelf Large Marine Ecosystems. Their secondary range includes the Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, as well as the Labrador Current, Gulf Stream and North Atlantic Gyre Open Ocean Areas.

Humpback feeding habitats are typically shallow banks or ledges with high seafloor relief (Hamazaki 2002; Payne et al. 1990). On breeding grounds, females with calves occur in much shallower waters than other groups of whales, and breeding adults use deeper more offshore waters (Ersts and Rosenbaum 2003; Smultea 1994). The habitat requirements of wintering humpbacks appear to be controlled by the conditions necessary for calving, such as warm water (75° Fahrenheit [F] to 82°F [24° Celsius {C} to 28°C]) and relatively shallow, low-relief ocean bottom in protected areas, created by islands or reefs (Clapham 2000; Craig and Herman 2000; Smultea 1994).

Humpback whales typically migrate from the northern feeding areas such as the Gulf of Maine (including Georges Bank, southwestern Nova Scotia, and the Bay of Fundy) or the Scotian Shelf to calving/breeding areas in the West Indies, where the majority of whales are found, particularly off the Dominican Republic, north of the territory of Turks and Caicos on Silver Bank, Navidad Bank, and in Samana Bay, though some whales were sighted in the Cape Verde Islands off the west coast of Africa (Waring et al. 2010). Individual variability in the timing of migrations may result in the presence of individuals in high-latitude areas throughout the year (Straley 1990).

Newfoundland-Labrador and Scotian Shelf Large Marine Ecosystems. The Gulf of St. Lawrence, Newfoundland Grand Banks, and Scotian Shelf are summer feeding grounds for humpbacks (Cetacean and Turtle Assessment Program 1982; Kenney and Winn 1986; Stevick et al. 2006; Whitehead 1982).

Northeast U.S. Continental Shelf Large Marine Ecosystem. The Gulf of Maine is one of the principal summer feeding grounds for humpback whales in the North Atlantic. The largest numbers of humpback whales are present from mid-April to mid-November. Other feeding locations in this ecosystem are Stellwagen Bank, Jeffreys Ledge, the Great South Channel, the edges and shoals of Georges Bank, Cashes Ledge, and Grand Manan Banks (Cetacean and Turtle Assessment Program 1982; Kenney and Winn 1986; Stevick et al. 2006; Weinrich et al. 1997; Whitehead 1982). Humpbacks are most likely to occur in the Chesapeake Bay between January and March; however, they could be found in the area year-round, based on sighting and stranding data in both mid-Atlantic waters and the Chesapeake Bay itself (Barco et al. 2002; Swingle et al. 2007). Photo-identification data support the repeated use of the mid-Atlantic region by individual humpback whales (Barco et al. 2002). Barco et al.'s study suggests the mid-Atlantic region might be where some mother humpbacks wean and separate from their calves.

3.4.2.7.3 Population and Abundance (Excerpts from Waring et al. (2013))

The best available estimate for the entire North Atlantic population (including the Gulf of Maine stock) derived from photographic mark-recapture analyses from the Years of the North Atlantic Humpback project is 11,570. The most recent line-transect survey, which did not include the Scotian Shelf portion of the stock, produced an estimate of abundance for Gulf of Maine humpback whales of 331 animals (CV=0.48) with a resultant minimum population estimate for this stock of 228 animals. The line-transect based on minimum population estimate is unrealistic because at least 500 uniquely identifiable individual whales from the Gulf of Maine stock were seen during the calendar year of that survey and the actual population would have been larger because re-sighting rates of Gulf of Maine humpbacks have historically been less than 1. Using the minimum count from at least two years prior to the year of a stock assessment report allows time to resight whales known to be alive prior to and after the focal year. Thus, the minimum population estimate is set to the 2008 mark-recapture-based count of 823.Current data suggest that the Gulf of Maine humpback whale stock is steadily increasing in numbers. This is consistent with an estimated average trend of 3.1 percent (SE=0.005) in the North Atlantic population overall for the period 1979–1993 (Stevick et al. 2003).

3.4.2.7.4 Predator/Prey Interactions

Humpback whales feed on a variety of invertebrates and small schooling fishes. The most common invertebrate prey are krill; the most common fish prey are herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead 1999). Feeding occurs both at the surface and in deeper waters, wherever prey is abundant. The humpback whale is the only species of baleen whale that shows strong evidence of cooperation when feeding in large groups (D'Vincent et al. 1985). Humpback whales were observed using "bubble nets" to herd prey (Jefferson et al. 2008b). Bubble nets are a feeding

strategy where the whales dive and release bubbles of air that float up in a column and trap prey inside; the humpbacks then lunge through the column of trapped prey to feed.

Friedlaender et al. (2009) analyzed the relationship between humpback whale foraging and prey abundance on Stellwagen Bank, Massachusetts. Sensors on the whales allowed the researchers to measure in fine detail the orientation and movement patterns of both humpback whales and their prey at meaningful ecological scales (Friedlaender et al. 2009). They found that differences between surface and bottom feeding behaviors in humpback whales correlated with vertical changes in the distribution and abundance of their primary prey, sand lance. Hazen et al. (2009) showed that in addition to prey abundance, other factors relate to humpback whale surface feeding in the Gulf of Maine, such as time of day and the height of the tides. Characteristics of the prey, such as light emitted and the shape of the schools formed by the prey, also relate to humpback whale surface-feeding.

This species is known to be attacked by both killer whales and false killer whales, as evidenced by tooth rake scars on their bodies and fins (Jefferson et al. 2008b).

3.4.2.7.5 Species-Specific Threats (Excerpts from Waring et al. (2013))

As with right whales, human impacts (vessel collisions and entanglements) may be slowing recovery of the humpback whale population. Of 20 dead humpback whales (principally in the mid-Atlantic region, where decomposition did not preclude examination for human impacts), Wiley et al. (1995) reported that six (30 percent) had major injuries possibly attributable to ship strikes, and five (25 percent) had injuries consistent with possible entanglement in fishing gear. One whale displayed scars that may have been caused by both ship strike and entanglement. Thus, 60 percent of the whale carcasses suitable for examination showed signs that anthropogenic factors may have contributed to, or been responsible for, their death.

3.4.2.8 Minke Whale (*Balaenoptera acutorostrata*)

Minke whales are the smallest species of mysticete in the AFTT Study Area and are classified as a single species with three subspecies recently recognized: *Balaenoptera acutorostrata davidsoni* in the North Atlantic, *Balaenoptera acutorostrata scammoni* in the North Pacific, and a subspecies that is formally unnamed but generally called the dwarf minke whale, which mainly occurs in the southern hemisphere (Jefferson et al. 2008b).

3.4.2.8.1 Status and Management (Excerpts from Waring et al. (2013))

The minke whale is protected under the MMPA but is not listed under the ESA. In the North Atlantic, there are four recognized populations: Canadian east coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). Minke whales off the eastern coast of the United States are considered to be part of the Canadian east coast stock, which inhabits the area from the western half of the Davis Strait (45°W) to the Gulf of Mexico. The relationship between this stock and the other three stocks is uncertain.

3.4.2.8.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Minke whales have a cosmopolitan distribution in temperate and tropical waters and generally occupy waters over the continental shelf, including inshore bays and even occasionally estuaries. However, records from whaling catches and research surveys worldwide indicate there may be an open-ocean component to the minke whale's habitat (Ingram et al. 2007; Jefferson et al. 2008b), including the Labrador Current, Gulf Stream, and North Atlantic Gyre Open Ocean Areas. They have an extensive

distribution in polar, temperate, and tropical waters in the northern and southern hemispheres (Jefferson et al. 2008b; Perrin and Brownell 2008); they are less common in the tropics than in cooler waters.

Minke whales generally participate in annual migrations between low-latitude breeding grounds in the tropics and subtropics in the winter and high-latitude feeding grounds (such as Gulf of Maine as well as the Saguenay-St. Lawrence region [Quebec]) in the summer (Kuker et al. 2005). Migration paths of the common minke whale show they follow patterns of prey availability (Jefferson et al. 2008b).

The minke whale is common and widely distributed within the U.S. Exclusive Economic Zone in the Atlantic Ocean (Cetacean and Turtle Assessment Program 1982). There appears to be a strong seasonal component to minke whale distribution. Like most other baleen whales, minke whales generally occupy the continental shelf proper rather than the continental shelf edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies, and in the mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to the distribution of minke whales exists but remains unconfirmed.

Scotian Shelf Large Marine Ecosystem. The St. Lawrence Estuary is known as a summer feeding ground for the North Atlantic population of the minke whale (Edds-Walton 2000).

Northeast U.S. Continental Shelf Large Marine Ecosystem. During summer and early fall, minke whales are found throughout the lower Bay of Fundy (Ingram et al. 2007). Spring and summer are times of relatively widespread and common occurrence, and are the seasons when the whales are most abundant in New England waters. In New England waters during fall there are fewer minke whales, while during winter the species appears to be largely absent.

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. Minke whales occur in the warmer waters of the southern United States during winter. Although they are not typically expected to occur within the Gulf of Mexico, observation records exist for mostly immature individuals in the Gulf of Mexico and Florida Keys (Stewart and Leatherwood 1985; Waring et al. 2013).

3.4.2.8.3 Population and Abundance

The minke whale is considered generally abundant in most areas of its range (Horwood 1990; Jefferson et al. 2008b). Although global population abundance is difficult to assess, estimates for the North Atlantic indicate there are more than 100,000 whales in the region and possibly more than 180,000 in the northern hemisphere (Jefferson et al. 2008b; Perrin and Brownell 2008; Skaug et al. 2004). Multiple estimates are available for portions of minke whale habitat. The best recent abundance estimate for this stock is 20,741 (CV=0.30) minke whales. This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey in July-August 2007 and is considered best because, while it did not cover any U.S. waters, the survey covered more of the minke whale range than the other surveys reported (Waring et al. 2013). The minimum population estimate for the Canadian East Coast minke whale is 16,199 animals.

3.4.2.8.4 Predator/Prey Interactions

This species preys on small invertebrates and schooling fishes, such as capelin, haddock, sand eels, pollock, herring, and cod (Jefferson et al. 2008b; Kuker et al. 2005; Lindstrom and Haug 2001; Reeves et al. 2002b). Similar to other rorquals, minke whales are lunge feeders, often plunging through patches of shoaling fish or krill (Hoelzel et al. 1989; Jefferson et al. 2008b).

Minke whales are prey for killer whales (Ford et al. 2005); a common minke was observed under attack by killer whales near British Columbia (Weller 2008).

3.4.2.8.5 Species-Specific Threats

Minke whales are documented as bycatch in gillnets in the mid-Atlantic and northeast fisheries. This species was also documented as bycatch in pelagic longline fisheries operating in the Atlantic Ocean, Caribbean, and Gulf of Mexico (Zollett 2009). Section 3.4.2.4 (General Threats to Marine Mammals) discusses general threats to marine mammals.

3.4.2.9 Bryde's Whale (*Balaenoptera brydei/edeni*)

Bryde's whales are among the least known of the baleen whales. Their classification and true numbers remain uncertain (Alves et al. 2010). Some scientists suggest that there may be up to three species (Bryde's whale, *Balaenoptera brydei*, Bryde's/Eden's whale, *Balaenoptera edeni* [Olsen 1913], and Omura's whale, *Balaenoptera omurai* (Wada et al. 2003) based on geographic distribution, inshore/offshore forms, and a pygmy form. For at least two of the species, the scientific name *B. edeni* is commonly used. The Bryde's whale's "pygmy form" has only recently been described and is now known as Omura's whale (Kato and Perrin 2008; Rice 1998). The International Whaling Commission continues to use the name *Balaenoptera edeni* for all Bryde's-like whales, although at least two species are recognized.

3.4.2.9.1 Status and Management

Bryde's whale is protected under the MMPA but not listed under the ESA. Current genetic research confirms that gene flow among Bryde's whale populations is low and suggests that management actions treat each as a distinct entity to ensure survival of the species (Kanda et al. 2007). Bryde's whales found in the northern Gulf of Mexico may represent a resident stock and are thus considered a separate stock for management purposes; however, there are no data to suggest genetic differentiation from the North Atlantic stock (Waring et al. 2010).

3.4.2.9.2 Habitat and Geographic Range

Unlike other baleen whale species, Bryde's whales are restricted to tropical and subtropical waters and do not generally occur beyond latitude 40° in either the northern or southern hemisphere (Jefferson et al. 2008b; Kato and Perrin 2008). The primary range of Bryde's whales in the Atlantic is in tropical waters south of the Caribbean, outside the Study Area, except for the Gulf of Mexico, where this species is thought to be the most common baleen (Würsig et al. 2000), although they may range as far north as Virginia (Kato and Perrin 2008). Long migrations are not typical of Bryde's whales, although limited shifts in distribution toward and away from the equator in winter and summer were observed (Best 1996; Cummings 1985).

Gulf of Mexico Large Marine Ecosystem. In the Gulf of Mexico, Bryde's whales were sighted near the shelf break in DeSoto Canyon (Davis et al. 2000; Davis and Fargion 1996; Jefferson and Schiro 1997). Most of the sighting records of Bryde's whales in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) are from NMFS abundance surveys, which were conducted during the spring (Davis et al. 2000; Davis and Fargion 1996; Hansen et al. 1996; Hansen et al. 1995; Jefferson and Schiro 1997; Maze-Foley and Mullin 2006; Mullin and Fulling 2004; Mullin and Hoggard 2000). However, there are stranding records from throughout the year (Würsig et al. 2000).

3.4.2.9.3 Population and Abundance

The best abundance estimate available for northern Gulf of Mexico Bryde's whales is 33 (CV=1.07). This estimate is from a summer 2009 oceanic survey covering waters from the 200 m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 16 Bryde's whales. There are insufficient data to assess population trends for this species (Waring et al. 2013).

3.4.2.9.4 Predator/Prey Interactions

Bryde's whales primarily feed on schooling fishes and are lunge feeders. Prey includes anchovy, sardine, mackerel, herring, krill, and pelagic red crab (Baker and Madon 2007; Jefferson et al. 2008b; Nemoto and Kawamura 1977). Like humpback whales, Bryde's whales were observed using "bubble nets" to herd prey (Jefferson et al. 2008b; Kato and Perrin 2008). Bryde's whale is known to be prey for killer whales, as evidenced by an aerial observation of 15 killer whales attacking a Bryde's whale in the Gulf of California (Weller 2008).

3.4.2.9.5 Species-Specific Threats

There are no significant species-specific threats to Bryde's whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.10 Sei Whale (*Balaenoptera borealis*)

The sei whale is one of at least three genetically distinct species of medium-sized rorquals, including the so-called pygmy or dwarf Bryde's whale (Kato and Perrin 2008; Rice 1998) and a new species, Omura's whale (*Balaenoptera omurai*). Many aspects of sei whale behavior and ecology are poorly understood, and this species is one of the least known rorquals.

3.4.2.10.1 Status and Management

The sei whale is listed as endangered under the ESA and depleted under the MMPA. Critical habitat is not designated for sei whales. A recovery plan for the sei whale was finalized in 2011 (National Marine Fisheries Service 2011). There are two stocks for the sei whale in the North Atlantic: a Nova Scotia stock and a Labrador Sea stock (Waring et al. 2013). The Nova Scotia stock is considered the management unit under NMFS jurisdiction; it includes the continental shelf waters of the northeastern United States, and extends northeastward to south of Newfoundland.

3.4.2.10.2 Habitat and Geographic Range

Sei whales have a worldwide distribution and are found primarily in cold temperate to subpolar latitudes. During the winter, sei whales are found from 20° N to 23° N and during the summer from 35° N to 50° N (Horwood 2009; Masaki 1976, 1977; Smultea et al. 2010). They are considered absent or at very low densities in most equatorial areas and in the Arctic Ocean (U.S. Department of Commerce 2010).

Sei whales spend the summer feeding in subpolar high latitudes and return to lower latitudes to calve in winter. Whaling data provide some evidence of varied migration patterns, based on reproductive class, with females arriving at and departing from feeding areas earlier than males (Horwood 1987; Perry et al. 1999). Sei whales are known to swim at speeds greater than 15 mi. (25 km) per hour and may be the fastest cetacean, after the fin whale (Horwood 1987; Jefferson et al. 2008b).

Labrador Current, North Atlantic Gyre, and Gulf Stream Open Ocean Areas. Sei whales are typically found in the open ocean and are rarely observed near the coast (Horwood 2009; Jefferson et al. 2008b). They are generally found between 10° and 70° latitudes. Satellite tagging data indicate sei whales feed and migrate east to west across large sections of the North Atlantic (Olsen et al. 2009); they are not often seen within the equatorial Atlantic. In the Study Area, the open ocean range includes the Labrador Current, North Atlantic Gyre, and Gulf Stream Open Ocean Areas.

Scotian Shelf and Northeast U.S. Continental Shelf Large Marine Ecosystems. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern United States and extends northeastward to south of Newfoundland. During the feeding season, a large portion of the Nova Scotia sei whale stock is centered in northerly waters of the Scotian Shelf (Waring et al. 2013).

The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Exclusive Economic Zone in the Atlantic Ocean, including the Gulf of Maine and Georges Bank. During spring and summer, sei whales occur in waters from the Bay of Fundy to northern Narragansett Bay. High concentrations are often observed along the northern flank, eastern tip, and southern shelf break of Georges Bank. During the fall, sei whales may be found in limited shelf areas of the Northeast Channel and in the western Gulf of Maine (Cetacean and Turtle Assessment Program 1982; Stimpert et al. 2003). Spring is the period of greatest abundance in Georges Bank and into the Northeast Channel area, along the Hydrographer Canyon (Cetacean and Turtle Assessment Program 1982; Waring et al. 2010).

3.4.2.10.3 Population and Abundance (Excerpts from Waring et al. (2013))

Commercial whaling in the 19th and 20th centuries depleted populations in all areas throughout the species' range, though they appear to be recovering in the northern hemisphere as a result of legal protection. Current global abundance is considered a minimum of 80,000 (Horwood 1987; Jefferson et al. 2008b). However, the abundance of sei whales in the Atlantic Ocean remains unknown. An August 2004 abundance estimate of 386 individuals is considered the best available for the Nova Scotia stock of sei whales. However, this estimate must be considered conservative in view of the known range of the sei whale in the entire western North Atlantic and the uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas. The Nova Scotia stock minimum population estimate is 208 (Waring et al. 2013).

3.4.2.10.4 Predator/Prey Interactions

Feeding occurs primarily around dawn, which appears to be correlated with vertical migrations of prey species (Horwood 2009). Unlike other rorquals, the sei whale skims to obtain its food, though, like other rorqual species, it does some lunging and gulping (Horwood 2009). Sei whales, like other baleen whales, are likely subject to occasional attacks by killer whales.

3.4.2.10.5 Species-Specific Threats

There are no significant species-specific threats to sei whales in the northwest Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses general threats to marine mammals.

3.4.2.11 Fin Whale (*Balaenoptera physalus*)

The fin whale is found in all of the world's oceans, except the Arctic Ocean, and is the second largest species of whale (Jefferson et al. 2008b). Fin whales have two recognized subspecies: *Balaenoptera physalus physalus* occurs in the North Atlantic Ocean, while *B. p. quoyi* occurs in the Southern Ocean.

3.4.2.11.1 Status and Management (Excerpts from Waring et al. (2013))

The fin whale is endangered under the ESA and is depleted under the MMPA. A final recovery plan was published in July 2010 for fin whales in U.S. waters. In the North Atlantic Ocean, the International Whaling Commission recognizes seven management stocks of fin whales: (1) Nova Scotia, (2) Newfoundland-Labrador, (3) West Greenland, (4) East Greenland-Iceland, (5) North Norway, (6) West Norway-Faroe Islands, and (7) British Isles-Spain-Portugal (U.S. Department of Commerce 2010). The western North Atlantic fin whale stock was assessed for management.

Fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock under the present International Whaling Commission scheme (Donovan 1991) and are currently considered the management unit under NMFS jurisdiction. However, the stock identity of North Atlantic fin whales has received relatively little attention, and whether the current stock boundaries define biologically isolated units has long been uncertain.

3.4.2.11.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Fin whales prefer temperate and polar waters and are rarely seen in warm tropical waters (Reeves et al. 2002a). They typically congregate in areas of high productivity and spend most of their time in coastal and shelf waters but can often be found in waters approximately 2,000 m deep (Aissi et al. 2008; Reeves et al. 2002a). Fin whales are often seen closer to shore after periodic patterns of upwelling (underwater motion) and the resultant increased krill density (Azzellino et al. 2008). This species is not known to have specific habitat preferences and is highly adaptable, following prey, typically off the continental shelf (Azzellino et al. 2008; Panigada et al. 2008).

Fin whales are common in waters of the U.S. Atlantic Exclusive Economic Zone, principally from Cape Hatteras northward, accounting for 46 percent of the large whales and 24 percent of all cetaceans sighted over the continental shelf during aerial surveys (Cetacean and Turtle Assessment Program 1982) between Cape Hatteras and Nova Scotia during 1978–82. In the Study Area, fin whales occur in summer foraging areas from the coast of North America to the Arctic, around Greenland, Iceland, northern Norway, and the Barents Sea. In the western Atlantic, they winter from the edge of sea ice south to the Gulf of Mexico and the West Indies (U.S. Department of Commerce 2010).

Hain et al. (1992) suggested that calving takes place during October to January in latitudes of the U.S. mid-Atlantic region; however, it is unknown where calving, mating, and wintering occur for most of the population. Results from the Navy's Sound Surveillance System program (Clark 1995) indicate a substantial deep-ocean distribution of fin whales. It is likely that fin whales occurring in the U.S. Exclusive Economic Zone in the Atlantic Ocean undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions. However, the popular notion that entire fin whale populations make distinct annual migrations like some other mysticetes has questionable support in the data; in the North Pacific, year-round monitoring of fin whale calls found no evidence for large-scale migratory movements (Watkins et al. 2000).

Open Ocean. The open ocean range of the fin whale includes the Gulf Stream, North Atlantic Gyre, and Labrador Current.

Northeast U.S. Continental Shelf Large Marine Ecosystem. Fin whales are common off the Atlantic coast of the United States in waters immediately off the coast seaward to the continental shelf (about the 1,000-fathom contour). In this region, they tend to occur north of Cape Hatteras where they accounted for about 46 percent of the large whales observed in surveys conducted between 1978 and

1982 (U.S. Department of Commerce 2010). During the summer, fin whales in this region tend to congregate in feeding areas between 41°20' N and 51°00' N, from shore seaward to the 1,000-fathom contour.

In the summer, fin whales are observed in the Gulf of Maine, the Bay of Fundy, the Gulf of St. Lawrence and St. Lawrence Estuary, and in offshore areas of Nova Scotia (Coakes et al. 2005; Johnston et al. 2005). Near the Bay of Fundy, fin whales are known to congregate close to the tip of Campobello Island, where they feed within localized upwellings and fronts in the Northeast U.S. Continental Shelf Large Marine Ecosystem (Johnston et al. 2005). New England waters are considered a major feeding ground for fin whales, and there is evidence that females continually return to this site (Waring et al. 2010). Forty-nine percent of fin whales sighted in the feeding grounds of Massachusetts Bay were sighted again within the same year, and 45 percent were sighted again in multiple years (Waring et al. 2010). Aerial observations in Onslow Bay, North Carolina, from August 2009 through August 2010 resulted in the sighting of a single fin whale (U.S. Department of the Navy 2010).

3.4.2.11.3 Population and Abundance

The best abundance estimate for the western North Atlantic fin whale stock is 3,522 (CV=0.27). The minimum population estimate for the western North Atlantic fin whale is 2,817 (Waring et al. 2013).

3.4.2.11.4 Predator/Prey Interactions

This species preys on small invertebrates such as copepods, as well as squid and schooling fishes, such as capelin, herring, and mackerel (Goldbogen et al. 2006; Jefferson et al. 2008b). The fin whale is not known to have a significant number of predators. However, in regions where killer whales are abundant, some fin whales exhibit attack scars on their flippers, flukes, and flanks, suggesting possible predation by killer whales (Aguilar 2008).

3.4.2.11.5 Species-Specific Threats

Fin whales are susceptible to both ship strikes and entanglement in fishing gear. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.12 Blue Whale (*Balaenoptera musculus*)

Blue whales are the largest species of animal on earth and are divided into three subspecies — northern hemisphere blue whale (*Balaenoptera musculus musculus*), Antarctic blue whale (*Balaenoptera musculus intermedia*), and the pygmy blue whale (*Balaenoptera musculus brevicauda*)

3.4.2.12.1 Status and Management

Blue whales are listed as endangered under the ESA and depleted under the MMPA. Critical habitat is not designated for blue whales. A recovery plan is in place for the blue whale in U.S. waters (Reeves 1998b). Blue whales in the western North Atlantic are classified as a single stock (Waring et al. 2010).

Widespread whaling over the last century is believed to have decreased the population to approximately 1 percent of its pre-whaling population size, although some authors have concluded that their population numbers were about 200,000 animals before whaling (Branch 2007; Sirovic et al. 2004). There was a documented increase in the blue whale population size between 1979 and 1994, but there is no evidence to suggest an increase in the population since then (Barlow 1994; Barlow and Taylor 2001; Carretta et al. 2010).

3.4.2.12.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

The distribution of the blue whale in the western North Atlantic generally extends from the Arctic to at least mid-latitude waters. Blue whales are most frequently sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence (Sears et al. 1987). The blue whale is best considered as an occasional visitor in U.S. Atlantic Exclusive Economic Zone waters, which may represent the current southern limit of its feeding range (Cetacean and Turtle Assessment Program 1982; Wenzel et al. 1988). All five sightings described in the foregoing two references were in August. Yochem and Leatherwood (1985) summarized records that suggested an occurrence of this species south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown. Using the U.S. Navy's Sound Surveillance System program, blue whales were detected and tracked acoustically in much of the North Atlantic, including in subtropical waters north of the West Indies and in deep water east of the U.S. Atlantic Exclusive Economic Zone, indicating the potential for long-distance movements (Clark 1995). Most of the acoustic detections were around the Grand Banks area of Newfoundland and west of the British Isles. Historical blue whale observations collected by Reeves et al. (2004) show a broad longitudinal distribution in tropical and warm temperate latitudes during the winter months, with a narrower, more northerly distribution in summer.

Newfoundland-Labrador Shelf Large Marine Ecosystem. Members of the North Atlantic population spend much of their time on continental shelf waters from eastern Canada (near the Quebec north shore) to the St. Lawrence Estuary and Strait of Belle Isle. Sightings were reported along the southern coast of Newfoundland during late winter and early spring (Reeves et al. 2004).

Scotian Shelf Large Marine Ecosystem. Blue whales are most frequently sighted in the waters off eastern Canada. Most records come from the Gulf of St. Lawrence (Waring et al. 2013).

Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems. Although the exact extent of their southern boundary and wintering grounds are not well understood, blue whales are occasionally found in waters off of the U.S. Atlantic coast (Waring et al. 2013).

Caribbean Sea and Gulf of Mexico Large Marine Ecosystems. Blue whale strandings have been recorded as far south as the Caribbean and the Gulf of Mexico (Waring et al. 2010).

3.4.2.12.3 Population and Abundance (Excerpts from Waring et al. (2013))

Little is known about the population size of blue whales in the Northwest Atlantic except for the Gulf of St. Lawrence area, and current data do not allow for an estimate of abundance of this stock. Mitchell (1974) estimated that the blue whale population in the western North Atlantic may number only in the low hundreds. The photo identification catalogue count of 440 recognizable individuals from the Gulf of St. Lawrence is considered a minimum population estimate for the western North Atlantic stock.

3.4.2.12.4 Predator/Prey Interactions

This species preys almost exclusively on various types of zooplankton, especially krill. They lunge feed and consume approximately six tons (5,500 kilograms [kg]) of krill per day (Jefferson et al. 2008b; Pitman et al. 2007). They sometimes feed at depths greater than 100 m, where their prey maintains dense groupings (Acevedo-Gutiérrez et al. 2002). Blue whales are documented as preyed on by killer whales (Jefferson et al. 2008b; Pitman et al. 2007). There is little evidence that killer whales attack this species in the North Atlantic or southern hemisphere, but 25 percent of photo-identified whales in the Gulf of California carry rake scars from killer whale attacks (Sears and Perrin 2008).

3.4.2.12.5 Species-Specific Threats

Threats for North Atlantic blue whales are poorly known but may include ship strikes, pollution, entanglement in fishing gear, and long-term changes in climate that may affect their prey distribution. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.13 Sperm Whale (*Physeter macrocephalus*)

Sperm whales are the largest of the odontocetes (toothed whales) and the most sexually dimorphic cetaceans, with males considerably larger than females. The sperm whale's extremely large head takes up to 25 to 35 percent of its total body length.

3.4.2.13.1 Status and Management

There are currently three stocks of sperm whales recognized within the Study Area managed under NMFS jurisdiction in the North Atlantic, Gulf of Mexico, and Puerto Rico and U.S. Virgin Islands. The sperm whale has been listed as a single endangered species since 1970 under the precursor to the ESA (National Marine Fisheries Service 2009) and is depleted under the MMPA. In 2011 NMFS received a petition to list the Gulf of Mexico stock as a Distinct Population Segment and in a 90-day finding announced that the petition presented substantial scientific or commercial information indicating that the petitioned action may be warranted (78 FR (61): 19176-19178, March 29, 2013). As a result, NMFS initiated a status review of sperm whales in the Gulf of Mexico to determine whether the petitioned action is warranted. Critical habitat is not designated for sperm whales, although the petition for the Gulf of Mexico Distinct Population Segment also requested that critical habitat be designated. A five-year review for sperm whales was finalized in 2009 (National Marine Fisheries Service 2009).

3.4.2.13.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Sperm whales are found throughout the world's oceans in deep waters to the edge of the ice at both poles (Leatherwood and Reeves 1983; Rice 1989; Whitehead 2002). Sperm whales show a strong preference for deep waters (Rice 1989; Whitehead 2003). Their distribution is typically associated with waters over the continental shelf break, over the continental slope, and into deeper waters. However, in some areas, adult males are reported to consistently frequent waters with bottom depths less than 330 ft. (100 m) and as shallow as 40 m (Jefferson et al. 2008b; Romero et al. 2001). Typically, sperm whale concentrations correlate with areas of high productivity. These areas are generally near drop-offs and areas with strong currents and steep topography (Gannier and Praca 2007; Jefferson et al. 2008b).

The distribution of the sperm whale in the U.S. Exclusive Economic Zone occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions. Waring et al. (1993; Waring et al. 2001) suggest that this offshore distribution is more commonly associated with the Gulf Stream edge and other features. However, the sperm whales that occur in the eastern U.S. Exclusive Economic Zone in the Atlantic Ocean likely represent only a fraction of the total stock. The nature of linkages of the U.S. habitat with those to the south, north, and offshore is unknown. Historical whaling records compiled by Schmidly (1981) suggested an offshore distribution off the southeast United States, over the Blake Plateau, and into deep ocean waters. In the southeast Caribbean, both large and small adults, as well as calves and juveniles of different sizes are reported (Watkins et al. 1985). Whether the northwestern Atlantic population is discrete from northeastern Atlantic is currently unresolved. The International Whaling Commission recognizes one stock for the North Atlantic, based on reviews of many types of stock studies (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.).

In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia and is widespread throughout the central portion of the mid-Atlantic Bight and the southern portion of Georges Bank. In summer, the distribution is similar but now also includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100-m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the mid-Atlantic Bight. Similar inshore (less than 200 m) observations were made on the southwestern and eastern Scotian Shelf, particularly in the region of "the Gully" (Whitehead and Weilgart 1991).

Open Ocean. Sperm whales are found throughout the Gulf Stream and North Atlantic Gyre. In 1972, extensive survey cruises covering much of the western and central North Atlantic Ocean found high densities of sperm whales in the Gulf Stream region, between 40° N and 50° N, over the North Atlantic Ridge (National Marine Fisheries Service 2006).

Newfoundland-Labrador Shelf Large Marine Ecosystem. High densities of sperm whales were found in the Grand Banks of Newfoundland (National Marine Fisheries Service 2006).

Scotian Shelf Large Marine Ecosystem. Off Nova Scotia, coastal whalers found sperm whales primarily in deep continental slope waters, especially in submarine canyons and around the edges of banks. During late spring and throughout the summer, this species is found on the continental shelf in waters less than 100 m deep on the southern Scotian Shelf and into the northeast United States (National Marine Fisheries Service 2006; Palka 2006).

Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems. Distribution along the east coast of the United States is centered along the shelf break and over the slope. During winter, high densities occur in inner slope waters east and northeast of Cape Hatteras, North Carolina (National Marine Fisheries Service 2006; Palka 2006; Waring et al. 2010). In spring, distribution shifts northward to Delaware and Virginia, and the southern portion of Georges Bank. Summer and fall distribution is similar, extending to the eastern and northern portions of Georges Bank and north into the Scotian Shelf. Occurrence south of New England on the continental shelf is highest in the fall (Waring et al. 2010). Aerial surveys in August 2009 off the Virginia coast resulted in the sighting of two sperm whales (U.S. Department of the Navy 2010). Aerial observations in Onslow Bay, North Carolina, from August 2009 through August 2010 resulted in the sighting of one sperm whale (U.S. Department of the Navy 2010). Aerial surveys conducted between August 2009 and August 2010 off Jacksonville, Florida, resulted in the sighting of one sperm whale.

Gulf of Mexico Large Marine Ecosystem. The sperm whale is the most common large cetacean in the northern Gulf of Mexico (Palka and Johnson 2007). Sperm whales aggregate at the mouth of the Mississippi River and along the continental slope in or near cyclonic cold-core eddies (counterclockwise water movements in the northern hemisphere with a cold center) (Davis et al. 2007). O'Hern and Biggs (2009) showed that most sperm whale groups were found within regions of enhanced sea surface chlorophyll. The distribution of sperm whales in the Gulf of Mexico is strongly linked to surface oceanography, such as loop current eddies that locally increase production and availability of prey (O'Hern and Biggs 2009). In the north-central Gulf of Mexico, sperm whales are especially common near the Mississippi Canyon, where some are present year-round, and mixed groups of females and bachelor groups of males are found.

In the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico), systematic aerial and ship surveys indicate that sperm whales inhabit continental slope and oceanic waters where they are widely distributed (Fulling et al. 2003; Maze-Foley and Mullin 2006; Mullin and Fulling 2004; Mullin and Hoggard 2000; Mullin et al. 2004). Seasonal aerial surveys confirm that sperm whales are present in the northern Gulf of Mexico in all seasons (Hansen et al. 1996; Mullin et al. 1994a; Mullin and Hoggard 2000). The information for southern Gulf of Mexico waters is more limited, but there are sighting and stranding records from each season with sightings widely distributed in continental slope waters of the western Bay of Campeche (Ortega-Ortiz 2002).

Caribbean Sea Large Marine Ecosystem. In waters surrounding Puerto Rico and the U.S. Virgin Islands, NMFS winter ship surveys indicate that sperm whales inhabit continental slope and oceanic waters (Roden and Mullin 2000; Swartz and Burks 2000; Swartz et al. 2002). Earlier sightings from the northeastern Caribbean were reported by Erdman (1970), Erdman et al. (1973) and Taruski and Winn (1976), and these and other sightings from Puerto Rican waters are summarized by Mignucci-Giannoni (1988). Mignucci-Giannoni found 43 records for sperm whales up to 1989 for waters of Puerto Rico, U.S. Virgin Islands, and British Virgin Islands, and suggested they occur from late fall through winter and early spring but are rare from April to September. In addition, sperm whales are one of the most common species to strand in waters of Puerto Rico and the Virgin Islands (Mignucci-Giannoni et al. 1999).

3.4.2.13.3 Population and Abundance (Excerpts from Waring et al. (2013))

Several estimates from selected regions of sperm whale habitat exist for select time periods; however, at present there is no reliable estimate of total sperm whale abundance in the western North Atlantic (Palka 2006; Waring et al. 2010). In 2004, a survey of waters from Maryland to the Bay of Fundy yielded an abundance estimate of 2,607, and a survey of waters from Florida to Maryland resulted in an abundance estimate of 2,197. Sightings have been almost exclusively in the continental shelf edge and continental slope areas. The best recent abundance estimate for sperm whales is 1,593 (CV=0.36) resulting from a 2011 survey (Palka 2012). Because all sperm whale estimates presented here were not corrected for dive-time, they are likely downwardly biased and an underestimate of actual abundance. The minimum population estimate for the western North Atlantic sperm whale is 3,539.

The best abundance estimate available for northern Gulf of Mexico sperm whales is 1,665 (CV=0.20) (Mullin 2007). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 1,409 sperm whales.

The best abundance estimate available for the Puerto Rico and U.S. Virgin Islands stock of sperm whales is unknown, and data are currently insufficient to calculate a minimum population estimate for this stock of sperm whales.

3.4.2.13.4 Predator/Prey Interactions

Sperm whales socialize for predator defense but also for foraging. Sperm whales feed on squid, other cephalopods (a type of mollusc), and bottom-dwelling fish and invertebrates (Davis et al. 2007; Marcoux et al. 2007; Rice 1989). Exactly how sperm whales search for, detect, and capture their prey remains uncertain. Jaquet and Gendron (2009) suggest that site-specific ecological factors, such as predation pressure and food availability, likely influence fundamental aspects of sperm whale social organization. False killer whales, pilot whales, and killer whales have been documented harassing and on occasion attacking sperm whales (Baird 2009b).

3.4.2.13.5 Species-Specific Threats

There are no significant species-specific threats to sperm whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.14 Dwarf/Pygmy Sperm Whale (*Kogia sima* and *Kogia breviceps*)

Before 1966, dwarf and pygmy sperm whales were thought to be a single species, until form and structure distinction was shown (Handley 1966); misidentifications of these two species are still common (Jefferson et al. 2008b). *Kogia* spp. are not often observed at sea, but they are among the more frequently stranded cetaceans (Caldwell and Caldwell 1989; Jefferson et al. 2008b; McAlpine 2009). Rare sightings indicate they may avoid human activity, and they are rarely active at the sea surface. They usually appear slow and sluggish, often resting motionless at the surface with no visible blow (Baird 2005; Jefferson et al. 2008b).

3.4.2.14.1 Status and Management

Kogia spp. are protected under the MMPA but not listed under the ESA. Although virtually nothing is known of population status for these species, stranding frequency suggests they may not be as uncommon as sighting records would suggest (Jefferson et al. 2008b; Maldini et al. 2005). The western North Atlantic population and the northern Gulf of Mexico population are considered separate stocks for management purposes, but there is no genetic evidence that these two populations differ (Waring et al. 2010).

3.4.2.14.2 Habitat and Geographic Range

Dwarf and pygmy sperm whales appear to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989; McAlpine 2002). *Kogia* can occur close to shore and sometimes over the outer continental shelf. However, several studies show that they may also generally occur beyond the continental shelf edge (Bloodworth and Odell 2008; MacLeod et al. 2004). The pygmy sperm whale may frequent more temperate habitats than the dwarf sperm whale, which is more of a tropical species. Data from the Gulf of Mexico suggest that *Kogia* spp. may associate with frontal regions along the continental shelf break and upper continental slope, where squid densities are higher (Baumgartner et al. 2001; Jefferson et al. 2008b). Although deep oceanic waters may be the primary habitat for this species, there are very few oceanic sighting records offshore. The lack of sightings may have more to do with the difficulty of detecting and identifying these animals at sea and lack of effort than with any real distributional preferences.

In the Study Area, this species is found primarily in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, the Gulf of Mexico, and Caribbean Sea (Bloodworth and Odell 2008; Caldwell and Caldwell 1989; Cardona-Maldonado and Mignucci-Giannoni 1999). A stranded pygmy sperm on the north shore of the Gulf of St. Lawrence represents the northernmost record for this species in the western Atlantic (Measures et al. 2004).

Pygmy sperm whales were one of the most commonly sighted species in the northern Gulf of Mexico from 1992 to 1994 and from 1996 to 2001 (Mullin and Fulling 2004). Fulling and Fertl (2003)noted a concentration of sightings in continental slope waters near the Mississippi River Delta. The delta is considered an important area for cetaceans in the northern Gulf of Mexico because of its high levels of productivity associated with oceanographic features.

3.4.2.14.3 Population and Abundance

Because *Kogia sima* and *Kogia breviceps* are difficult to differentiate at sea, the reported abundance estimates prior to the 2011 estimate are for both species of *Kogia*. The best abundance estimate for dwarf sperm whales is the result of a shipboard and aerial survey conducted during June–August 2011 (Palka 2012)—1,042 (CV=0.65). The minimum population estimate for dwarf sperm whales is 632 animals. The best abundance estimate for pygmy sperm whales from the 2011 survey is 741 (CV=0.40) (Palka 2012). The minimum population estimate for dwarf sperm whales is 535 animals (Waring et al. 2013).

3.4.2.14.4 Predator/Prey Interactions

Kogia feed on cephalopods and, less often, on deep-sea fishes and shrimp (Beatson 2007; Caldwell and Caldwell 1989). A study showed cephalopods (squid) were the primary prey of pygmy sperm whales in the Pacific Ocean, making up 78.7 percent of prey abundance and 93.4 percent contribution by mass. Stomach samples revealed an extreme diversity of cephalopod prey, with 38 species from 17 families (West et al. 2009).

Kogia are likely subject to occasional killer whale predation, as are other whale species.

3.4.2.14.5 Species-Specific Threats

There are no significant species-specific threats to *Kogia* in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.15 Beluga Whale (*Delphinapterus leucas*)

The beluga whale is a member of the family Monodontidae, which it shares with the narwhal, *Monodon monoceros.* Belugas can be confused with female narwhals, which overlap with their range and are superficially similar in appearance.

3.4.2.15.1 Status and Management

Beluga whales are protected under the MMPA, although the only stock that is managed under NMFS jurisdiction occurs outside of the Study Area, in Cook Inlet, Alaska. There are three recognized stocks of belugas that may occur within the Study Area: St. Lawrence, Eastern High Arctic/Baffin Bay, and West Greenland (Jefferson et al. 2008b). These stocks are endangered under Canada's Species at Risk Act (Her Majesty the Queen in Right of Canada 2003).

3.4.2.15.2 Habitat and Geographic Range

This species' distribution nearly spans the Arctic and is found only in high latitudes of the northern hemisphere. Belugas are found in Arctic and subarctic waters along the northern coasts of Canada, Alaska, Russia, Norway, and Greenland (O'Corry-Crowe 2008; Stewart and Stewart 1989). Distribution is centered mainly between 49° N and 80° N from the west coast of Greenland to eastern Scandinavia.

Belugas occur primarily in shallow coastal waters, as shallow as 1 to 3 m. They can also be found in offshore waters greater than 800 m deep (Jefferson et al. 2008a; Richard et al. 2001). During the winter, belugas are believed to occur in offshore waters associated with pack ice, but little is known about the distribution, ecology, or behavior in winter. In most regions, belugas are believed to migrate in the direction of the advancing polar ice front. However, in some areas, they may remain behind this front and overwinter in enclosed areas of unfrozen water and ice leads. In the spring, they migrate to warmer

shallow water in coastal estuaries, bays, and rivers for molting and calving (North Atlantic Marine Mammal Commission 2000).

West Greenland Shelf and Newfoundland-Labrador Shelf Large Marine Ecosystems. This species is known to occur in the extreme northwestern portion of the Study Area. The St. Lawrence Estuary is at the southern limit of the distribution of this species (Jefferson et al. 2008a; O'Corry-Crowe 2008). A population of greater than 1,100 is known to reside in the St. Lawrence Estuary year-round (Lebeuf et al. 2007). On the west coast of Greenland, belugas are found from Qaanaaq in the north to Paamiut in the south in the fall, winter, and spring. Belugas are rare along this coast in summer (North Atlantic Marine Mammal Commission 2000).

3.4.2.15.3 Population and Abundance

The global population is relatively well studied and is estimated at 150,000 (Jefferson et al. 2008a; O'Corry-Crowe 2008). The St. Lawrence stock is estimated at 900 to 1,000, the Eastern High Arctic/Baffin Bay stock at 21,213, and the West Greenland stock at 7,941 (Jefferson et al. 2008a).

3.4.2.15.4 Predator/Prey Interactions

Beluga whales prey on various types of fish and invertebrates. In some parts of their range, it is clear that belugas are feeding in nearshore waters on seasonally abundant coastal fishes, such as salmon, herring, capelin, smelt, and saffron cod. Much of their prey depends on distribution and seasonal availability (Jefferson et al. 2008a).

Killer whales and polar bears both are predators of belugas.

3.4.2.15.5 Species-Specific Threats

There are no significant species-specific threats to beluga whales in the Northwest Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.16 Narwhal (*Monodon monoceros*)

Narwhals, along with beluga whales, are members of the Monodontidae family, sometimes referred to as the "white whales." The most conspicuous characteristic of the male narwhal is its single 7–10 ft. (2–3 m) long tusk, an incisor tooth that projects from the left side of the upper jaw.

3.4.2.16.1 Status and Management

The narwhal is not listed under the ESA and is protected under the MMPA. There is no stock that occurs in the U.S. Exclusive Economic Zone in the Atlantic Ocean; however, populations from Hudson Strait and Davis Strait may extend into the Study Area at its northwest extreme (Heide-Jorgensen 2009).

3.4.2.16.2 Habitat and Geographic Range

Being the cetacean with the northernmost range, narwhals prefer cold Arctic waters. They are also known to be a deepwater species. In the summer, they are found in more northern areas, and as ice begins to form, they tend to follow the ice to more open waters for the winter. They are often found in deep fjords and cracks and leads in the ice (Heide-Jorgensen 2009; Reeves and Tracey 1980).

Newfoundland-Labrador Shelf Large Marine Ecosystem. Narwhals winter in the regions of Hudson Strait and Baffin Bay-Davis Strait, as well as Disko Bay. Narwhals wintering in Hudson Strait in smaller numbers are assumed to belong to the northern Hudson Bay summer population. Tagged narwhals in

the summering grounds in Admiralty Inlet showed their annual migration following the ice during the autumn to more open waters of Melville Bay and Eclipse Sound in central and southern Baffin Bay and northern Davis Strait (Dietz et al. 2008; Heide-Jorgensen 2009). Before the fast ice forms in the fall, narwhals move into deep water along the edge of the continental shelf, with depths of up to 1,000 to 2,000 m (Heide-Jorgensen 2009).

3.4.2.16.3 Population and Abundance

Global population abundance is estimated at more than 50,000, including about 35,000 in northern Davis Strait and Baffin Bay, 1,300 in Hudson Strait, and 300 in Scoresby Sound (Heide-Jorgensen 2009; Jefferson et al. 2008b). Recent estimates of abundance for the wintering grounds of west Greenland are of about 7,819 (Heide-Jorgensen 2009).

3.4.2.16.4 Predator/Prey Interactions

Narwhals feed mainly on fish and squid, but much depends on seasonal availability. A large part of their diet consists of medium to large fish, such as turbot and cod (Jefferson et al. 2008b). A recent study on stomach content analysis showed that in summer, their diet is mainly Arctic cod, polar cod, and squid (Heide-Jorgensen 2009). In fall, squid is the main source of prey, and in winter, Greenland halibut and squid are the main sources (Laidre and Heide-Jorgensen 2005; Laidre et al. 2003). This species uses suction to bring prey into the mouth.

Killer whales and polar bears are the only known predators of narwhals (Heide-Jorgensen 2009). Killer whales hunt them in the summer open-water season, and polar bears hunt them from sea ice in winter and spring (Heide-Jorgensen 2009).

3.4.2.16.5 Species-Specific Threats

There are no significant species-specific threats to narwhals in the northwest Atlantic, although climate change may be a concern because this species inhabits an extreme northern range. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.17 Beaked Whales (Various Species)

Based upon available data, six beaked whales are known in the western North Atlantic Ocean: Cuvier's beaked whale (*Ziphius cavirostris*), northern bottlenose whale (*Hyperoodon ampullatus*), and four members of the genus *Mesoplodon* —True's (*M. mirus*), Gervais' (*M. europaeus*), Blainville's (*M. densirostris*), and Sowerby's (*M. bidens*) beaked whales, which, with the exception of *Ziphius* and *Hyperoodon*, are nearly indistinguishable at sea (Coles 2001). *Ziphius* and three species of *Mesoplodon* (Blainville's, Gervais', and Sowerby's) are known to occur in the Gulf of Mexico, based on stranding or sighting data (Hansen et al. 1995; Würsig et al. 2000). Sowerby's beaked whale in the Gulf of Mexico is considered extralimital because there is only one known stranding of this species (Bonde and O'Shea 1989) and because it normally occurs in northern temperate waters of the North Atlantic (Mead 1989a). Because of the scarcity of biological information available for individual species, the difficulty of species-level identifications for *Mesoplodon* species, and the lack of data on individual stock structure and abundance estimates, *Ziphius* and *Mesoplodon* species are presented collectively here with species-specific information if available.

3.4.2.17.1 Status and Management

All beaked whales are protected under the MMPA but none are listed under the ESA. Stock structure in the Atlantic, Gulf of Mexico, and U.S. Virgin Islands is unknown; however, these are assumed to be separate for management purposes.

3.4.2.17.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Collectively, beaked whales occur in all regions of the Study Area but may be most common in the Northeast and Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems. The continental shelf margins from Cape Hatteras to southern Nova Scotia were recently identified as known key areas for beaked whales in a global review by MacLeod and Mitchell (2006). MacLeod and Mitchell (2006) also described the northern Gulf of Mexico continental shelf margin as "a key area" for beaked whales. Beaked whales were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Hansen et al. 1996; Mullin and Hoggard 2000). Some of the aerial survey sightings may have included Cuvier's beaked whale, but identification of beaked whale species from aerial surveys is problematic. Beaked whale sightings made during spring and summer vessel surveys were widely distributed in waters greater than 500 m deep.

Cuvier's beaked whale is one of the more commonly seen and the best known. Similar to other beaked whale species, this oceanic species generally occurs in waters past the edge of the continental shelf and occupies almost all temperate, subtropical, and tropical waters of the world, as well as subpolar and even polar waters in some areas. The distribution of Cuvier's beaked whales is poorly known, and is based mainly on stranding records (Leatherwood et al. 1976). Strandings were reported from Nova Scotia along the eastern U.S. coast south to Florida, around the Gulf of Mexico, and within the Caribbean (Cetacean and Turtle Assessment Program 1982; Heyning 1989; Houston 1990; Leatherwood et al. 1976; MacLeod 2006; Mignucci-Giannoni et al. 1999). Cuvier's beaked whale sightings have occurred principally along the continental shelf edge in the mid-Atlantic region off the northeast U.S. coast (Cetacean and Turtle Assessment Program 1982; Hamazaki 2002; Palka 2006; Waring et al. 1992; Waring et al. 2001) in late spring or summer, although strandings and sightings were reported in the Caribbean Sea and the Gulf of Mexico as well (Dalebout et al. 2006). Cuvier's beaked whales are generally sighted in waters with a bottom depth greater than 200 m and are frequently recorded in waters with bottom depths greater than 1,000 m (Falcone et al. 2009; Jefferson et al. 2008b).

True's beaked whales appear to occur only in temperate waters, and possibly only in warm temperate waters. Most records of it occurring in the northwest Atlantic suggest a probable relation with the Gulf Stream (MacLeod 2000; Mead 1989b).

Gervais' beaked whale occurs only in the Atlantic Ocean and Gulf of Mexico, within a range both north and south of the equator to a latitude of 40° (Jefferson et al. 2008b; MacLeod 2006). Although the distribution seems to range across the entire temperate and tropical Atlantic, most records are from the western North Atlantic waters from New York to Texas (more than 40 published records).

Sowerby's beaked whales appear to inhabit more temperate waters than many other members of the genus and are the most northerly distributed of Atlantic species of *Mesoplodon*, found in cold temperate waters of the North Atlantic Ocean, generally north of 30˚ N. In the Study Area, they range from Massachusetts to Labrador (MacLeod et al. 2006; Mead 1989a). There were several at-sea sightings off Nova Scotia and Newfoundland, from New England waters north to the ice pack (MacLeod et al. 2006; Waring et al. 2010). Sowerby's beaked whale may be found within the Northeast U.S. Continental Shelf,

Newfoundland-Labrador Shelf, and Scotian Shelf Large Marine Ecosystems as well as the Labrador Current Open Ocean Area.

Blainville's beaked whales are one of the most widely distributed of the distinctive toothed whales in the *Mesoplodon* genus (Jefferson et al. 2008b; MacLeod et al. 2006). In the Study Area, this species is known to occur in enclosed deepwater seas, such as the Gulf of Mexico and Caribbean Sea. There are records for this species from the eastern coast of the United States and Canada, from as far north as Nova Scotia (Northeastern U.S. Continental Shelf and Newfoundland-Labrador Shelf Large Marine Ecosystems), and south to Florida and the Bahamas within the Southeastern U.S. Continental Shelf Large Marine Ecosystem (MacLeod and Mitchell 2006; Mead 1989a).

3.4.2.17.3 Population and Abundance (Excerpts from Waring et al. (2013))

Estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow et al. 2006) as well as one estimate alone of each Cuvier's beaked whales, Gervais' beaked whales, and Sowerby's beaked whales. Sightings are almost exclusively in the continental shelf edge and continental slope areas. The total number of Blainville's and True's beaked whales off the eastern U.S. and Canadian Atlantic coasts are unknown, and seasonal abundance estimates are not available for these stocks. The best abundance estimates for Northwest Atlantic beaked whale stocks are as follows: Cuvier's beaked whales - 4,962 (CV=0.37) with a minimum population estimate of 3,670; Gervais' beaked whales - 1,847 (CV=0.96) with a minimum of 935; Sowerby's beaked whales - 3,653 (CV=0.69) with a minimum of 2,160.

The best abundance estimate available for Cuvier's beaked whales in the northern Gulf of Mexico is 74 (CV=1.04). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. However, this abundance estimate is negatively biased because only sightings of beaked whales that could be positively identified to species were used. The minimum population estimate for the northern Gulf of Mexico is 36 Cuvier's beaked whales. The total number of Blainville's and Gervais' beaked whales in the northern Gulf of Mexico is unknown. The best available abundance estimate is for *Mesoplodon* spp., and is a combined estimate for Blainville's beaked whale and Gervais' beaked whale. The estimate of abundance for *Mesoplodon* spp. in oceanic waters, using data from a summer 2009 oceanic survey, is 149 (CV=0.91).

3.4.2.17.4 Predator/Prey Interactions

Beaked whales are generally deepwater feeders and prey on both squid and fish. Examination of stomach contents from stranded *Mesoplodon* species indicates that they feed primarily on deep-water cephalopods (MacLeod et al. 2003). Stomach content analyses of captured and stranded *Mesoplodon* species suggest that beaked whales are deep divers that feed at or close to the bottom in deep oceanic waters, taking whatever suitable prey they encounter or feeding on whatever species are locally abundant (Ohizumi 2002). Stomach content analyses from Cuvier's beaked whales show that they feed mostly on deep-sea squid, fish, and crustaceans (Hickmott 2005; Santos et al. 2007). Data show that Cuvier's beaked whales use suction to ingest prey (Jefferson et al. 2008b; Werth 2006).

3.4.2.17.5 Species-Specific Threats

Impacts from anthropogenic noise have become a serious concern with regard to beaked whales over the past decade. Section 3.4.3.1.2.7 (Stranding) summarizes several stranding events that have been associated with the use of naval sonar. In addition, disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of beaked whales' range, notably in areas of concentrated

military activity, oil and gas activity, or shipping. Ongoing studies are currently being conducted to address this issue and its impact, if any, on this and other marine species.

3.4.2.18 Northern Bottlenose Whale (*Hyperoodon ampullatus*)

3.4.2.18.1 Status and Management

The northern bottlenose whale is not listed under the ESA but is protected under the MMPA. There are two populations of northern bottlenose whales in the western north Atlantic: one in the area referred to as the Gully and a second in Davis Strait off northern Labrador. The Gully is a unique ecosystem that appears to have long provided a stable year-round habitat for a distinct population of bottlenose whales (Dalebout et al. 2006).

3.4.2.18.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Northern bottlenose whales are distributed in the North Atlantic from Nova Scotia to about 70° in the Davis Strait, along the east coast of Greenland to 77°, and from England to the west coast of Spitzbergen. It is largely a deep-water species and is very seldom found in waters less than 2,000 m deep (Mead 1989b). There are two main centers of bottlenose whale distribution in the western North Atlantic, one in the area called the Gully just north of Sable Island, Nova Scotia, and the other in Davis Strait off northern Labrador (Reeves et al. 1993). The northern bottlenose whale occurs from New England to Baffin Island and to southern Greenland. Strandings as far south as North Carolina were observed, although that is outside of the natural range or at the edge of the southern range for this more subarctic species (Jefferson et al. 2008b; MacLeod et al. 2006).

3.4.2.18.3 Population and Abundance

Current estimates of abundance are around 40,000 in the eastern North Atlantic, but population estimates for this species along the eastern U.S. coast are unknown (Jefferson et al. 2008b; Palka 2006; Waring et al. 2010). Abundance estimates for the Gully population, derived from studies at the entrance to the Gully from 1988 to 1995, estimated the population to be around 230 (Waring et al. 2013). Wimmer and Whitehead (2004) observed individuals moving between several Scotian Shelf canyons more than 62 mi. (100 km) from the Gully and estimated a population of 163 (Waring et al. 2013; Wimmer and Whitehead 2004).

3.4.2.18.4 Predator/Prey Interactions

This species preys primarily on squid but will also take fishes, sea cucumbers, seastars, and prawns, as confirmed by stomach content analyses. They appear to be more benthic (bottom of the sea) feeders, foraging at depths of between 500 and 1,500 m (Hooker and Whitehead 2002; Jefferson et al. 2008b).

3.4.2.18.5 Species-Specific Threats

There are no significant species-specific threats to northern bottlenose whales in the northwest Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.19 Rough-Toothed Dolphin (*Steno bredanensis*)

3.4.2.19.1 Status and Management

This species is not listed under the ESA but is protected under the MMPA. Rough-toothed dolphins are among the most widely distributed species of tropical dolphins, but little information is available on population status (Jefferson 2009; Jefferson et al. 2008b). The east U.S. Atlantic and Gulf of Mexico populations of the rough-toothed dolphin are considered two separate stocks for management

purposes, but there is insufficient genetic information to differentiate these stocks (Waring et al. 2013; Wimmer and Whitehead 2004).

3.4.2.19.2 Population and Abundance (Excerpts from Waring et al. (2013))

The number of rough-toothed dolphins off the eastern United States and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen during surveys. Three rough-toothed dolphins were observed from a ship in July 1998 during a line-transect sighting survey conducted from 6 July to 6 September 1998 by a ship and plane that surveyed 25,588.57 mi. (15,900 km) of track line in waters north of Maryland (38°N) (Palka 2006). An abundance estimate of 30 (CV=0.86) was calculated based on this one sighting. The current population size for the rough-toothed dolphin in the northern Gulf of Mexico is 624 (CV=0.991). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for northern Gulf of Mexico rough-toothed dolphins is 311.

3.4.2.19.3 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

The distribution of the rough-toothed dolphin is poorly understood worldwide. These dolphins are thought to be a tropical to warm-temperate species and historically have been reported in deep oceanic waters in the Atlantic, Pacific, and Indian Oceans and the Mediterranean and Caribbean Seas (Gannier and West 2005; Leatherwood and Reeves 1983; Perrin and Walker 1975; Reeves et al. 2003). Rough-toothed dolphins were, however, observed in both shelf and oceanic waters in the northern Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2003). In the western North Atlantic, tracking of five rough-toothed dolphins that were rehabilitated and released following a mass stranding on the east coast of Florida in 2005 demonstrated a variety of ranging patterns (Wells et al. 2008b). All tagged rough-toothed dolphins moved through a large range of water depths averaging greater than 100 ft. (30 m), though each of the five tagged dolphins transited through very shallow waters at some point, with most of the collective movements recorded over a gently sloping sea floor.

3.4.2.19.4 Predator/Prey Interactions

Prey of rough-toothed dolphins includes fish and cephalopods. They are known to feed on large fishes such as mahi mahi (Miyazaki and Perrin 1994; Pitman and Stinchcomb 2002). They also prey on reef fish, and Perkins and Miller (1983) noted that parts of reef fish were found in the stomachs of stranded rough-toothed dolphins in Hawaii. Rough-toothed dolphins also feed during the day on near-surface fishes, including flying fishes (Gannier and West 2005).

Rough-toothed dolphins have not been documented to be preyed on by any other species, but they may be subject to predation by killer whales.

3.4.2.19.5 Species-Specific Threats

There are no significant species-specific threats to rough-toothed dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.20 Bottlenose Dolphin (*Tursiops truncatus*)

3.4.2.20.1 Status and Management

This species is not listed under the ESA but is protected under the MMPA. Along the U.S. east coast and northern Gulf of Mexico, the bottlenose dolphin stock structure is well studied. There are currently

52 management stocks identified by NMFS in the western North Atlantic and Gulf of Mexico, including oceanic, coastal, and estuarine stocks (Waring et al. 2010). Most stocks in the Study Area are designated as Strategic or Depleted under the MMPA. For a complete listing of currently identified stocks within the Study Area, see Table 3.4-1.

3.4.2.20.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

The bottlenose dolphin occurs in tropical to temperate waters of the Atlantic Ocean as well as inshore, nearshore, and offshore waters of the Gulf of Mexico and U.S. east coast. They generally do not range north or south of 45° latitude (Jefferson et al. 2008b; Wells and Scott 2008). They occur in most enclosed or semi-enclosed seas in habitats ranging from shallow, murky, estuarine waters to also deep, clear offshore waters in oceanic regions (Jefferson et al. 2008b; Wells et al. 2009). Bottlenose dolphins are also often found in bays, lagoons, channels, and river mouths and are known to occur in very deep waters of some ocean regions. Open ocean populations occur far from land; however, population density appears to be highest in nearshore areas (Scott and Chivers 1990).

There are two morphologically and genetically distinct bottlenose dolphin morphotypes (distinguished by physical differences) (Duffield 1987; Duffield et al. 1983) described as the coastal and offshore forms. Both inhabit waters in the western North Atlantic Ocean and Gulf of Mexico (Curry and Smith 1997; Hersh and Duffield 1990; Mead and Potter 1995) along the U.S. Atlantic coast. The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula, and along the Gulf of Mexico coast. North of Cape Hatteras, the two morphotypes are separated across bathymetry during summer months. Aerial surveys flown during 1979–1981 indicated a concentration of bottlenose dolphins in waters less than 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf break corresponding to the offshore stock (Cetacean and Turtle Assessment Program 1982; Kenney 1990). However, during winter months and south of Cape Hatteras, North Carolina, the ranges of the coastal and offshore morphotypes overlap to some degree.

Seasonally, bottlenose dolphins occur over the outer continental shelf and inner slope as far north as Georges Bank (Cetacean and Turtle Assessment Program 1982; Kenney 1990). Sightings occurred along the continental shelf break from Georges Bank to Cape Hatteras during spring and summer (Cetacean and Turtle Assessment Program 1982; Kenney 1990). In Canadian waters, bottlenose dolphins were occasionally sighted on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995). The range of the offshore bottlenose dolphin includes waters beyond the continental slope (Kenney 1990), and offshore bottlenose dolphins may move between the Gulf of Mexico and the Atlantic (Wells et al. 1999). Dolphins with characteristics of the offshore type have stranded as far south as the Florida Keys.

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987–1988 (Scott et al. 1988). However, reanalysis of stranding data (McLellan et al. 2002) and extensive analysis of genetic (Rosel et al. 2009), photo-identification (Zolman 2002), and satellite telemetry (Southeast Fisheries Science Center, unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are five coastal stocks of bottlenose dolphins: the Northern Migratory stock, Southern Migratory stock, a South Carolina/Georgia Coastal stock, a Northern Florida Coastal stock, and a Central Florida Coastal stock (Waring et al. 2013). Similarly, five coastal or open ocean stocks are identified in the Gulf of Mexico: Continental Shelf, eastern coastal, northern coastal, western coastal, and oceanic (Waring et al. 2013).

Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present primarily in the inshore waters of the bays, sounds, and estuaries. Photo-identification and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Gubbins et al. 2003; Litz 2007; Mazzoil et al. 2005; Zolman 2002), and similar patterns were observed in bays and estuaries along the Gulf of Mexico coast (Balmer et al. 2008; Wells et al. 1987). There are over 40 individual stocks resident in bays, sounds, and estuaries from North Carolina through the Gulf of Mexico, with 32 recognized in the Gulf of Mexico alone, although the structure of these stocks is uncertain but appears to be complex.

3.4.2.20.3 Population and Abundance

Although abundance is not estimated for all stocks that occur in U.S. Atlantic and Gulf of Mexico waters, there are estimated to be over 100,000 individuals in the U.S. Atlantic and 35,000–45,000 in the Gulf of Mexico (Waring et al. 2013). Current estimates used by NMFS for management are summarized in Table 3.4-1.

3.4.2.20.4 Predator/Prey Interactions

Bottlenose dolphins are opportunistic feeders, taking a variety of fishes, cephalopods, and crustaceans (Wells and Scott 1999) and using a variety of feeding strategies (Shane et al. 1986). In addition to using echolocation, a process for locating prey by emitting sound waves that reflect back, bottlenose dolphins likely detect and orient to fish prey by listening for the sounds they produce, so-called passive listening (Barros and Myrberg 1987; Barros and Wells 1998). Nearshore bottlenose dolphins prey predominantly on coastal fishes and cephalopods, while offshore individuals prey on open ocean cephalopods and a large variety of near-surface and mid-water fishes (Mead and Potter 1995).

This species is known to be preyed on by killer whales and sharks (Wells and Scott 1999). As many as half the observed bottlenose dolphin in Florida exhibit scars from shark attacks. Primary shark predators are considered to be the bull, tiger, great white, and dusky sharks (Wells and Scott 1999).

3.4.2.20.5 Species-Specific Threats

There are no significant species-specific threats to bottlenose dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.21 Pantropical Spotted Dolphin (*Stenella attenuata*)

3.4.2.21.1 Status and Management

This species is not listed under the ESA but is protected under the MMPA. The western North Atlantic and northern Gulf of Mexico populations are considered separate stocks for management purposes, although there is currently not enough information to distinguish them (Waring et al. 2013).

3.4.2.21.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

The pantropical spotted dolphin is distributed in offshore tropical and subtropical waters of the Atlantic Ocean between about 40° N and 40° S (Baldwin et al. 1999; Perrin 2008c). The species is much more abundant in the lower latitudes of its range. It is found mostly in deeper offshore waters but does approach the coast in some areas (Jefferson et al. 2008b; Perrin 2001). Most sightings of this species in the Gulf of Mexico and Caribbean occur over the lower continental slope (Mignucci-Giannoni et al. 2003; Moreno et al. 2005). Pantropical spotted dolphins in the offshore Gulf of Mexico do not appear to have a preference for any one specific habitat type, such as within the Loop Current, inside cold-core eddies, or along the continental slope (Baumgartner et al. 2001).

Northeast and Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. The pantropical spotted dolphin is the most commonly sighted species of cetacean in the oceanic waters of the northern Gulf of Mexico. Pantropical spotted dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen et al. 1996; Mullin and Hoggard 2000). Along the U.S. Atlantic coast, sightings have concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic.

3.4.2.21.3 Population and Abundance (Excerpts from Waring et al. (2013))

The best recent abundance estimate for western North Atlantic stock of pantropical spotted dolphins is 4,439 (CV=0.49). This is the sum of estimates from two 2004 western U.S. Atlantic surveys and is considered best because these two surveys together have the most complete coverage of the species' habitat. The minimum population estimate for this stock is 3,010.

The best abundance estimate available for northern Gulf of Mexico pantropical spotted dolphins is 34,067 (CV=0.18) (Mullin 2007). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone.

3.4.2.21.4 Predator/Prey Interactions

Pantropical spotted dolphins prey on near-surface fishes, squid, and crustaceans and on some mid-water species (Perrin and Hohn 1994). Results from various tracking and food habit studies suggest that pantropical spotted dolphins in the eastern tropical Pacific and off Hawaii feed primarily at night on surface and mid-water species that rise after dark with the deep scattering layer (stratified zones in the ocean, usually composed of marine organisms that migrate vertically from depth to surface and back again at different times of day) (Baird et al. 2001; Evans 1994; Robertson and Chivers 1997).

Pantropical spotted dolphins may be preyed on by killer whales and sharks and were observed fleeing killer whales in Hawaiian waters (Baird et al. 2006). Other predators may include the pygmy killer whale, false killer whale, and occasionally the short-finned pilot whale (Perrin 2008c).

3.4.2.21.5 Species-Specific Threats

There are no significant species-specific threats to pantropical spotted dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.22 Atlantic Spotted Dolphin (*Stenella frontalis*)

3.4.2.22.1 Status and Management (Excerpts from Waring et al. (2013))

The Atlantic spotted dolphin is not listed under the ESA but is protected under the MMPA. The Atlantic spotted dolphin occurs in two forms that may be distinct subspecies (Perrin et al. 1994a; Perrin et al. 1987; Rice 1998): the large, heavily spotted form, which inhabits the continental shelf and is usually found inside or near the 200-m isobath; and the smaller, less spotted island and offshore form, which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2003, 2004). The western North Atlantic population is provisionally being considered a separate stock from the Gulf of Mexico stock(s) for management purposes based on genetic analysis. The U.S. Virgin Islands population is provisionally being considered a separate stock, although there is currently no information to differentiate this stock from the Atlantic Ocean and Gulf of Mexico stocks.

3.4.2.22.2 Habitat and Geographic Range

The Atlantic spotted dolphin is found in nearshore tropical to warm-temperate waters, predominantly over the continental shelf and upper slope. In the eastern Gulf of Mexico, for instance, the species often occurs over the mid-shelf (Griffin and Griffin 2003). In the western Atlantic, this species is distributed from New England to Brazil and is found in the Gulf of Mexico as well as the Caribbean Sea (Perrin 2008a). Atlantic spotted dolphin sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic.

In the Study Area, this species' primary range extends into the Gulf Stream Open Ocean Area and throughout the Southeast Continental U.S. Shelf, Gulf of Mexico, and Caribbean Sea Large Marine Ecosystems (Fulling et al. 2003; Mullin and Fulling 2003, 2004; Roden and Mullin 2000). The large, heavily spotted coastal form of the Atlantic spotted dolphin typically occurs over the continental shelf but usually at least 4.9 to 12.4 mi. (8 to 20 km) offshore (Davis et al. 1998; Perrin 2002; Perrin et al. 1994a). Higher numbers of spotted dolphins are reported over the west Florida continental shelf (Southeast Continental Shelf Large Marine Ecosystem) from November to May than during the rest of the year, suggesting that this species may migrate seasonally (Griffin and Griffin 2003).

3.4.2.22.3 Population and Abundance (Excerpts from Waring et al. (2013))

Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. At their November 1999 meeting, the Atlantic Scientific Review Group recommended that without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. There remains debate over how distinguishable both species are at sea, although in the waters south of Cape Hatteras identification to species is made with very high certainty. This does not, however, account for the potential for a mixed species herd, as has been recorded for several dolphin assemblages. Pending further genetic studies for clarification of this problem, a single species abundance estimate will be used as the best estimate of abundance, combining species-specific data from the northern as well as southern portions of the species' ranges. The best recent abundance estimate for western North Atlantic stock of Atlantic spotted dolphins is 26,798 (CV=0.66). The minimum population estimate based on the 2011 abundance estimates is 16,151.

The current population size for the Atlantic spotted dolphin in the northern Gulf of Mexico is unknown because the survey data from the continental shelf that covers the majority of this stock's range are more than eight years old (Wade and Angliss 1997). However, the previous abundance estimate for the Atlantic spotted dolphin in the northern Gulf of Mexico was 37,611 (CV=0.28), based on combined estimates of abundance for both the outer continental shelf (fall surveys, 2000–2001) and oceanic waters (spring and summer surveys, 2003–2004).

The abundance of the Puerto Rico and U.S. Virgin Islands stock of Atlantic spotted dolphins is unknown.

3.4.2.22.4 Predator/Prey Interactions

Atlantic spotted dolphins feed on small cephalopods, fishes, and benthic invertebrates (Perrin et al. 1994a). Atlantic spotted dolphins in the Gulf of Mexico were observed feeding cooperatively on clupeid fishes and are known to feed in association with shrimp trawlers (Fertl and Leatherwood 1997; Fertl and Wursig 1995). In the Bahamas, this species was observed to chase and catch flying fish (MacLeod et al.

2004). The diet of the Atlantic spotted dolphin varies depending on its location (Jefferson et al. 2008b; Perrin et al. 1994a).

This species was documented to be prey for killer whales and sharks (Jefferson et al. 2008b; Perrin et al. 1994a).

3.4.2.22.5 Species-Specific Threats

There are no significant species-specific threats to Atlantic spotted dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.23 Spinner Dolphin (*Stenella longirostris*)

3.4.2.23.1 Status and Management

The spinner dolphin is protected under the MMPA but is not listed under the ESA. For management purposes, the western North Atlantic and Gulf of Mexico populations are considered separate stocks, although there is currently insufficient data to differentiate them (Waring et al. 2013).

3.4.2.23.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

This is presumably an offshore, deep-water species (Perrin and Gilpatrick 1994; Schmidly 1981), and its distribution in the Atlantic is very poorly known. In the western North Atlantic, these dolphins occur in deep water along most of the U.S. coast south to the West Indies and Venezuela, including the Gulf of Mexico. Spinner dolphin sightings have occurred exclusively in deeper (greater than 2,000 m) oceanic waters of the northeast U.S. coast (Cetacean and Turtle Assessment Program 1982; Waring et al. 1992). Stranding records exist from North Carolina, South Carolina, Florida, and Puerto Rico in the Atlantic and in Texas and Florida in the Gulf of Mexico. In the Study Area, the open ocean range of the spinner dolphin includes the southern portions of the Gulf Stream and North Atlantic Gyre as well as Caribbean Sea and Gulf of Mexico. Although spinner dolphins were sighted and stranded off the southeastern U.S. coast, they are not common in those waters, except perhaps off southern Florida (Waring et al. 2010).

Gulf of Mexico Large Marine Ecosystem. In the northern Gulf of Mexico, spinner dolphins are found mostly in offshore waters beyond the edge of the continental shelf (Waring et al. 2013). This species was seen during all seasons in the northern Gulf of Mexico during aerial surveys between 1992 and 1998 (Waring et al. 2013).

3.4.2.23.3 Population and Abundance

There is insufficient data to calculate an abundance estimate for the western North Atlantic stock of spinner dolphins (Waring et al. 2013). The best abundance estimate available for northern Gulf of Mexico spinner dolphins is 11,441 (CV=0.83). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 6,221 spinner dolphins (Waring et al. 2013).

3.4.2.23.4 Predator/Prey Interactions

Spinner dolphins feed primarily on small mid-water fishes, squids, and shrimp and they dive to at least 655 to 985 ft. (200 to 300 m) (Perrin and Gilpatrick 1994). They forage primarily at night, when the mid-water community migrates toward the surface and the shore (Benoit-Bird 2004; Benoit-Bird et al. 2001).

Spinner dolphins track the horizontal migrations of their prey (Benoit-Bird and Au 2003), allowing foraging efficiencies (Benoit-Bird 2004; Benoit-Bird and Au 2003). Foraging behavior was also linked to lunar phases in scattering layers off the island of Hawaii (Benoit-Bird and Au 2004).

Spinner dolphins may be preyed on by sharks, killer whales, pygmy killer whales, and short-finned pilot whales (Perrin 2008d).

3.4.2.23.5 Species-Specific Threats

There are no significant species-specific threats to spinner dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.24 Clymene Dolphin (*Stenella clymene*)

3.4.2.24.1 Status and Management

The species is not listed under the ESA but is protected under the MMPA. The clymene dolphin has an extensive range in the tropical Atlantic Ocean. There are insufficient data to determine the population trends for this species (Waring et al. 2010).

3.4.2.24.2 Habitat and Geographic Range

Clymene dolphins are a tropical to subtropical species, primarily sighted in deep waters well beyond the edge of the continental shelf (Fertl et al. 2003). In the western North Atlantic, clymene dolphins were observed as far north as New Jersey, although sightings were primarily in offshore waters east of Cape Hatteras over the continental slope and are likely to be strongly influenced by oceanographic features of the Gulf Stream (Fertl et al. 2003; Moreno et al. 2005; Mullin and Fulling 2003). Clymene dolphins in the Gulf of Mexico are observed most frequently on the lower slope and deepwater areas, primarily west of the Mississippi River, in regions of cyclonic or confluent circulation (Davis et al. 2002; Mullin et al. 1994a). Clymene dolphins were seen in the winter, spring and summer during GulfCet aerial surveys of the northern Gulf of Mexico during 1992 to 1998 (Hansen et al. 1996; Mullin and Hoggard 2000).

3.4.2.24.3 Population and Abundance

Data are insufficient to estimate abundance for the western North Atlantic stock. The best abundance estimate available for northern Gulf of Mexico clymene dolphins is 129 (CV=1.00). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 64 individuals (Waring et al. 2013).

3.4.2.24.4 Predator/Prey Interactions

Available information on feeding habits is very limited. This species preys on small fish and squid at moderate depths and feeds primarily at night (Fertl et al. 1997; Jefferson et al. 2008b; Perrin et al. 1981).

This species is possibly preyed on by killer whales and large sharks, as evidenced by scars observed on their bodies, although actual predation was not observed (Jefferson 2008; Jefferson et al. 2008b).

3.4.2.24.5 Species-Specific Threats

There are no significant species-specific threats to clymene dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.25 Striped Dolphin (*Stenella coeruleoalba*)

3.4.2.25.1 Status and Management

This species is not listed under the ESA but is protected under the MMPA. For management purposes, the Gulf of Mexico population is provisionally considered a separate stock, although there are not sufficient genetic data to differentiate the Gulf of Mexico stock from the western North Atlantic stock (Waring et al. 2010). There is very little information on stock structure in the western North Atlantic and insufficient data to assess population trends of this species (Waring et al. 2010).

3.4.2.25.2 Habitat and Geographic Range (Excerpts from Waring et al. (2010))

The striped dolphin is one of the most common and abundant dolphin species, with a worldwide range that includes both tropical and temperate waters.

Although primarily a warm-water species, the range of the striped dolphin extends higher into temperate regions than those of any other species in the genus *Stenella* (spotted, spinner, clymene, and striped dolphins); it is found in the western North Atlantic from Nova Scotia south to at least Jamaica as well as in the Gulf of Mexico. In general, striped dolphins appear to prefer continental slope waters offshore to the Gulf Stream (Leatherwood et al. 1976; Perrin et al. 1994c; Schmidly 1981).

Gulf Stream Open Ocean Area. Striped dolphins are relatively common in the cooler offshore waters of the U.S. east coast. Along the mid-Atlantic ridge in oceanic waters of the North Atlantic Ocean, striped dolphins are sighted in significant numbers south of 50° N (Waring et al. 2010). In waters off the northeastern U.S. coast, striped dolphins are distributed along the continental shelf edge from Cape Hatteras to the southern margin of Georges Bank and also occur offshore over the continental slope and rise in the mid-Atlantic region (Cetacean and Turtle Assessment Program 1982; Mullin and Fulling 2003). Continental shelf edge sightings in the Cetacean and Turtle Assessment Program (1982) were generally centered along the 1,000-m depth contour in all seasons. During 1990 and 1991 cetacean habitat-use surveys, striped dolphins were associated with the Gulf Stream north wall and warm-core ring features (Waring et al. 1992). Striped dolphins seen in a survey of the New England Sea Mounts (Palka 1997) were in waters that were between 20° and 27°C and deeper than about 3,000 ft. (900 m).

Gulf of Mexico Large Marine Ecosystem. Striped dolphins are also found throughout the deep, offshore waters of the northern Gulf of Mexico. Sightings of striped dolphins in the northern Gulf of Mexico typically occur in oceanic waters and during all seasons (Waring et al. 2010).

3.4.2.25.3 Population and Abundance

The total number of striped dolphins off the U.S. or Canadian Atlantic coasts is unknown, although several estimates from selected regions are available for select time periods. Sightings are almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank. The best abundance estimate for striped dolphins is 46,882 (CV=0.33) based on a 2011 survey (Palka 2012). The minimum population estimate for the western North Atlantic striped dolphin is 35,763 (Waring et al. 2013).

The best abundance estimate available for northern Gulf of Mexico striped dolphins is 3,325 (CV=0.48) (Mullin 2007). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (Waring et al. 2013).

3.4.2.25.4 Predator/Prey Interactions

Striped dolphins often feed in open sea or sea bottom zones along the continental slope or just beyond it in oceanic waters. Most of their prey possess light-emitting organs, suggesting that striped dolphins may be feeding at great depths, possibly diving to 655 to 2,295 ft. (200 to 700 m) (Archer and Perrin 1999). Striped dolphins may feed at night to take advantage of the deep scattering layer's diurnal vertical movements. Small mid-water fishes (in particular lanternfishes) and squids are the predominant prey (Perrin et al. 1994c).

This species was documented to be preyed on by sharks (Ross 1971). It may also be subject to predation by killer whales.

3.4.2.25.5 Species-Specific Threats

There are no significant species-specific threats to striped dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.26 Fraser's Dolphin (*Lagenodelphis hosei*)

3.4.2.26.1 Status and Management

This species is not listed under the ESA but is protected under the MMPA. The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there are no genetic data to differentiate this stock from the western North Atlantic stock.

3.4.2.26.2 Habitat and Geographic Range

Fraser's dolphin is a tropical, oceanic species, except where deep water approaches the coast (Dolar 2008). This species is assumed to occur in the tropical western North Atlantic, although only a single sighting of approximately 250 individuals was recorded in waters 3,300 m deep in the waters off Cape Hatteras during a 1999 vessel survey (National Marine Fisheries Service 1999).

Gulf of Mexico Large Marine Ecosystem. The first record for the Gulf of Mexico was a mass stranding in the Florida Keys in 1981 (Hersh and Odell 1986; Leatherwood et al. 1993). Since then, there have been documented strandings on the west coast of Florida and in southern Texas (Yoshida et al. 2010). Sightings of Fraser's dolphin in the northern Gulf of Mexico typically occur in oceanic waters greater than 656.2 ft. (200 m). This species was observed in the northern Gulf of Mexico during all seasons.

3.4.2.26.3 Population and Abundance

Current data are insufficient to calculate a population estimate for the western North Atlantic and Gulf of Mexico oceanic stocks of Fraser's dolphins (Waring et al. 2013).

3.4.2.26.4 Predator/Prey Interactions

Fraser's dolphin feeds on mid-water fishes, squids, and shrimps and has not been documented to be prey to any other species (Jefferson and Leatherwood 1994; Perrin et al. 1994b). However, this species may be subject to predation by killer whales.

3.4.2.26.5 Species-Specific Threats

There are no significant species-specific threats to Fraser's dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats To Marine Mammals) discusses threats to marine mammals.

3.4.2.27 Risso's Dolphin (*Grampus griseus*)

3.4.2.27.1 Status and Management

Risso's dolphin is not listed under the ESA but is protected under the MMPA. Risso's dolphins in the Atlantic Ocean are separated into the Gulf of Mexico and the North Atlantic stocks (Waring et al. 2010).

3.4.2.27.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Risso's dolphins are distributed worldwide in tropical and temperate waters along the continental shelf break and over the continental slope and outer continental shelf (Baumgartner 1997; Canadas et al. 2002; Cetacean and Turtle Assessment Program 1982; Davis et al. 1998; Green et al. 1992; Kruse et al. 1999; Mignucci-Giannoni 1998). Risso's dolphins were also found in association with submarine canyons (Mussi et al. 2004). In the northwest Atlantic, Risso's dolphins occur from Florida to eastern Newfoundland (Baird and Stacey 1991; Leatherwood et al. 1976).

Open Ocean. The range of the Risso's dolphin distribution in open-ocean waters of the North Atlantic is known to include the Gulf Stream and the southwestern portions of the North Atlantic Gyre.

Northeast U.S. and Southeast U.S. Continental Shelf Large Marine Ecosystems. Off the northeast U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (Cetacean and Turtle Assessment Program 1982; Payne et al. 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne et al. 1984). In general, the population occupies the mid-Atlantic continental shelf edge year round and is rarely seen in the Gulf of Maine (Payne et al. 1984). During 1990, 1991 and 1993, spring/summer surveys conducted along the continental shelf edge and in deeper oceanic waters sighted Risso's dolphins associated with strong bathymetric features, Gulf Stream warm core rings, and the Gulf Stream north wall (Hamazaki 2002; Waring et al. 1992, 1993).

Gulf of Mexico Large Marine Ecosystem. Risso's dolphins in the northern Gulf of Mexico occur throughout oceanic waters but are concentrated in continental slope waters (Baumgartner 1997; Maze-Foley and Mullin 2006). Risso's dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen et al. 1996; Mullin and Hoggard 2000).

3.4.2.27.3 Population and Abundance

Nine abundance estimates are available for Risso's dolphins from selected regions for select time periods. Sightings were almost exclusively in continental shelf edge and continental slope. The best abundance estimate for Risso's dolphins is 15,197 (CV=0.55) based on a 2011 survey (Palka 2012). The minimum population estimate for the western North Atlantic Risso's dolphin is 9,857 (Waring et al. 2013).

The best abundance estimate available for northern Gulf of Mexico Risso's dolphins is 2,442 (CV=0.57). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 1,563 individuals (Waring et al. 2013).

3.4.2.27.4 Predator/Prey Interactions

Cephalopods and crustaceans are the primary prey for the Risso's dolphins (Clarke 1996), which feed mainly at night (Baird 2008; Jefferson et al. 2008b).

This dolphin may be preyed on by both killer whales and sharks, although there is no documented report of predation by either species (Weller 2008).

3.4.2.27.5 Species-Specific Threats

There are no significant species-specific threats to Risso's dolphins in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.28 Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*)

3.4.2.28.1 Status and Management

The Atlantic white-sided dolphin is not listed under the ESA but is protected under the MMPA. Three stocks of the Atlantic white-sided dolphin in the western North Atlantic Ocean were suggested for conservation management: Gulf of Maine, Gulf of St. Lawrence, and Labrador Sea (Palka et al. 1997; Waring et al. 2004). However, genetic analysis indicates that no definite stock structure exists. The species is considered abundant in the North Atlantic (Jefferson et al. 2008b; Waring et al. 2013).

3.4.2.28.2 Habitat and Geographic Range

This species is found primarily in cold temperate to subpolar continental shelf waters to the 328 ft. (100 m) depth contour (Cetacean and Turtle Assessment Program 1982; Mate et al. 1994; Selzer and Payne 1988). Occurrence of Atlantic white-sided dolphins in the northeastern United States probably reflects fluctuations in food availability as well as oceanographic conditions (Palka et al. 1997; Selzer and Payne 1988). Before the 1970s, Atlantic white-sided dolphins were found primarily offshore in waters over the continental slope; however, since then, they occur primarily in waters over the continental shelf, replacing white-beaked dolphins, which were previously sighted in the area. This shift may have been the result of an increase in sand lance and a decline in herring in continental shelf waters (Payne et al. 1990). Areas of feeding importance are around Cape Cod and on the northwest edge of Georges Bank, in an area defined as the Great South Channel-Jeffreys Ledge corridor (Cetacean and Turtle Assessment Program 1982; Palka et al. 1997). Selzer and Payne (1988) sighted white-sided dolphins more frequently in areas of high seafloor relief and where sea surface temperatures and salinities were low, although these environmental conditions might be only secondarily influencing dolphin distribution; seasonal variation in sea surface temperature and salinity and local nutrient upwelling in areas of high seafloor relief may affect preferred prey abundances, which in turn might affect dolphin distribution (Selzer and Payne 1988).

Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems. This species' open ocean range includes the Gulf Stream. Atlantic white-sided dolphins are common in waters of the continental slope from New England in the west, north to southern Greenland (Cipriano 2008; Jefferson et al. 2008b). Along the Canadian and U.S. Atlantic coast, this species is most common from Hudson Canyon north to the Gulf of Maine (Palka et al. 1997).

Northeast U.S. Continental Shelf Large Marine Ecosystem. From January to April, low numbers of white-sided dolphins may be found from Georges Bank to Jeffreys Ledge. Even lower numbers are found south of Georges Bank (Palka et al. 1997; Payne et al. 1990; Waring et al. 2004). From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy (Payne et al. 1990; Waring et al. 2004). During this time, strandings occur from New Brunswick to New York (Palka et al. 1997). From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to the southern Gulf of Maine. Sightings occur year-round south

of Georges Bank, particularly around Hudson Canyon, but in low densities (Cetacean and Turtle Assessment Program 1982; Palka 1997; Payne et al. 1990; Waring et al. 2004).

Southeast U.S. Continental Shelf Large Marine Ecosystem. A few strandings were collected on Virginia and North Carolina beaches, which appear to represent the southern edge of the range for this species (Cipriano 2008; Testaverde and Mead 1980).

3.4.2.28.3 Population and Abundance

This species is quite abundant throughout its range, with numbers estimated to be in the hundreds of thousands. The best available current abundance estimate for white-sided dolphins in the western North Atlantic stock is 48,819 (CV=0.61) based on a 2011 survey (Palka 2012). However, because of apparent changes in the seasonal distribution of this species, the best available abundance estimate may come from one of the non-summer abundance surveys to be conducted between 2011-2015 (Waring et al. 2013).

3.4.2.28.4 Predator/Prey Interactions

The stomach contents of Atlantic white-sided dolphins caught through fishing bycatch, as well as those stranded off of the coast of New England, have included at least 26 fish species and three cephalopod species. The most prominent species were the silver hake, spoonarm octopus, and haddock. There is seasonal variation in the diet; Atlantic herring was found in more dolphins during the summer than in winter (Craddock et al. 2009). This species is known to feed in association with other delphinid (dolphin-like) and large whale species (Jefferson et al. 2008b; Palka 1997).

This species was not documented to be prey for any other species (Jefferson et al. 2008b).

3.4.2.28.5 Species-Specific Threats

A review of 405 cases of marine mammal mortalities on Cape Cod and southeastern Massachusetts from 2000 to 2006 concluded that mass strandings were the main cause of mortality for 69 percent of Atlantic white-sided dolphins (Bogomolni et al. 2010).

3.4.2.29 White-Beaked Dolphin (*Lagenorhynchus albirostris*)

3.4.2.29.1 Status and Management

The white-beaked dolphin is not listed under the ESA but is protected under the MMPA. There are at least two separate stocks of the white-beaked dolphin in the North Atlantic: one in the eastern and another in the western North Atlantic. Abundance has declined in some areas, such as the Gulf of Maine, but this may be more closely related to habitat shifts than to direct changes in population size.

3.4.2.29.2 Habitat and Geographic Range

White-beaked dolphins are found in cold-temperate and subarctic waters of the North Atlantic. In the western North Atlantic Ocean, the white-beaked dolphin occurs throughout northern waters of the east coast of the United States and eastern Canada, from eastern Greenland through the Davis Strait and south to Massachusetts (Lien et al. 2001).

Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems. Within the Study Area, white-beaked dolphins are concentrated in the western Gulf of Maine and around Cape Cod (Cetacean and Turtle Assessment Program 1982; Palka et al. 1997). Before the 1970s, these dolphins were found primarily in waters over the continental shelf of the Gulf of Maine

and Georges Bank; since then, they occur mainly in waters over the continental slope and are replaced by large numbers of Atlantic white-sided dolphins (Katona et al. 1993; Palka et al. 1997; Sergeant et al. 1980). This habitat shift might be a result of an increase in sand lance and a decline in herring in continental shelf waters (Payne et al. 1990).

Sightings are common in nearshore waters of Newfoundland and Labrador (Lien et al. 2001). They also occur in the Gulf of St. Lawrence (Waring et al. 2010). During Cetacean and Turtle Assessment Program (1982) surveys, white-beaked dolphins were typically sighted in shallow coastal waters near Cape Cod and along Stellwagen Bank, with a bottom depth ranging from 43 to 2,454 ft. (13 to 748 m) (Palka et al. 1997).

3.4.2.29.3 Population and Abundance

The total number of white-beaked dolphins in U.S. and Canadian waters is unknown. The best and only recent abundance estimate for the western North Atlantic white-beaked dolphin is 2,003 (CV=0.94), an estimate derived from aerial survey data collected in August 2006. It is assumed this estimate is negatively biased because the survey only covered part of the species' habitat. The minimum population estimate for these white-beaked dolphins is 1,023 (Waring et al. 2013).

3.4.2.29.4 Predator/Prey Interactions

This species preys on small mid-water and schooling fish, such as herring and haddock, and squid and crustaceans (Jefferson et al. 2008b). Cooperative feeding was observed (Jefferson et al. 2008b).

The white-beaked dolphin is possibly preyed on by killer whales and sharks. Although no attacks were documented, groups of white-beaked dolphin were observed fleeing from killer whales (Kinze 2008).

3.4.2.29.5 Species-Specific Threats

There are no significant species-specific threats to white-beaked dolphins in the northwest Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.30 Common Dolphin (*Delphinus delphis/capensis*)

Because of the relatively recent discovery that common dolphins represent two distinct species (short-beaked common dolphin and long-beaked common dolphin), rather than a single species as previously thought, much of the biological information for dolphins of the genus *Delphinus* cannot be reliably applied to one or the other, especially in regions where the two species overlap (Heyning and Perrin 1994).

3.4.2.30.1 Status and Management

Common dolphins are protected under the MMPA but not listed under the ESA. Only the short-beaked common dolphin has occurrence within the Study Area. A discrete population of long-beaked common dolphins is known from the east coast of South America in the western Atlantic (Jefferson et al. 2008b). A single stock of short-beaked common dolphins is found within the Study Area: the western North Atlantic stock (Jefferson et al. 2009; Waring et al. 2013).

3.4.2.30.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

In the North Atlantic, common dolphins occur over the continental shelf along the 100–2,000-m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (29°W)

(Doksaeter et al. 2008; Waring et al. 2008). The species is less common south of Cape Hatteras, although schools were reported as far south as the Georgia/South Carolina border (32° N) (Jefferson et al. 2009).

Gulf Stream Open Ocean Area. There is a well-studied population of short-beaked common dolphins in the western North Atlantic, associated with the Gulf Stream (Jefferson et al. 2009). It occurs mainly in offshore waters, ranging from Florida/Georgia to the Canada maritime provinces (Waring et al. 2010).

Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems. In waters off the northeastern U.S. coast, common dolphins are distributed along the continental slope and are associated with Gulf Stream features (Cetacean and Turtle Assessment Program 1982; Hamazaki 2002; Selzer and Payne 1988; Stone et al. 1992). They primarily occur from Cape Hatteras northeast to Georges Bank (35° to 42°N) during mid-January to May (Cetacean and Turtle Assessment Program 1982; Hain et al. 1981; Payne et al. 1984). Common dolphins move onto Georges Bank and the Scotian Shelf from mid-summer to autumn. Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins are occasionally found in the Gulf of Maine (Selzer and Payne 1988). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11°C (Gowans and Whitehead 1995; Sergeant et al. 1970).

3.4.2.30.3 Population and Abundance

The current best abundance estimate for common dolphins off the U.S. or Canadian Atlantic coasts is based on a 2011 survey of 67,191 (CV=0.29) (Palka 2012). The minimum population estimate for the western North Atlantic common dolphin is 52,893 (Waring et al. 2013).

3.4.2.30.4 Predator/Prey Interactions

Stomach contents of *Delphinus* from outside of the Study Area in California waters revealed 19 species of fish and two species of cephalopods; *Delphinus* feed primarily on organisms in the vertically migrating deep scattering layer. Diel (a 24-hour cycle that often involves a day and the adjoining night) fluctuations in vocal activity, with more vocal activity during late evening and early morning, appear to be linked to feeding in the deep scattering layer, which rises in this same time frame (Goold 2000). In the western North Atlantic, oceanic dolphins feed more on squid than those in more nearshore waters (Perrin 2008b).

Short-beaked common dolphins are known to be preyed on by killer whales (Visser 1999) and large sharks (Leatherwood et al. 1973), although little is known about the impact of this predation on populations.

3.4.2.30.5 Species-Specific Threats

There are no significant species-specific threats to common dolphins in the northwest Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.31 Melon-Headed Whale (*Peponocephala electra*)

3.4.2.31.1 Status and Management

The melon-headed whale is not listed under the ESA but is protected under the MMPA. For management purposes, the western North Atlantic population and Gulf of Mexico population are considered separate stocks, although genetic data that differentiate these two stocks is lacking (Waring et al. 2010).

3.4.2.31.2 Habitat and Geographic Range

Melon-headed whales are found worldwide in tropical and subtropical waters. They are occasionally reported at higher latitudes, but these movements are considered to be beyond their typical range because the records indicate these movements occurred during incursions of warm water currents (Perryman et al. 1994). Melon-headed whales are most often found in offshore deep waters but sometimes move close to shore over the continental shelf. In the Study Area, this species was observed in deep waters of the Gulf of Mexico, well beyond the edge of the continental shelf and in waters over the abyssal plain, primarily west of Mobile Bay, Alabama (Davis and Fargion 1996; Mullin et al. 1994b; Waring et al. 2010). Sightings of melon-headed whales in the northern Gulf of Mexico were documented in all seasons during GulfCet aerial surveys 1992 and 1998 (Hansen et al. 1996; Mullin and Hoggard 2000). Sightings of whales from the Western North Atlantic stock are rare, but a group of 20 whales was sighted during surveys in 1999, and a group of 80 whales was sighted off Cape Hatteras, North Carolina, in 2002, in waters greater than 8,202 ft. (2,500 m) deep (Waring et al. 2013).

3.4.2.31.3 Population and Abundance

The abundance of melon-headed whales off the eastern United States and Canadian Atlantic coast is unknown because of the rarity of sightings during surveys (Waring et al. 2010). The best abundance estimate available for northern Gulf of Mexico melon-headed whale stock is 2,283 (CV=0.76) (Mullin 2007). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (Waring et al. 2013).

3.4.2.31.4 Predator/Prey Interactions

Melon-headed whales prey on squid, pelagic fishes, and occasionally crustaceans. Most of the fish and squid families eaten by this species consist of mid-water forms found in waters up to 4,920 ft. (1,500 m) deep, suggesting that feeding takes place deep in the water column (Jefferson and Barros 1997).

Melon-headed whales are believed to be preyed on by killer whales and were observed fleeing from killer whales in Hawaiian waters (Baird et al. 2006).

3.4.2.31.5 Species-Specific Threats

There are no significant species-specific threats to melon-headed whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.32 Pygmy Killer Whale (*Feresa attenuata*)

3.4.2.32.1 Status and Management

The pygmy killer whale is not listed under the ESA but is protected under the MMPA. For management purposes, the Gulf of Mexico population is considered a separate stock although there is not yet sufficient genetic information to differentiate this stock from the western North Atlantic stocks (Waring et al. 2013).

3.4.2.32.2 Habitat and Geographic Range

Although the pygmy killer whale has an extensive global distribution, it is not known to occur in high densities in any region and is therefore probably one of the least abundant pantropical delphinids. The pygmy killer whale is generally an open ocean deepwater species (Davis et al. 2000; Würsig et al. 2000). This species has a worldwide distribution in tropical and subtropical oceans. Pygmy killer whales

generally do not range poleward of 40° N or of 35° S (Donahue and Perryman 2008; Jefferson et al. 2008b).

North Atlantic Gyre and Gulfstream Open Ocean Areas. In the Study Area, this species occurs in the North Atlantic Gyre and the Gulfstream, although sightings are rare. Most observations outside the tropics are associated with strong, warm western boundary currents that effectively extend tropical conditions into higher latitudes (Ross and Leatherwood 1994).

Gulf of Mexico Large Marine Ecosystem. In the northern Gulf of Mexico, the pygmy killer whale is found primarily in deeper waters off the continental shelf and in waters over the abyssal plain (Davis et al. 2000; Würsig et al. 2000).

3.4.2.32.3 Population and Abundance

There are no available abundance estimates for the western North Atlantic stock of pygmy killer whales, and this species is relatively rare in the Gulf of Mexico. The best estimate available for northern Gulf of Mexico pygmy killer whales is 152 (CV=1.02). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 75 pygmy killer whales (Waring et al. 2013).

3.4.2.32.4 Predator/Prey Interactions

Pygmy killer whales feed predominantly on fish and squid. They are known to attack other dolphin species, apparently as prey, although this is not common (Jefferson et al. 2008b; Perryman and Foster 1980; Ross and Leatherwood 1994).

The pygmy killer whale has no documented predators (Weller 2008). It may be subject to predation by killer whales.

3.4.2.32.5 Species-Specific Threats

There are no significant species-specific threats to pygmy killer whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.33 False Killer Whale (*Pseudorca crassidens*)

3.4.2.33.1 Status and Management

The false killer whale is not listed under the ESA but is protected under the MMPA. Little is known of the status of most false killer whale populations around the world. While the species is not considered rare, few areas of high density are known. The population found in the Gulf of Mexico is considered a separate stock for management purposes; however, there are no genetic data to differentiate this stock from the western North Atlantic stock.

3.4.2.33.2 Habitat and Geographic Range

False killer whales occur worldwide throughout warm temperate and tropical oceans in deep open-ocean waters and around oceanic islands and only rarely come into shallow coastal waters (Baird et al. 2008; Leatherwood and Reeves 1983; Odell and McClune 1999). Occasional inshore movements are associated with movements of prey and shoreward flooding of warm ocean currents (Stacey et al. 1994). In the Study Area, this species occurs rarely in the southwestern regions of the North Atlantic Gyre. Sightings of this species in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur in oceanic waters,

primarily in the eastern Gulf (Maze-Foley and Mullin 2006; Mullin and Fulling 2004). False killer whales were seen only in the spring and summer during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen et al. 1996; Mullin and Hoggard 2000) and in the spring during vessel surveys (Mullin et al. 2004).

3.4.2.33.3 Population and Abundance

The current population size for the false killer whale in the northern Gulf of Mexico is unknown because the survey data are more than eight years old (Waring et al. 2013). However, the previous best abundance estimate available for northern Gulf of Mexico false killer whales is 777 (CV=0.56) (Mullin 2007). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (Waring et al. 2010).

3.4.2.33.4 Predator/Prey Interactions

False killer whales feed primarily on deep-sea cephalopods and fish (Odell and McClune 1999). They may prefer large fish species, such as mahi mahi and tuna. Twenty-five false killer whales that stranded off the coast of the Strait of Magellan (outside of the Study Area) were examined and found to feed primarily on cephalopods and fish. Squid beaks were found in nearly half of the stranded animals. The most important prey species were found to be squid, followed by Patagonian grenadier, a coastal fish (Alonso et al. 1999).

False killer whales were observed attacking dolphins and large whales, such as humpback and sperm whales (Baird 2009a). They are known to behave aggressively toward small cetaceans in tuna purse seine nets. Unlike other whales or dolphins, false killer whales frequently pass prey back and forth among individuals before they start to eat the fish, in what appears to be a way of affirming social bonds (Baird et al. 2010).

This species is believed to be preyed on by large sharks and killer whales (Baird 2009b).

3.4.2.33.5 Species-Specific Threats

There are no significant species-specific threats to false killer whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.34 Killer Whale (*Orcinus orca*)

3.4.2.34.1 Status and Management

The killer whales in the Atlantic and Gulf of Mexico are not listed under the ESA although, like all marine mammals, they are protected under the MMPA. Although some populations, particularly in the northwest Pacific, are extremely well studied, little is known about killer whale populations in most areas including the northwest Atlantic. Killer whales are apparently not highly abundant anywhere but are observed in higher concentration in Antarctic waters. For management purposes, the western North Atlantic population and Gulf of Mexico population are considered separate stocks (Waring et al. 2010).

3.4.2.34.2 Habitat and Geographic Range

Killer whales are found in all marine habitats, from the coastal zone (including most bays and inshore channels) to deep oceanic basins and from equatorial regions to the polar pack ice zones of both hemispheres. Although killer whales are also found in tropical waters and the open ocean, they are generally most numerous in coastal waters and at higher latitudes (Dahlheim and Heyning 1999).

Open Ocean. The open ocean range of the killer whale in the Study Area includes the Labrador Current, Gulf Stream, and North Atlantic Gyre.

Northeast and Southeast Large Marine Ecosystems. Killer whales are considered rare and uncommon in waters of the U.S. Exclusive Economic Zone in the Atlantic Ocean (Katona et al. 1988; Waring et al. 2010). During the 1978 to 1981 Cetacean and Turtle Assessment Program surveys, there were 12 killer whale sightings, which made up 0.1 percent of the 11,156 cetacean sightings in the surveys (Cetacean and Turtle Assessment Program 1982; Waring et al. 2010).

Nearshore observations are rare. Forty animals were observed in the southern Gulf of Maine in September 1979 and 29 animals in Massachusetts Bay in August 1986 (Katona et al. 1988; Waring et al. 2010).

Gulf of Mexico Large Marine Ecosystem. Sightings of killer whales in the Gulf of Mexico on surveys from 1951 to 1995 were in waters ranging from 840 to 8,700 ft. (256 to 2,652 m), with an average of 4,075 ft. (1,242 m), and were most frequent in the north-central region of the Gulf of Mexico. Killer whales are relatively uncommon in the northern Gulf of Mexico, with only 49 (CV=0.77) individuals estimated to occur there (CV=0.77) (Waring et al. 2010). Some previous estimates were much higher, but these suffered from low precision due to the relative rarity with which killer whales are sighted on Gulf of Mexico research cruises.

3.4.2.34.3 Population and Abundance

Killer whales are distributed worldwide but are not considered particularly abundant anywhere in the world. Research indicates there are well in excess of 50,000, and perhaps even more than 100,000 worldwide (Ford 2008). The number of killer whales in the waters of the east coast of the United States and eastern Canada is not known. However, killer whale abundance in these waters appears relatively low. Nonetheless, there are likely to be at least several hundred to several thousand in these waters (Waring et al. 2010).

Data are currently insufficient to calculate a population estimate for the western North Atlantic stock of killer whales. The best abundance estimate available for northern Gulf of Mexico killer whales is 28 (CV=1.02). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The minimum population estimate for the northern Gulf of Mexico is 14 killer whales (Waring et al. 2013).

3.4.2.34.4 Predator/Prey Interactions

Killer whales are apex predators and feed on a variety of prey, including bony fishes, elasmobranchs (a class of fish composed of sharks, skates, and rays), cephalopods, seabirds, sea turtles, and other marine mammals (Fertl et al. 1996; Jefferson et al. 2008b). Some populations are known to specialize in specific types of prey (Jefferson et al. 2008b; Krahn et al. 2004; Wade et al. 2009).

The killer whale has no known natural predators; it is considered to be the top predator of the oceans (Ford et al. 2005).

3.4.2.34.5 Species-Specific Threats

There are no significant species-specific threats to killer whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.35 Long-Finned Pilot Whale (*Globicephala melas*)

There are two species of pilot whales in the western Atlantic: the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea; therefore, the ability to separately assess the two stocks in U.S. Atlantic waters is limited.

3.4.2.35.1 Status and Management (Excerpts from Waring et al. (2013))

Long-finned pilot whales are not listed under the ESA but are protected under the MMPA. The structure of the Western North Atlantic stock of long-finned pilot whales is uncertain (Fullard et al. 2000; International Council of the Exploration of the Sea 1993). Morphometric (Bloch and Lastein 1993) and genetic (Fullard et al. 2000; Siemann 1994) studies have provided little support for stock structure across the Atlantic (Fullard et al. 2000). However, Fullard et al. (2000) have proposed a stock structure that is related to sea-surface temperature: (1) a cold-water population west of the Labrador/North Atlantic Current and (2) a warm-water population that extends across the Atlantic in the Gulf Stream.

3.4.2.35.2 Habitat and Geographic Range (Excerpts from Waring et al. (2010))

Long-finned pilot whales inhabit temperate and subpolar zones from North Carolina to North Africa (and the Mediterranean) and north to Iceland, Greenland and the Barents Sea (Abend 1993; Abend and Smith 1999; Buckland et al. 1993; Leatherwood et al. 1976; Sergeant 1962). They occur along the continental shelf break, in continental slope waters, and in areas of high topographic relief (Olson 2009).

They occur in high densities over the continental slope in the western North Atlantic during winter and spring and inhabit waters over the continental shelf in summer and fall. They are associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring et al. 2010). In coastal areas, long-finned pilot whale distribution in the western Atlantic is known to extend essentially from Canada to Cape Hatteras, North Carolina (Waring et al. 2010).

Northeast U.S. Continental Shelf Large Marine Ecosystem. In U.S. Atlantic waters, pilot whales (*Globicephala* spp.) are distributed principally along the continental shelf edge off the northeastern U.S. coast in winter and early spring (Abend and Smith 1999; Cetacean and Turtle Assessment Program 1982; Hamazaki 2002; Payne and Heinemann 1993). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters; they remain in these areas through late autumn (Cetacean and Turtle Assessment Program 1982; Payne and Heinemann 1993). Pilot whales tend to occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring et al. 1992) and the two species overlap spatially along the mid-Atlantic shelf break between Cape Hatteras, North Carolina, and New Jersey (Payne and Heinemann 1993).

3.4.2.35.3 Population and Abundance (Excerpts from Waring et al. (2013))

There are estimated to be approximately 31,100 long-finned pilot whales in the western North Atlantic (this estimate likely includes a small number of short-finned pilot whales) (Best 2007; Olson 2009). Off the east coast of the United States, long- and short-finned pilot whales overlap, and no reliable method of distinguishing these two very similar species has been identified for sightings at sea (with the exception of genetic analysis from biopsy samples, which is not often done). The best available abundance estimates are from surveys conducted during the summer of 2004. These survey data are combined with an analysis of the spatial distribution of the two species based on genetic analyses of biopsy samples to derive separate abundance estimates (L. Garrison, National Marine Fisheries Service

Southeast Fisheries Science Center, personal communication). The resulting abundance estimate for long-finned pilot whales in U.S. waters is 12,619 (CV=0.37).

3.4.2.35.4 Predator/Prey Interactions

Both pilot whale species feed primarily on squid but also eat fish, including mackerel, cod, turbot, herring, hake, and dogfish (Bernard and Reilly 1999). They are also known to feed on shrimp (Gannon et al. 1997; Jefferson et al. 2008b). Feeding generally takes place at depths between 656 and 1,640 ft. (between 200 and 500 m) (Jefferson et al. 2008b). Some accounts of pilot whale attacks on small marine mammals are known, but pilot whales generally are not known to prey on marine mammals (Weller et al. 1996).

Killer whales are possible predators of long-finned pilot whales.

3.4.2.35.5 Species-Specific Threats

There are no significant species-specific threats to long-finned pilot whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.36 Short-Finned Pilot Whale (*Globicephala macrorhynchus*)

There are two species of pilot whales in the western Atlantic: the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea; therefore, the ability to separately assess the two stocks in U.S. Atlantic waters is limited. Only the short-finned pilot whale occurs in the Gulf of Mexico and Caribbean.

3.4.2.36.1 Status and Management

The short-finned pilot whale is not listed under the ESA but is protected under the MMPA. Studies are currently being conducted at the NMFS Southeast Fisheries Science Center to evaluate genetic population structure in short-finned pilot whales. The short-finned pilot whale population is managed as three stocks: Western North Atlantic stock, U.S. Virgin Islands stock, and Gulf of Mexico Oceanic stock. These three stocks are considered separate from the long-finned pilot whale population in the U.S. Atlantic Ocean.

3.4.2.36.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Short-finned pilot whales range throughout warm temperate to tropical waters of the world, generally in deep offshore areas. Thus, the species occupies waters over the continental shelf break, in slope waters, and in areas of high topographic relief (Olson 2009). While pilot whales are typically distributed along the continental shelf break, movements over the continental shelf are commonly observed in the northeastern United States. Atlantic distribution in the open ocean is known to include the Gulf Stream and North Atlantic Gyre. Sightings of pilot whales (*Globicephala* spp.) in the western North Atlantic occur primarily near the continental shelf break ranging from Florida to the Nova Scotian Shelf (Mullin and Fulling 2003). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between Cape Hatteras, North Carolina, and New Jersey (Payne and Heinemann 1993). In addition, short-finned pilot whales are documented along the continental shelf and continental slope in the northern Gulf of Mexico (Hansen et al. 1996; Mullin and Fulling 2003; Mullin and Hoggard 2000), and in the Caribbean.

3.4.2.36.3 Population and Abundance (Excerpts from Waring et al. (2013))

The best available abundance estimates for the western North Atlantic stock of short-finned pilot whales are from surveys conducted during the summer of 2004 because these are the most recent surveys covering the full range of pilot whales in U.S. Atlantic waters. These survey data were combined with an analysis of the spatial distribution of the two species based on genetic analyses of biopsy samples to derive separate abundance estimates (L. Garrison, National Marine Fisheries Service Southeast Fisheries Science Center, personal communication). The resulting abundance estimate for short-finned pilot whales is 24,674 (CV=0.45). The best abundance estimate available for northern Gulf of Mexico short-finned pilot whales is 2,415 (CV=0.66). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone. The abundance of the Puerto Rico and U.S. Virgin Islands stock of short-finned pilot whales is unknown (Waring et al. 2013).

3.4.2.36.4 Predator/Prey Interactions

Pilot whales feed primarily on squid, to which they are generally well adapted (Jefferson et al. 2008b; Werth 2006), but they also take fish (Bernard and Reilly 1999). Pilot whales are not generally known to prey on other marine mammals, but records from the eastern tropical Pacific suggest that the short-finned pilot whale does occasionally chase and attack, and may even eat, dolphins during fishery operations (Olson 2009; Perryman and Foster 1980). They were also observed harassing sperm whales in the Gulf of Mexico (Weller et al. 1996).

This species is not known to have any predators (Weller 2008), but it may be subject to predation by killer whales.

3.4.2.36.5 Species-Specific Threats

There are no significant species-specific threats to short-finned pilot whales in the northwest Atlantic or Gulf of Mexico. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.37 Harbor Porpoise (*Phocoena phocoena*)

3.4.2.37.1 Status and Management

The harbor porpoise is not listed under the ESA but is protected under the MMPA. The Gulf of Maine–Bay of Fundy stock is the only stock of harbor porpoise under NMFS management within the Study Area.

3.4.2.37.2 Habitat and Geographic Range (Excerpts from Waring et al. (2013))

Harbor porpoises inhabit cool temperate-to-subpolar waters, often where prey aggregations are concentrated (Watts and Gaskin 1985). Thus, they are frequently found in shallow waters, most often near shore, but they sometimes move into deeper offshore waters. Harbor porpoises are rarely found in waters warmer than 63°F (17°C) (Read 1999) and closely follow the movements of their primary prey, Atlantic herring (Gaskin 1992).

Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems. During summer (July to September), harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 ft. (460 m) deep (Gaskin 1977; Kraus et al. 1983; Palka 1995a; Palka 1995b), with a few sightings in the upper Bay of Fundy and on the northern edge of Georges Bank (Palka 2000). During fall (October to December) and spring (April to June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south.

They are seen from the coastline to deep waters (greater than 5,906 ft. or 1,800 m) (Westgate et al. 1998), although most of the population is found over the continental shelf. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. There does not appear to be a temporally coordinated migration or a specific migratory route to and from the Bay of Fundy region.

3.4.2.37.3 Population and Abundance

The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is 79,883 (CV=0.32) based on a 2011 survey (Palka 2012). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 61,415 (Waring et al. 2013).

3.4.2.37.4 Predator/Prey Interactions

This species preys on a variety of fish and cephalopods. The harbor porpoise is known to be attacked and killed by common bottlenose dolphins (Jefferson et al. 2008b).

3.4.2.37.5 Species-Specific Threats

Harbor porpoises have been documented as bycatch in a variety of fisheries, including sink and drift gillnets, herring weirs, and pelagic long-lines (Waring et al. 2013; Zollett 2009).

3.4.2.38 Polar Bear (*Ursus maritimus*)

3.4.2.38.1 Status and Management

In May 2008**,** the polar bear was added as a threatened species under the ESA due to loss of sea ice habitat caused by climate change; it is also protected under the MMPA. Critical habitat was designated for areas of the Alaska coast, outside of the Study Area, in 2010. The polar bear is managed by the U.S. Fish and Wildlife Service under the Department of the Interior.

3.4.2.38.2 Habitat and Geographic Range

Polar bears prefer to inhabit areas of pack ice throughout the Arctic. Typically, they are found on the edge of the ice flow and in areas of moving ice. Much of their habitat depends on sea ice, and they generally do not spend large amounts of time on land, unless the ice has melted and they are in areas without ice access (Amstrup and DeMaster 1988). Monnett and Gleason (2006) present aerial survey results that indicate polar bears are observed on land at a much higher rate than in the water (3.8 percent of observations in water in years 1987–2003 and 19.9 percent in 2004) (Monnett and Gleason 2006). Observations of free-swimming polar bears from 1987 to 2003 showed that they can occur at a distance of 3 to 47 miles (4.8 to 75.6 km) from land and 14 to 217 miles (22.5 to 349.2 km) from pack ice (Monnett and Gleason 2006).

Newfoundland-Labrador Shelf Large Marine Ecosystem. The polar bear does not occur within the U.S. Exclusive Economic Zone, although it does occur at the northern extreme of the Study Area in association with pack ice between Canada and Greenland. Polar bears are found throughout the Canadian Arctic to Greenland and Svalbard, Norway. They were found as far south as James Bay, Newfoundland, and Iceland in the North Atlantic (Amstrup and DeMaster 1988; DeMaster and Stirling 1981). The Davis Strait polar bear subpopulation, which accounts for most of the polar bears that occur in the Study Area, is distributed in the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer, and southwest Greenland (Committee on the Status of Endangered Wildlife in Canada 2002).

3.4.2.38.3 Population and Abundance

There are three subpopulations of polar bear that occur within or very near the Study Area: Foxe Basin, Baffin Bay, and Davis Strait (Committee on the Status of Endangered Wildlife in Canada 2002; Hutchings and Festa-Bianchet 2009). Estimates of abundance for these subpopulations are 2,300 bears for the Foxe Basin subpopulation, 2,200 for the Baffin Bay subpopulation, and 1,400 for the Davis Strait subpopulation (Committee on the Status of Endangered Wildlife in Canada 2002). A recent comparison of population trends for polar bears in the Arctic showed that subpopulations were declining in Baffin Bay, Kane Basin, Western Hudson Bay, and Norwegian Bay (Hutchings and Festa-Bianchet 2009). Subpopulations in Foxe Basin and Davis Strait, which are both near or within the Study Area, are either stable or of uncertain status (Hutchings and Festa-Bianchet 2009).

3.4.2.38.4 Predator/Prey Interactions

Polar bears obtain most of their prey from the sea but rarely hunt directly in the water (Amstrup 2003; Jefferson et al. 2008b). They feed mainly on ringed seals and bearded seals. Although seals are their primary source of prey, they are known to hunt larger animals, such as walruses and even small beluga whales and narwhals (Rugh and Shelden 1993; Stirling 2009). Similar to other bear species, polar bears will feed on human refuse, and when trapped on land for long periods are known to feed on small amounts of terrestrial vegetation (Amstrup 2003). They sometimes feed on Arctic cod as well. Polar bears in Hudson Bay and southeastern Baffin Island are known to fast for many months, while ice is melting during the summer, returning to the ice when it re-forms in the autumn. It appears that these animals have amazing fasting abilities but generally do not fast if they have regular access to sea ice throughout the year. Polar bears hunt by waiting near a hole in the ice used by seals for breathing and then attack when the seal surfaces to breathe. They have a well-developed sense of smell, which they use to do much of their hunting (Amstrup 2003). In at least some areas, the diets of polar bears have shifted from species associated with ice (ringed and bearded seals) to species less associated with ice (harbor and harp seals) (McKinney et al. 2009).

Polar bears have no natural predators.

3.4.2.38.5 Species-Specific Threats

The primary threat to this species is climate change and associated sea ice loss. Changes in sea ice patterns thought to be caused by climate change is reducing the size, growth, reproduction, and survival of polar bears in affected areas and is significantly shrinking their available habitat (Amstrup 2003; Durner et al. 2009).

3.4.2.39 Ringed Seal (*Pusa hispida*)

3.4.2.39.1 Status and Management

The Arctic subspecies of ringed seals was listed as threatened under the ESA in 2012 and is protected under the MMPA. This species does not occur in the U.S. Exclusive Economic Zone in the Atlantic Ocean and therefore is not managed by NMFS. Although there is no genetic evidence or other data to differentiate stocks of ringed seals, the North Atlantic Marine Mammal Commission Scientific Committee has recognized three stock areas in the northwest Atlantic based primarily on the low likelihood of mixing between the areas. Area 1 is centered on Baffin Bay and includes northeastern Canada and West Greenland coincident with the northern extreme of the Study Area (North Atlantic Marine Mammal Commission 1997).

3.4.2.39.2 Habitat and Geographic Range

Ringed seal have a circumpolar distribution throughout the Arctic basin, Hudson Bay and straights, and the Bering, Okhotsk, and Baltic Seas. The distribution of ringed seals is strongly correlated with pack and land-fast ice (Born et al. 2002; Jefferson et al. 2008b) in areas over virtually any water depth (Reeves 1998a). In the western Atlantic, they occur as far south as northern Newfoundland, northward to the pole and throughout the Canadian Arctic. They also occur throughout the Greenland Large Marine Ecosystem and can be found south to as far as Labrador off the Canadian east coast in the Newfoundland-Labrador Shelf Large Marine Ecosystem (Hammill 2009).

3.4.2.39.3 Population and Abundance

Abundance of ringed seals is very difficult to estimate because of their inaccessible habitat and tendency to spend much of the breeding season hidden from view in dens or snow caves, when many pinniped estimates are made. Therefore, any estimates are of questionable accuracy and are probably underestimates. The North Atlantic Marine Mammal Commission Scientific Committee derived a rough estimate of the abundance of ringed seals in Area 1 (coincident with the northern extreme of the Study Area) of approximately 1.3 million seals, based on extending existing estimates to areas of similar habitat (North Atlantic Marine Mammal Commission 1997).

3.4.2.39.4 Predator/Prey Interactions

Ringed seals are opportunistic feeders and eat a wide variety of prey species. More than 70 prey species were identified, including fish and planktonic and benthic crustaceans (Hammill 2009). They mostly forage solitarily or in small groups typically in deep water, under ice floes, and in the benthic communities of shallower water. The amphipod *Themisto libellula* is known to be the dominant prey type in the diet of immature ringed seals from Grise Fiord, whereas Arctic cod (*Bweogadzls saida*) and polar cod (*Arctogadus glacialis*) compose the diet of adult ringed seals (Holst et al. 2001; Jefferson et al. 2008b).

Polar bears are the primary ringed seal predator, but some may also be taken by killer whales, Greenland sharks, and walruses (Hammill 2009).

3.4.2.39.5 Species-Specific Threats

Ringed seals are harvested for subsistence use by Arctic natives and are also caught incidentally in fishing gear. Climate change is potentially the most serious threat to ringed seal populations since much of their habitat depends on pack ice.

3.4.2.40 Bearded Seal (*Erignathus barbatus*)

3.4.2.40.1 Status and Management

The bearded seal is not listed under the ESA, although two Distinct Population Segments in the Pacific have been proposed as endangered. The bearded seal is protected under the MMPA. This species does not normally occur in the U.S. Atlantic Exclusive Economic Zone but does occur in waters of eastern Canada (Kovacs 2009). The population structure of this species is not well understood in the western North Atlantic.

3.4.2.40.2 Habitat and Geographic Range

Bearded seals have a circumpolar distribution in the Arctic, generally south of 80° N latitude, and are subarctic in some areas, such as the western North Atlantic. While they are typically strongly tied to ice,

bearded seals are known to haul out on land, swim up rivers, and live in open-ocean areas for extended periods (Cleator 1996; Jefferson et al. 2008b).

Newfoundland-Labrador Shelf Large Marine Ecosystem and Scotian Shelf Large Marine Ecosystem. The preferred habitat is drifting pack ice in shallow waters. Bearded seals are found in the Arctic realm, within the following marine regions: North Greenland, West Greenland Shelf, Northern Labrador, Baffin Bay-Davis Strait, Hudson Complex, and the High Arctic Archipelago. This species spends most of its time near where the coastal ice forms and in less than 656 ft. (200 m) of water (Jefferson et al. 2008b; Kovacs 2009). Sightings outside the species' typical range were reported as far south as Cape Cod, Massachusetts.

3.4.2.40.3 Population and Abundance

Due to the patchy distribution of individuals moving with ice floes, it is difficult to make accurate abundance estimates for this species (Kovacs 2009), and no estimates exist specifically for the western Atlantic. The best available global population estimate for the bearded seal is 450,000 to 500,000, approximately half of which inhabit the Bering and Chukchi Seas (Jefferson et al. 2008b). Rough estimates based on aerial surveys conducted over a 35-year period indicated densities in Canadian waters to be approximately 0.24 seal per square kilometer in preferred habitat. The population estimate for bearded seals in Canadian waters during the survey period was 190,000 (Cleator 1996).

3.4.2.40.4 Predator/Prey Interactions

The bearded seal's diet is composed largely of demersal fish and benthic invertebrate species. Dominant prey items vary among seasons and regions. In the Bering and Chukchi Seas, bearded seals consume capelin, Arctic and saffron cod, long-snouted pricklebacks, sculpins, flatfishes, several species of snailfish, and eelpouts. Invertebrates preyed on are crabs, clams, snails, amphipods, shrimps, marine worms, and octopuses. The adult diet appears to differ somewhat from that of juveniles (Jefferson et al. 2008b; Kovacs 2009).

Polar bears, killer whales, and Greenland sharks are known bearded seal predators (Kovacs 2009).

3.4.2.40.5 Species-Specific Threats

Loss of sea ice is a potentially significant threat to the habitat of bearded seals.

3.4.2.41 Hooded Seal (*Cystophora cristata*)

3.4.2.41.1 Status and Management

Hooded seals are not listed under the ESA but are protected under the MMPA. The global hooded seal population was divided by the International Council for the Exploration of the Sea into three separate stocks based on specific breeding sites: Northwest Atlantic, Greenland Sea ("West Ice"), and White Sea ("East Ice"). The western North Atlantic stock (synonymous with the International Council for the Exploration of the Sea Northwest Atlantic Stock) give birth and nurse off the coast of eastern Canada in three specific areas: coastal Newfoundland and Labrador (an area that is known as the Front), the Gulf of St. Lawrence, and the Davis Strait (Waring et al. 2007).

3.4.2.41.2 Habitat and Geographic Range

Hooded seals are distributed in the Arctic and the cold temperate North Atlantic Ocean (Bellido et al. 2007). At sea, hooded seals stay primarily near continental coastlines but are known to wander widely.

This species follows the seasonal movement of pack ice, on which it breeds. In the Study Area, its primary range is around the Newfoundland-Labrador Shelf and Scotian Shelf (Bellido et al. 2007).

Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems. Hooded seals remain on the Newfoundland continental shelf during winter/spring (Stenson et al. 1996). Breeding and pupping areas are in the Gulf of St. Lawrence and north of Newfoundland and east of Labrador, as well as in the Davis Strait and near Jan Mayen Island in the Arctic Ocean (Hammill et al. 1997; Jefferson et al. 2008b; Kovacs 2008).

Northeast and Southeast U.S. Continental Shelf and Caribbean Sea Large Marine Ecosystems. Hooded seals are highly migratory and may wander as far south as Puerto Rico (Mignucci-Giannoni and Odell 2001), with increased occurrences from Maine to Florida. These appearances usually occur between January and May in New England waters, and in summer and autumn off the southeast U.S. coast and in the Caribbean (Harris et al. 2001; McAlpine et al. 1999; Mignucci-Giannoni and Odell 2001). Six hooded seal strandings were also reported between 1975 and 1996 in North Carolina, Florida, Georgia, Puerto Rico, and the U.S. Virgin Islands (Mignucci-Giannoni and Odell 2001).

3.4.2.41.3 Population and Abundance

The number of hooded seals in the western North Atlantic is relatively well known and is derived from pup production estimates produced from whelping (birthing) pack surveys. The best estimate of abundance for western North Atlantic hooded seals is 592,100 (SE=94,800). The minimum population estimate based on the 2005 pup survey results is 512,000. Present data are insufficient to calculate the minimum population estimate for U.S. waters (Waring et al. 2007).

3.4.2.41.4 Predator/Prey Interactions

The main prey species of hooded seals are redfish and cod, but they forage on squid and Greenland halibut as well (Hammill et al. 1997; Hauksson and Bogason 1997). Some overlap and competition exists for prey between hooded seals and harp seals (Tucker et al. 2009).

This species is preyed on by polar bears and killer whales (Kovacs 2009).

3.4.2.41.5 Species-Specific Threats

Although hooded seals are documented to be taken incidentally in commercial fishing gear, the level of take is very small compared to the size of the population. Hooded seals are also hunted commercially in Canada.

3.4.2.42 Harp Seal (*Pagophilus groenlandicus*)

3.4.2.42.1 Status and Management

The harp seal is not listed under the ESA but is protected under the MMPA. The harp seal is the most abundant pinniped in the western North Atlantic Ocean (Canada Department of Fisheries and Oceans 2003). The Western North Atlantic stock is the largest and is divided into two breeding herds: the Front herd, which breeds off the coast of Newfoundland and Labrador, and the Gulf herd, which breeds near the Magdalen Islands in the Gulf of St. Lawrence (Reeves et al. 2002b; Waring et al. 2004).

3.4.2.42.2 Habitat and Geographic Range

Harp seals are closely associated with drifting pack ice, where they breed and molt and forage in the surrounding waters (Lydersen and Kovacs 1993; Ronald and Healey 1981). Harp seals make extensive

movements over much of the continental shelf within their winter range in the waters off Newfoundland (Bowen and Siniff 1999). The primary range of this species is throughout the Arctic, but the secondary range includes the western waters of the Scotian Shelf and the Northeast U.S. Continental Shelf.

Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems. Typically, harp seals are distributed in the pack ice of the North Atlantic segment of the Arctic Ocean and through Newfoundland and the Gulf of St. Lawrence (Reeves et al. 2002b). Most western North Atlantic harp seals congregate off the east coast of Newfoundland-Labrador (the Front) to pup and breed. The remainder (the Gulf herd) gathers to pup near the Magdalen Islands in the Gulf of St. Lawrence (Morissette et al. 2006; Ronald and Dougan 1982).

Northeast U.S. Continental Shelf Large Marine Ecosystem. The number of sightings and strandings of harp seals off the northeastern United States has been increasing (Harris et al. 2002; McAlpine and Walker 1999; Stevick and Fernald 1998). These occurrences are usually during January through May (Harris et al. 2002), when the Western North Atlantic stock of harp seals is at its most southern point in distribution (Waring et al. 2004). Harp seals occasionally enter the Bay of Fundy, but McAlpine and Walker (1999) suggested that winter ocean surface currents might limit the probability of occurrences in this bay.

3.4.2.42.3 Population and Abundance

The best estimate of abundance for western North Atlantic harp seals is 6.9 million (95 percent CI 6.0–7.7 million). The minimum population estimate based on the 2008 pup survey results is 6.5 million (CV=0.06) seals. Data are insufficient to calculate the minimum population estimate for U.S. waters (Waring et al. 2013).

3.4.2.42.4 Predator/Prey Interactions

Harp seals feed on a variety of prey, which vary with age class, season, location, and year (Lavigne 2008). Prey preference studies have revealed that harp seals prefer small fish to crustaceans (Lindstrom et al. 1998). The main prey species of harp seals are sand eels, herring, and cod. Capelin also is an important food source of the harp seal (Hauksson and Bogason 1997). Contrary to popular belief, harp seals rarely eat commercially important Atlantic cod (*Gadus morhua*) (Lavigne 2008). Most foraging occurs at depths of less than 90 m, although dives as deep as 568 m have been recorded (Folkow et al. 2004; Lydersen and Kovacs 1993). Harp seals feed intensively during the winter and summer and less so during the spring and fall migrations or during pupping and molting (Ronald and Healey 1981). Some overlap and competition exists for prey between hooded seals and harp seals (Tucker et al. 2009).

This species is preyed on by polar bears, killer whales, and sharks (Lavigne 2008).

3.4.2.42.5 Species-Specific Threats

Although harp seals are documented to be taken incidentally in commercial fishing gear, the level of take is very small compared to the size of the population. Harp seals are also hunted commercially in Canada and Greenland.

3.4.2.43 Gray Seal (*Halichoerus grypus*)

3.4.2.43.1 Status and Management

The gray seal is not listed under the ESA but is protected under the MMPA. The gray seal is found on both sides of the North Atlantic, with three major populations: eastern Canada, northwestern Europe, and the Baltic Sea (Katona et al. 1993; Waring et al. 2010). These stocks are separated by geography, differences in the breeding season, and genetic variation (Waring et al. 2010). There are two breeding concentrations in eastern Canada: one at Sable Island and the other on the pack ice in the Gulf of St. Lawrence; they are treated as separate populations for management purposes (Mohn and Bowen 1996).

3.4.2.43.2 Habitat and Geographic Range

The Western North Atlantic stock is equivalent to the eastern Canada population and ranges from New York to Labrador (Waring et al. 2013). The gray seal is considered a coastal species and may forage far from shore but does not appear to leave the continental shelf regions (Lesage and Hammill 2001). Gray seals haul out on ice, exposed reefs, or beaches of undisturbed islands (Lesage and Hammill 2001). Haul-out sites are often near rough seas and riptides (Hall and Thompson 2008; Jefferson et al. 2008b; Katona et al. 1993). Remote uninhabited islands tend to have the largest gray seal haul-outs (Reeves et al. 1992). In the Study Area, the primary range of this species includes the northwestern waters of the Newfoundland-Labrador Shelf, the Scotian Shelf, and the Northeast U.S. Continental Shelf (Davies 1957; Hall and Thompson 2008). In the western North Atlantic Ocean, the gray seal population is centered in the Canadian maritimes, including the Gulf of St. Lawrence and the Atlantic coasts of Nova Scotia, Newfoundland, and Labrador.

Newfoundland-Labrador and Scotian Shelf Large Marine Ecosystems. The largest concentrations of gray seals are found in the southern half of the Gulf of St. Lawrence, where most seals breed on ice, and around Sable Island, where most seals breed on land (Davies 1957; Hammill and Gosselin 1995; Hammill et al. 1998).

Northeast U.S. Continental Shelf Large Marine Ecosystem. Gray seals range south into the northeastern United States, with strandings as far south as North Carolina (Hammill et al. 1998; Waring et al. 2004). Small numbers of gray seals and pupping have been observed on several isolated islands along the central coast of Maine and in Nantucket Sound (the southernmost breeding site is Muskeget Island) (Andrews and Mott 1967; Rough 1995; Waring et al. 2004). Resident colonies and pupping have been observed since 1994 on Seal and Green Islands in Penobscot Bay off the central coast of Maine (Waring et al. 2004). Spring and summer sightings off Maine are primarily on offshore ledges of the central coast of Maine (Richardson et al. 1995). In the late 1990s, a year-round breeding population of approximately 400 animals was documented on outer Cape Cod and Muskeget Island (Barlas 1999; Waring et al. 2004).

3.4.2.43.3 Population and Abundance

A 2004 survey of the Canadian population obtained estimates ranging between 208,720 (SE=29,730) and 223,220 (SE=17,376). The herd on Sable Island is growing, but the Gulf of St. Lawrence population has changed little (Canada Department of Fisheries and Oceans 2003). This decline is attributed to a sharp decline in the quantity of suitable ice breeding habitat in the southern Gulf of St. Lawrence, possibly the result of global climate change (Hammill et al. 2003). A minimum of 1,000 pups were born in the northeastern United States during 2002 (Wood et al. 2003), but present data are insufficient to calculate the minimum population estimate for U.S. waters (Waring et al. 2010).

3.4.2.43.4 Predator/Prey Interactions

This species preys on a variety of deep-ocean and bottom-dwelling organisms. They also prey on schooling fish and occasionally sea birds. Examples of prey are smelt, skates, and molluscs (Jefferson et al. 2008b). Feeding during the breeding season is minimal (Hauksson and Bogason 1997).

This species is preyed on by sharks (Jefferson et al. 2008b). They are also probably prey of killer whales (Weller 2008).

3.4.2.43.5 Species-Specific Threats

A review of 405 cases of marine mammal mortalities on Cape Cod and southeastern Massachusetts from 2000 to 2006 concluded that gray seals are highly susceptible to human interaction. Forty-five percent of gray seal deaths are due to interactions with humans (Bogomolni et al. 2010). In U.S. waters, approximately 500 gray seals are killed annually as bycatch, most of which are by sink gillnets in northeast Atlantic fisheries (Waring et al. 2010). In Canada, a few hundred gray seals are killed each year by hunters (Waring et al. 2010).

3.4.2.44 Harbor Seal (*Phoca vitulina*)

3.4.2.44.1 Status and Management

The harbor seal is not listed under the ESA but is protected under the MMPA. This is the most common and frequently reported seal in the northeastern United States (Agler et al. 1993). Currently, harbor seals along the coast of the eastern United States and Canada represent a single population (Temte et al. 1991; Waring et al. 2010).

3.4.2.44.2 Habitat and Geographic Range

The harbor seal is one of the most widely distributed seals, found in nearly all temperate coastal waters of the northern hemisphere (Jefferson et al. 2008b). Harbor seals are a coastal species, rarely found more than 7.7 mi. (20 km) from shore, and frequently occupy bays, estuaries, and inlets (Baird 2001). Individual seals were observed several kilometers upstream in coastal rivers (Baird 2001). Haul-out sites vary but include intertidal and subtidal rock outcrops, sandbars, sandy beaches, and even peat banks in salt marshes (Burns 2008; Gilbert and Guldager 1998; Prescott 1982; Schneider and Payne 1983; Wilson 1978). Harbor seals occur in the cold and temperate nearshore waters of the northwest Atlantic, typically above 30° N. In the Study Area, their distribution includes the Gulf of St. Lawrence, the Scotian Shelf, the Gulf of Maine, the Bay of Fundy, and the Northeast U.S. Continental Shelf.

Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems. In U.S. waters, breeding and pupping normally occur in waters north of the New Hampshire and Maine borders, although breeding is recorded as far south as Cape Cod (Katona et al. 1993; Waring et al. 2010). Harbor seals are found year-round in the coastal waters of eastern Canada and Maine and occur from the southern New England coast to the New Jersey coast from September to May (Katona et al. 1993; Waring et al. 2010). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter (Barlas 1999; Jacobs and Terhune 2000; Rosenfeld et al. 1988; Whitman and Payne 1990). A northward movement from southern New England to Maine and eastern Canada occurs before the pupping season, which takes place from mid-May through June along the Maine coast (deHart 2002; Kenney 1994; Richardson et al. 1995; Whitman and Payne 1990; Wilson 1978).

Southeast U.S. Continental Shelf Large Marine Ecosystem. Rare sightings and strandings were recorded through the Carolinas and as far south as Florida (Waring et al. 2013).

3.4.2.44.3 Population and Abundance

The NMFS 2010 Stock Assessment Report states that there is insufficient data to calculate a minimum population estimate for Western North Atlantic harbor seal stock; however, the NMFS 2009 Stock Assessment Report indicated the best estimate of abundance for this stock was 99,340 (CV=0.097) (Waring et al. 2009). An estimated 5,575 harbor seals overwintered in southern New England in 1999, increasing from an estimated 2,834 in 1981 (Barlas 1999).

3.4.2.44.4 Predator/Prey Interactions

The main prey species of the harbor seal are cod, some rockfish species, sand eels, saithe, herring, catfish, and capelin. Harbor seals are also known to feed on cephalopods. Pups feed on bottom-dwelling crustaceans during their first few weeks of foraging. Sand eels are the main prey for individuals foraging in the south of their range, while cod is the main prey for other geographic areas. There is no seasonal variation in prey species, but capelin and herring are more numerous in the fall and winter (Hauksson and Bogason 1997; Jefferson et al. 2008b; Reeves et al. 1992).

Adult harbor seals are known to be preyed on by killer whales, sharks, and Steller sea lions, and pups may be preyed on by eagles, ravens, gulls, and coyotes (Burns 2008; Weller 2008).

3.4.2.44.5 Species-Specific Threats

There are no significant species-specific threats for harbor seals in the western North Atlantic. Section 3.4.2.4 (General Threats to Marine Mammals) discusses threats to marine mammals.

3.4.2.45 Walrus (*Odobenus rosmarus*)

3.4.2.45.1 Status and Management

The walrus is not listed under the ESA but is protected under the MMPA. The walrus is managed by the U.S. Fish and Wildlife Service under the Department of the Interior. Five subpopulations of the Atlantic subspecies are suggested, based on genetic analysis. These subpopulations inhabit the Hudson Strait, West Greenland, Northwest Greenland, East Greenland, and Franz Josef Land-Svalbard (Andersen et al. 2009). The Hudson Strait subpopulation occurs within the northern extreme of the Study Area but does not normally occur in U.S. east coast waters.

3.4.2.45.2 Habitat and Geographic Range

Walruses occur in shallow, continental shelf areas and are seldom found in deep waters. Walruses haul out on ice floes and sandy beaches or rocky shores, along remote stretches of mainland coastlines or islands (Jefferson et al. 2008b; Kastelein 2009).

West Greenland and Newfoundland-Labrador Shelf Large Marine Ecosystems. Walruses are found throughout the Atlantic realm, around the tip of Greenland, and throughout the North Atlantic waters of Canada. This includes north Greenland, north and east Iceland, the east Greenland Shelf, the west Greenland Shelf, northern Grand Banks-southern Labrador, northern Labrador, Baffin Bay-Davis Strait, the Hudson Complex, High Arctic Archipelago, and the Beaufort-Amundsen-Viscount and Melville-Queen Maud Islands (Jefferson et al. 2008b). Walruses are known to stay fairly close to land for most of their lives and make shallow dives inshore from the continental shelf and slope, so they do not regularly occur in deep oceanic waters. Migration of the subpopulation in the Hudson Strait to west Greenland suggests

that there is a perennial migration in the Baffin Bay region for the Atlantic subspecies (Andersen et al. 2009). When the ice breaks up along the western coast of Greenland, with the warm water brought in by the Irminger Current from the south, it is thought that there is room for a northward migration by these walruses.

3.4.2.45.3 Population and Abundance

There are thought to be roughly 10,000 walruses in the western Atlantic population (the Atlantic subspecies) (Kastelein 2009); however, there are no accurate numbers for the portion of the population that occurs within the Study Area. The North Atlantic Marine Mammal Commission (undated) identifies eight putative stocks in the Atlantic ranging from 500 to 6,000 individuals.

3.4.2.45.4 Predator/Prey Interactions

Walruses are primarily benthic feeders, with a large proportion of their prey consisting of molluscs (Andersen et al. 2009; Kastelein and Wiepkema 1989; Stewart et al. 2003). They use their tusks to plow through the bottom sediments and dig up prey, most of which they find in the upper few centimeters of sediment or on or just above the bottom. Walrus diet also consists of snails, soft-shell crabs, amphipods, shrimp, sea cucumbers, tunicates, and slow-moving fish. Some prey on seals, small whales, and seabirds and may occasionally scavenge marine mammal carcasses. Walruses are known to consume between 88 and 176 pounds (lb.) (40 and 80 kg) of food per day (Jefferson et al. 2008b; Kastelein and Wiepkema 1989).

Walruses are preyed on by killer whales and polar bears (Jefferson et al. 2008b).

3.4.2.45.5 Species-Specific Threats

Illegal hunting and human activities near haul-outs pose a potentially significant threat to walrus.

3.4.2.46 West Indian Manatee (*Trichechus manatus*)

3.4.2.46.1 Status and Management

West Indian manatees are listed as endangered under the ESA and as depleted under the MMPA. The West Indian manatee is divided into the Florida (*Trichechus manatus latirostris*) and Antillean (*Trichechus manatus manatus*) subspecies (Lefebvre et al. 2001). Both subspecies may be found within the Study Area although the Antillean manatee only occurs in the Caribbean Sea Large Marine Ecosystem, extending eastward to Puerto Rico. The Florida population is closely monitored and managed by the U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission. The Florida manatee population is divided into four management units: the Upper St. Johns River (4 percent of the population), Atlantic Coast (46 percent), Southwest Florida (38 percent), and Northwest Florida (12 percent). Data indicate that the Upper St. Johns River and Northwest Florida management units are flourishing, and the Atlantic Coast management unit is likely stable. The U.S. Fish and Wildlife Service is researching the status of the Southwest Florida management unit (U.S. Fish and Wildlife Service 2010). Preliminary analyses from U.S. Fish and Wildlife Service indicate that all four management units are doing well. Critical habitat is designated at multiple inland rivers and coastal waterways throughout Florida, although the designation does not define any primary constituent elements. The designated critical habitat only overlaps with the Study Area within the St. Johns (Mayport), Banana Rivers (Port Canaveral), St. Mary's River entrance channel (Kings Bay), and a small portion of inland waters encompassed by the South Florida Ocean Measurement Facility Testing Range boundary (Figure 3.4-2). However, the Mayport basin and the Trident basin are not considered critical habitat by U.S. Fish and Wildlife Service. A petition to revise manatee critical habitat was submitted

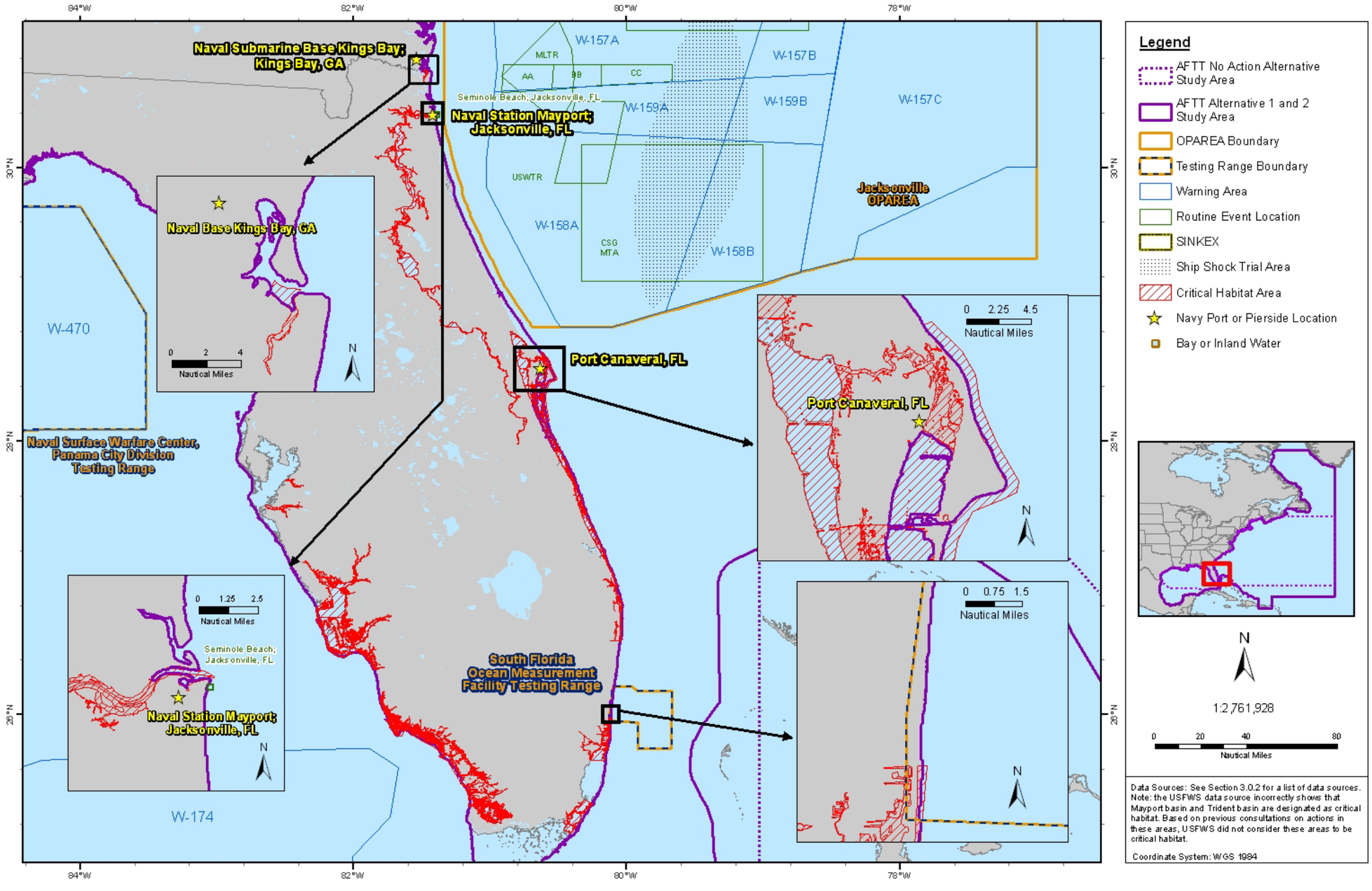

Figure 3.4-2: Designated Critical Habitat Areas for Florida Manatee in the Study Area

AFTT: Atlantic Fleet Training and Testing; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; OPAREA: Operating Area; SINKEX: Sinking Exercise; USWTR: Undersea Warfare Training Area

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in 2009, and a 12-month finding on that petition by U.S. Fish and Wildlife Service stated that revisions should be made, including defining primary constituent elements, but sufficient funding is not currently available (FR 75 (7): 1574-1581, January 12, 2010).

3.4.2.46.2 Habitat and Geographic Range (Excerpts from U.S. Fish and Wildlife Service 2010 in Waring et al. (2010))

Manatees are found in coastal marine, brackish, and freshwater habitats. They are typically found in sea grass beds, canals, creeks, embayments, and lagoons near the mouths of rivers and sloughs (Lefebvre et al. 2000). Habitat selection is influenced by food, water temperatures, and freshwater resources. Females with calves are influenced by additional factors when selecting habitats, including ambient noise, currents, and increased amounts of forage (Gannon et al. 2007). Groups of manatees, sometimes in the hundreds, often congregate near sources of warm water (Deutsch et al. 2003; Jefferson et al. 2008b).

Florida manatees are found throughout the southeastern United States. Because manatees are a sub-tropical species with little tolerance for cold, they are generally restricted to the inland and coastal waters of peninsular Florida during the winter, when they shelter in or near warm-water springs, industrial effluents, and other warm water sites (Hartman 1979; Lefebvre et al. 2001; Stith et al. 2006). In warmer months, manatees leave these sites and can disperse great distances. Individuals have been sighted as far north as Massachusetts, as far west as Texas, and in all states in between (Fertl et al. 2005; Rathbun 1988; Schwartz 1995; U.S. Fish and Wildlife Service Jacksonville Field Office 2008). Warm-weather sightings are most common in Florida and coastal Georgia.

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. In the Study Area, the West Indian manatee (Florida subspecies) occurs from the southeastern United States to the Caribbean (Jefferson et al. 2008b; Morales-Vela et al. 2003). The West Indian manatee's primary range extends along both the Atlantic and Gulf coasts of Florida, while the secondary range extends north to the coastal waters of North Carolina on the east side, and into the Gulf of Mexico on the west side. They are reported regularly in coastal rivers of Georgia and South Carolina in warmer months (Lefebvre et al. 2001). Manatees are common in the St. Johns River and Port Canaveral and may have limited seasonal occurrence in the Pascagoula River, Great Bay, Sabine Lake, and Galveston Bay.

Caribbean Large Marine Ecosystems. The Antillean subspecies of West Indian manatee is only found in eastern Mexico and Central America, northern and eastern South America, and in the Greater Antilles (Lefebvre et al. 1989) within the Caribbean Large Marine Ecosystem. All studies suggest that manatees in Puerto Rico are most often detected in protected areas around cays, in secluded bays, and shallow seagrass beds east of San Juan, the east, south, and southwest coasts, and not far from fresh water sources (U.S. Fish & Wildlife Service Caribbean Field Office 2009).

3.4.2.46.3 Population and Abundance

The exact population for the West Indian manatee is unknown; however, the highest minimum count of 5,067 Florida manatees was recorded based on a January 2010 synoptic survey (U.S. Fish and Wildlife Service 2010).

3.4.2.46.4 Predator/Prey Interactions

West Indian manatees are herbivorous and are known to consume more than 60 species of plants. They typically feed on bottom vegetation, plants in the water column, and shoreline vegetation, such as

hyacinths and marine sea grasses (Reynolds et al. 2009). In some areas, they are known to feed on algae and parts of mangrove trees (Jefferson et al. 2008b; Mignucci-Giannoni and Beck 1998).

Although large sharks, crocodiles, and killer whales are all considered to be potential predators, there is little evidence to confirm this (Weller 2008).

3.4.2.46.5 Species-Specific Threats

The Florida manatee is negatively impacted by cold stress, hurricanes, toxic red tide poisoning, habitat destruction (such as loss of seagrass), and other natural and human-made factors. However, vessel strikes are the single greatest cause of death for Florida manatees, accounting for 24 percent of manatee deaths in Florida during the last 30 years (Jett and Thapa 2010). A review of research on the effectiveness of laws reducing boat speeds in areas of known manatee habitat indicated that reducing boat speeds in specific areas is an appropriate, reasonable, and defensible management action although more studies on the effectiveness of boat speed reduction are suggested (Calleson and Frohlich 2007).

3.4.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine mammals known to occur within the Study Area. Tables 2.8-1 through 2.8-3 present the proposed training and testing activities for each alternative, the typical locations where those activities occur, the number of events, and the ordnance typically expended for each activity. The potential stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to marine mammals in the Study Area that are analyzed below include the following:

- Acoustic (sonar and other active acoustic sources; explosives; pile driving; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; aircraft noise)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables, guidance wires, and parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary stressors

In this analysis, marine mammal species are grouped together based on similar biology (such as hearing) or behaviors (such as feeding or expected reaction to stressors) when most appropriate for the discussion. In addition, for some stressors species are grouped based on their taxonomic relationship and discussed as follows: mysticetes (baleen whales), odontocetes (toothed whales), pinnipeds (seals and the walrus), the polar bear, and the West Indian manatee.

When impacts are expected to be similar to all species or when it is determined there is no impact on any species, the discussion will be general and not species-specific. Where impacts can be quantified, the analysis will be species-specific. In addition, if activities are expected to occur only in or will be concentrated in certain areas, the discussion will be geographically specific if applicable. Mitigation measures have been designed to minimize the potential impacts wherever possible and practicable. The approach to mitigation and the details of each measure proposed are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring.)

3.4.3.1 Acoustic Stressors

3.4.3.1.1 Non-Impulsive and Impulsive Sound Sources

Long recognized by the scientific community (Payne and Webb 1971), and summarized by the National Academies of Science, human-generated sound could possibly harm marine mammals or significantly interfere with their normal activities (National Research Council 2005). Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al. 2007; Southall et al. 2007). Furthermore, many other factors besides just the received level of sound may affect an animal's reaction such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound.

Methods used to predict acoustic effects on marine mammals build on the Conceptual Framework for Assessing Effects from Sound Producing Activities (Section 3.0.5.7.1). Additional research specific to marine mammals is presented where available.

3.4.3.1.2 Analysis Background and Framework

3.4.3.1.2.1 Direct Injury

The potential for direct injury to marine mammals is inferred from terrestrial mammal experiments and from post-mortem examination of marine mammals believed to have been exposed to underwater explosions (Ketten et al. 1993; Richmond et al. 1973; Yelverton et al. 1973). Additionally, noninjurious effects on marine mammals are extrapolated to injurious effects based on data from terrestrial mammals to estimate the potential for injury (Southall et al. 2007). Actual effects on marine mammals may differ due to anatomical and physiological adaptations to the marine environment; e.g., some characteristics such as a reinforced trachea and flexible thoracic cavity (Ridgway and Dailey 1972) may or may not decrease the risk of lung injury.

Potential direct injury from non-impulsive sound sources, such as sonar, is unlikely due to lower peak pressures and slower rise times than potentially injurious sources such as explosives. Non-impulsive sources also lack the strong shock wave associated with an explosion. Therefore, primary blast injury and barotrauma (i.e., injuries caused by large, rapid pressure changes) would not occur due to exposure to non-impulsive sources such as sonar. The theories of sonar-induced acoustic resonance and bubble formation are discussed below. Although these phenomena are feasible under extreme, controlled laboratory conditions, they are difficult to replicate in the natural environment and are therefore unlikely to occur.

Primary Blast Injury and Barotrauma

The greatest potential for direct, nonauditory tissue effects is primary blast injury and barotrauma after exposure to high amplitude impulsive sources, such as explosions. Primary blast injury refers to those injuries that result from the initial compression of a body exposed to a blast wave. Primary blast injury is usually limited to gas-containing structures (e.g., lung and gut) and the auditory system (Craig and Hearn 1998; Craig Jr. 2001; Phillips and Richmond 1990). Barotrauma refers to injuries caused when large pressure changes occur across tissue interfaces, normally at the boundaries of air-filled tissues such as

the lungs. Primary blast injury to the respiratory system, as measured in terrestrial mammals, may consist of lung contusions (lung bruises), pneumothorax (collapsed lung), pneumomediastinum (air in the chest between the lungs), traumatic lung cysts, or interstitial or subcutaneous emphysema (collection of air outside of the lungs) (Phillips and Richmond 1990). These injuries may be fatal, depending on the severity of the trauma. Rupture of the lung may introduce air into the vascular system, possibly producing air emboli that can cause a stroke or heart attack by restricting oxygen delivery to these organs. Though often secondary in life-threatening severity to pulmonary blast trauma, the gastrointestinal tract can also suffer contusions (bruises) and lacerations (cuts) from blast exposure, particularly in air-containing regions of the tract. Potential traumas include hematoma (collection of blood outside of a blood vessel), bowel perforation, mesenteric tears, and ruptures of the hollow abdominal viscera (organs). Although hemorrhage of solid organs (e.g., liver, spleen, and kidney) from blast exposure is possible, rupture of these organs is rarely encountered.

The only known occurrence of mortality or injury to a marine mammal due to a U.S. Navy training or testing event involving impulsive sources occurred in March 2011. A group of long-beaked common dolphins entered the 640 m mitigation zone surrounding an explosive with a net explosive weight of 3.97 kg (8.8 lb.) set at a depth of 48 feet, approximately 0.5–0.75 nm from shore. One minute after detonation, three animals were observed at the surface, and a fourth animal stranded 42.3 miles (68 km) to the north of the detonation site three days later. Upon necropsy, all four animals were found to have sustained typical mammalian primary blast injuries (Danil and St. Ledger 2011). Section 3.4.3.1.2.7 (Stranding) provides more information on this topic.

Auditory Trauma

Relatively little is known about auditory system trauma in marine mammals resulting from a known sound exposure. A single study spatially and temporally correlated the occurrence of auditory system trauma in humpback whales with the detonation of a 5,000 kg (11,023 lb.) explosive (Ketten et al. 1993). The exact magnitude of the exposure in this study cannot be determined, but it is likely the trauma was caused by the shock wave produced by the explosion. There are no known occurrences of direct auditory trauma in marine mammals exposed to tactical sonar or other non-impulsive sound sources (Ketten 2012). The potential for auditory trauma in marine mammals exposed to impulsive sources (e.g., explosions) is inferred from tests of submerged terrestrial mammals exposed to underwater explosions (Ketten et al. 1993; Richmond et al. 1973; Yelverton et al. 1973).

Acoustic Resonance

Acoustic resonance occurs when an object is vibrated at its resonant frequency, resulting in enhanced vibration of that object. In 2002, NMFS convened a panel of government and private scientists to consider the hypothesis of mid-frequency sonar-induced resonance of gas-containing structures (i.e., lungs) (National Oceanic and Atmospheric Administration 2002). It modeled and evaluated the likelihood that Navy mid-frequency sonar caused resonance effects in beaked whales that eventually led to their stranding. The conclusions of that group were that resonance in air-filled structures was not likely to have caused a mass stranding event in the Bahamas in 2000 (National Oceanic and Atmospheric Administration 2002). The frequencies at which resonance was predicted to occur in uncollapsed lungs were below 50 Hz, well below the frequencies used by the mid-frequency sonar systems associated with the Bahamas event (National Oceanic and Atmospheric Administration 2002). Furthermore, air cavity vibrations were not considered to be of sufficient magnitude to cause tissue damage, even at the worst-case resonant frequencies that would lead to the greatest vibratory response. These same conclusions would apply to other training and testing activities involving acoustic sources. Therefore, the Navy

concludes that acoustic resonance leading to tissue damage is not likely under realistic conditions during training and testing, and this type of impact is not considered further in this analysis.

Bubble Formation (Acoustically Induced)

A suggested indirect cause of injury to marine mammals is rectified diffusion (Crum and Mao 1996), the process of increasing the size of a bubble by exposing it to a sound field. The process depends on many factors, including the sound pressure level and duration. Under this hypothesis, microscopic bubbles assumed to exist in the tissues of marine mammals may experience one of three things: (1) bubbles grow to the extent that tissue hemorrhage (injury) occurs; (2) bubbles develop to the extent that an immune response is triggered or nervous system tissue is subjected to enough localized pressure that pain or dysfunction occurs (a stress response without injury); or (3) the bubbles are cleared by the lung without negative consequence to the animal. The probability of rectified diffusion, or any other indirect tissue effect, will necessarily be based on what is known about the specific process involved. Rectified diffusion is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate nitrogen gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard 1979). The dive patterns of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater nitrogen gas supersaturation (Houser et al. 2001). If surface intervals between dives are short, there is insufficient time to clear nitrogen in tissues accumulated due to pressures experienced while diving. Subsequent dives can increase tissue nitrogen accumulation, leading to greater levels of nitrogen saturation at each ascent. If rectified diffusion were possible in marine mammals exposed to a high level of sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness (e.g., nausea, disorientation, localized pain, breathing problems, etc.).

It is unlikely that the short duration of sonar or explosion sounds would last long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis is also suggested: stable microbubbles could be destabilized by high-level sound exposures so bubble growth would occur through static diffusion of gas out of the tissues. In such a scenario, the marine mammal would need to be in a gas-supersaturated state for a long enough time for bubbles to become a problematic size. Recent research with *ex vivo* supersaturated bovine tissues suggests that for a 37 kHz signal, a sound exposure of approximately 215 dB re 1 µPa would be required before microbubbles became destabilized and grew (Crum et al. 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 µPa at 1 m, a whale would need to be within 33 ft. (10 m) of the sonar dome to be exposed to such sound levels. Furthermore, tissues in the study were supersaturated by exposing them to pressures of 400 to 700 kilopascals (kPa) for periods of hours and then releasing them to ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400 to 700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Houser et al. 2001). It is improbable that this mechanism would be responsible for stranding events or traumas associated with beaked whale strandings. Both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

There is considerable disagreement among scientists as to the likelihood of bubble formation in diving marine mammals (Evans and Miller 2003; Piantadosi and Thalmann 2004). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced

tissue separations (Fernández et al. 2005; Jepson et al. 2003), nitrogen bubble formation as the cause of the traumas has not been verified. The presence of bubbles postmortem, particularly after decompression, is not necessarily indicative of bubble pathology. Prior experimental work demonstrates that the postmortem presence of bubbles following decompression in laboratory animals can occur as a result of invasive investigative procedures (Stock et al. 1980).

Nitrogen Decompression

Although not a direct injury, variations in diving behavior or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Hooker et al. 2012; Jepson et al. 2003; Saunders et al. 2008). The mechanism for bubble formation would be different from rectified diffusion, but the effects would be similar. Although hypothetical, the potential process is under debate in the scientific community (Hooker et al. 2012; Saunders et al. 2008). The hypothesis speculates that if exposure to a startling sound elicits a rapid ascent to the surface, tissue gas saturation sufficient for the evolution of nitrogen bubbles might result (Fernández et al. 2005; Hooker et al. 2012; Jepson et al. 2003). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation.

Recent modeling suggests that even unrealistically rapid rates of ascent from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected in beaked whales (Zimmer and Tyack 2007). Tyack et al. (2006) suggested that emboli observed in animals exposed to mid-frequency active sonar (Fernández et al. 2005; Jepson et al. 2003) could stem instead from a behavioral response that involves repeated dives, shallower than the depth of lung collapse.
A bottlenose dolphin was trained to repetitively dive to specific depths to elevate nitrogen saturation to the point that asymptomatic nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of any nitrogen gas bubbles (Houser et al. 2009).

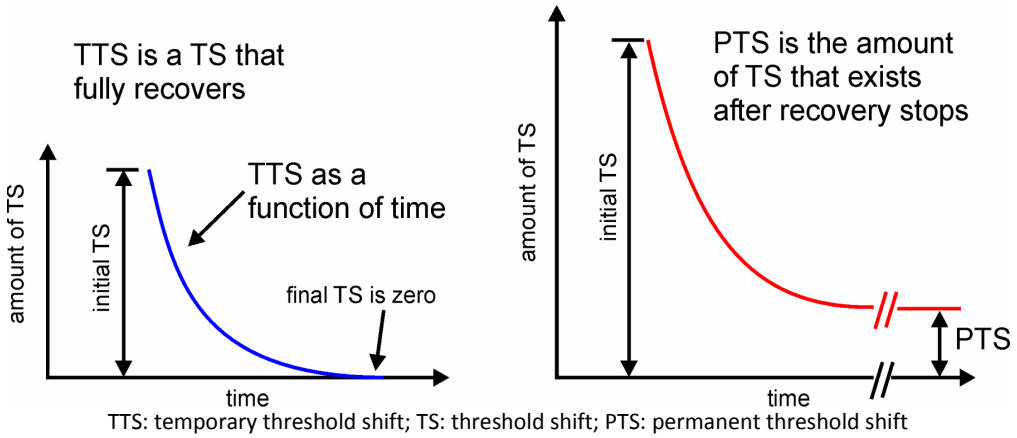
More recently, modeling has suggested that the long, deep dives performed regularly by beaked whales over a lifetime could result in the saturation of long-halftime tissues (e.g. fat, bone lipid) to the point that they are supersaturated when the animals are at the surface (Hooker et al. 2009). Proposed adaptations for prevention of bubble formation under conditions of persistent tissue saturation have been suggested (Fahlman et al. 2006; Hooker et al. 2009), while the condition of supersaturation required for bubble formation has been demonstrated in bycatch animals drowned at depth and brought to the surface (Moore et al. 2009). Since bubble formation is facilitated by compromised blood flow, it has been suggested that rapid stranding may lead to bubble formation in animals with supersaturated, long-halftime tissues because of the stress of stranding and the cardiovascular collapse that can accompany it (Houser et al. 2009).

A fat embolic syndrome was identified by Fernández et al. (2005) coincident with the identification of bubble emboli in stranded beaked whales. The fat embolic syndrome was the first pathology of this type identified in marine mammals, and was thought to possibly arise from the formation of bubbles in fat bodies, which subsequently resulted in the release of fat emboli into the blood stream. Recently, Dennison et al. (2011) reported on investigations of dolphins stranded in 2009–2010 and, using ultrasound, identified gas bubbles in kidneys of 21 of 22 live-stranded dolphins and in the liver of 2 two of 22. The authors postulated that stranded animals are unable to recompress by diving, and thus may retain bubbles that are otherwise re-absorbed in animals that can continue to dive. The researchers concluded that the minor bubble formation observed can be tolerated since the majority of stranded

dolphins released did not re-strand (Dennison et al. 2011). Recent modeling by Kvadsheim et al. (2012) determined that while behavioral and physiological responses to sonar have the potential to result in bubble formation, the actually observed behavioral responses of cetaceans to sonar did not imply any significantly increased risk of over what may otherwise occur normally in individual marine mammals. By extension, no marine mammals addressed in this analysis are given differential treatment due to the possibility for acoustically mediated bubble growth.

3.4.3.1.2.2 Hearing Loss

The most familiar effect of exposure to high intensity sound is hearing loss, meaning an increase in the hearing threshold. The meaning of the term "hearing loss" does not equate to "deafness." This phenomenon associated with hearing loss is called a noise-induced threshold shift, or simply a threshold shift (Miller 1974). If high-intensity sound overstimulates tissues in the ear, causing a threshold shift, the impacted area of the ear (associated with and limited by the sound's frequency band) no longer provides the same auditory impulses to the brain as before the exposure (Ketten 2012). The distinction between permanent threshold shift (PTS) and temporary threshold shift (TTS) is based on whether there is complete recovery of a threshold shift following a sound exposure. If the threshold shift eventually returns to zero (the threshold returns to the pre-exposure value), the threshold shift is a TTS. The recovery to pre-exposure threshold from studies of marine mammals is usually on the order of minutes to hours for the small amounts of TTS induced (Finneran et al. 2005a; Nachtigall et al. 2004). The recovery time is related to the exposure duration, sound exposure level, and the magnitude of the threshold shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran et al. 2005a; Mooney et al. 2009a). In some cases, threshold shifts as large as 50 dB (loss in sensitivity) have been temporary, although recovery sometimes required as much as 30 days (Ketten 2012). If the threshold shift does not return to zero but leaves some finite amount of threshold shift, then that remaining threshold shift is a PTS. Again for clarity, PTS as discussed in this document is not a complete loss of hearing, but instead is the loss of hearing sensitivity over a particular range of frequencies. Figure 3.4-3 shows one hypothetical threshold shift that completely recovers, a TTS, and one that does not completely recover, leaving some PTS. The actual amount of threshold shift depends on the amplitude, duration, frequency, temporal pattern of the sound exposure, and on the susceptibility of the individual animal.



TTS: temporary threshold shift; TS: threshold shift; PTS: permanent threshold shift

Figure 3.4-3: Two Hypothetical Threshold Shifts

Although both auditory trauma and fatigue may result in hearing loss, the mechanisms responsible for auditory fatigue differ from auditory trauma and would primarily consist of metabolic fatigue and

exhaustion of the hair cells and cochlear tissues. The term "auditory fatigue" is often used to mean "TTS"; however, in this analysis the Navy uses a more general meaning to differentiate between fatigue mechanisms (e.g., metabolic exhaustion and distortion of tissues) and trauma mechanisms (e.g., physical destruction of cochlear tissues occurring at the time of exposure).

Hearing loss due to auditory fatigue in marine mammals was studied by numerous investigators (Finneran et al. 2010a, b; Finneran et al. 2005a; Finneran and Schlundt 2010; Finneran et al. 2007; Finneran et al. 2000; Finneran et al. 2002; Kastak et al. 2007; Lucke et al. 2009; Mann et al. 2010; Mooney et al. 2009a; Mooney et al. 2009b; Nachtigall et al. 2003; Nachtigall et al. 2004; Popov et al. 2011; Schlundt et al. 2000; Southall et al. 2007). The studies of marine mammal auditory fatigue were all designed to determine relationships between TTS and exposure parameters such as level, duration, and frequency. In these studies, hearing thresholds were measured in trained marine mammals before and after exposure to intense sounds. The difference between the pre-exposure and post-exposure thresholds indicates the amount of TTS. Species studied include the bottlenose dolphin (total of nine individuals), beluga (2), harbor porpoise (1), finless porpoise (2), California sea lion (3), harbor seal (1), and northern elephant seal (1). Some of the more important data obtained from these studies are onset-TTS levels—exposure levels sufficient to cause a just-measurable amount of TTS, often defined as 6 dB of TTS (for example Schlundt et al. 2000).

Primary findings of the marine mammal TTS studies discussed above (unless otherwise cited) are:

- The growth and recovery of TTS are analogous to those in terrestrial mammals. This means that, as in terrestrial mammals, threshold shifts primarily depend on the amplitude, duration, frequency content, and temporal pattern of the sound exposure.
- The amount of TTS increases with exposure sound pressure level and the exposure duration.
- For continuous sounds, exposures of equal energy lead to approximately equal effects (Ward 1997). For intermittent sounds, less hearing loss occurs than from a continuous exposure with the same energy (some recovery will occur during the quiet period between exposures) (Kryter et al. 1965; Ward 1997).
- The Sound Exposure Level is correlated with the amount of TTS and is a good predictor for onset-TTS from single, continuous exposures with similar durations. This agrees with human TTS data presented by Ward et al. (1958; 1959a). However, for longer duration sounds, beyond 16–32 seconds, the relationship between TTS and sound exposure level breaks down, and duration becomes a more important contributor to TTS (Finneran et al. 2010a).
- The maximum TTS after tonal exposures occurs one-half to one octave above the exposure frequency (Finneran et al. 2007; Schlundt et al. 2000). Thus, TTS from tonal exposures can extend over a large (greater than one octave) frequency range.
- For bottlenose dolphins, non-impulsive sounds with frequencies above 10 kHz are more hazardous than those at lower frequencies (i.e., lower sound exposure levels required to affect hearing) (Finneran and Schlundt 2010).
- The amount of observed TTS tends to decrease at differing rates following noise exposure; however, the relationship is not monotonic. The amount of time required for complete recovery of hearing depends on the magnitude of the initial shift; for relatively small shifts, recovery may be complete in a few minutes, while large shifts (e.g., 40 dB) require several days for recovery.
- TTS can accumulate across multiple intermittent exposures, but the resulting TTS will be less than the TTS from a single, continuous exposure with the same sound exposure level. This means that predictions based on total, cumulative sound exposure level will overestimate the amount of TTS from intermittent exposures.

Although there have been no marine mammal studies designed to measure PTS, the potential for PTS in marine mammals can be estimated based on known similarities between the inner ears of marine and terrestrial mammals. Experiments with marine mammals have revealed similarities to terrestrial mammals for features such as TTS, age-related hearing loss, ototoxic drug-induced hearing loss, masking, and frequency selectivity. Therefore, in the absence of marine mammal PTS data, onset-PTS exposure levels may be estimated by assuming some upper limit of TTS that equates to the onset of PTS, then using TTS growth relationships from marine and terrestrial mammals to determine the exposure levels capable of producing this amount of TTS.

Hearing loss resulting from auditory fatigue could effectively reduce the distance over which animals can communicate, detect biologically relevant sounds such as predators, and echolocate (for odontocetes). The costs to marine mammals with TTS, or even some degree of PTS, have not been studied; however, it is likely that a relationship between the duration, magnitude, and frequency range of hearing loss could have consequences to biologically important activities (e.g., intraspecific communication, foraging, and predator detection) that affect survivability and reproduction.

3.4.3.1.2.3 Auditory Masking

As with hearing loss, auditory masking can effectively limit the distance over which a marine mammal can communicate, detect biologically relevant sounds, and echolocate (odontocetes). Unlike auditory fatigue, which always results in a localized stress response, behavioral changes resulting from auditory masking may not be coupled with a stress response. Another important distinction between masking and hearing loss is that masking only occurs in the presence of the sound stimulus, whereas hearing loss can persist after the stimulus is gone.

Critical ratios, the lowest ratio of signal-to-noise at which a signal can be detected, were determined for pinnipeds (Southall et al. 2000; Southall et al. 2003). Detections of signals under varying masking conditions were determined for active echolocation and passive listening tasks in odontocetes (Au and Pawloski 1989; Erbe 2000; Johnson 1971). These studies provide baseline information from which the probability of masking can be estimated. Clark et al. (2009) developed a method for estimating masking effects on communication signals for low-frequency cetaceans, including calculating the cumulative impact of multiple noise sources. For example, their technique calculates that in Stellwagen Bank National Marine Sanctuary, when two commercial vessels pass through a right whale's optimal communication space (estimated as a sphere of water with a diameter of 10.8 nm [20 km]), that space is decreased by 84 percent. This method relies on empirical data on source levels of calls (which is unknown for many species) and requires many assumptions about ancient ambient noise conditions and simplifications of animal behavior, but it is an important step in determining the impact of anthropogenic noise on animal communication.

Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background noise. In cetaceans, vocalization changes were reported from exposure to anthropogenic noise sources such as sonar, vessel noise, and seismic surveying.

In the presence of low-frequency active sonar, humpback whales were observed to increase the length of their "songs" (Fristrup et al. 2003; Miller et al. 2000), possibly due to the overlap in frequencies between the whale song and the low frequency active sonar. Right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased

anthropogenic noise (Parks et al. 2007) as well as increasing the amplitude (intensity) of their calls (Parks 2009; Parks et al. 2011). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test, with transmissions centered at 57 Hz at up to 220 dB re: 1 µPa (Bowles et al. 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or the displacement of animals from the area.

Differential vocal responses in marine mammals were documented in the presence of seismic survey noise. An overall decrease in vocalization during active surveying was noted in large marine mammal groups (Potter et al. 2007), while blue whale feeding/social calls increased when seismic exploration was underway (Di lorio and Clark 2010), indicative of a potentially compensatory response to the increased noise level. Melcon et al. (2012) recently documented that blue whales decreased the proportion of time spent producing certain types of calls when mid-frequency sonar was present. At present it is not known if these changes in vocal behavior corresponded to changes in foraging or any other behaviors.

Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke et al. 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether this is a possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

3.4.3.1.2.4 Physiological Stress

Marine mammals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, and interactions with predators all contribute to the stress a marine mammal experiences. In some cases, naturally occurring stressors can have profound impacts on marine mammals; for example, chronic stress, as observed in stranded animals with long-term debilitating conditions (e.g., disease), was demonstrated to result in an increased size of the adrenal glands and an increase in the number of epinephrine-producing cells (Clark et al. 2006). Anthropogenic activities have the potential to provide additional stressors beyond those that occur naturally.

Although sample sizes are small, the data collected to date suggest that different types of sounds potentially cause variable degrees of stress in marine mammals. Belugas demonstrated no catecholamine (hormones released in situations of stress) response to the playback of oil drilling sounds (Thomas et al. 1990b) but showed an increase in catecholamines following exposure to impulsive sounds produced from a seismic water gun (Romano et al. 2004). A bottlenose dolphin exposed to the same seismic water gun signals did not demonstrate a catecholamine response, but did demonstrate an elevation in aldosterone, a hormone suggested as being a significant indicator of stress in odontocetes (St. Aubin and Dierauf 2001; St. Aubin and Geraci 1989). Increases in heart rate were observed in bottlenose dolphins to which conspecific calls were played, although no increase in heart rate was observed when tank noise was played back (Miksis et al. 2001). A beluga's heart rate was observed to increase during exposure to noise, with increase dependent upon frequency band of noise and duration of exposure, with a sharp decrease to normal or below normal levels upon cessation of the exposure

(Lyamin et al. 2011). It is unknown how chronic exposure to acoustic stressors may affect marine mammals. Opportunistic comparison of levels of stress-related hormone metabolites in North Atlantic right whale feces collected before and after the tragic events of 11 September 2001 showed a decrease in metabolite levels corresponding to lower levels of ambient noise due to reduced ship traffic (Rolland et al. 2012). Collectively, these results suggest a variable response that depends on the characteristics of the received signal and prior experience with the received signal.

Other types of stressors include the presence of vessels, fishery interactions, acts of pursuit and capture, the act of stranding, and pollution. In contrast to the limited amount of work performed on stress responses resulting from sound exposure, a considerably larger body of work exists on stress responses associated with pursuit, capture, handling and stranding. Many cetaceans exhibit an apparent vulnerability in the face of these particular situations when taken to the extreme. A recent study compared pathological changes in organs/tissues of odontocetes stranded on beaches or captured in nets over a 40-year period (Cowan and Curry 2008). The type of changes observed indicate harm to multiple systems caused in part by an overload of catecholamines into the system, as well as a restriction in blood supply capable of causing tissue damage or tissue death. This extreme response to a major stressor(s) is thought to be mediated by the overactivation of the animal's normal physiological adaptations to diving or escape. Pursuit, capture, and short-term holding of belugas resulted in a decrease in thyroid hormones (St. Aubin and Geraci 1988) and increases in epinephrine (St. Aubin and Dierauf 2001). In bottlenose dolphins, the trend is more complicated with the duration of the handling time potentially contributing to the magnitude of the stress response (Ortiz and Worthy 2000; St. Aubin 2002; St. Aubin et al. 1996). Male gray seals subjected to capture and short-term restraint showed an increase in cortisol levels accompanied by an increase in testosterone (Lidgard et al. 2008). This result may be indicative of a compensatory response that enables the seal to maintain reproduction capability in spite of stress. Elephant seals demonstrate an acute cortisol response to handling but do not demonstrate a chronic response; on the contrary, adult females demonstrate a reduction in the adrenocortical response following repetitive chemical immobilization (Engelhard et al. 2002). Similarly, no correlation between cortisol levels and heart or respiration rate changes were seen in harbor porpoises during handling for satellite tagging (Eskesen et al. 2009). Taken together, these studies illustrate the wide variations in the level of response that can occur when faced with these stressors.

Factors to consider when trying to predict a stress or cueing response include the mammal's life history stage and whether they are naïve or experienced with the sound. Prior experience with a stressor may be of particular importance as repeated experience with a stressor may dull the stress response via acclimation (St. Aubin and Dierauf 2001).

The sound characteristics that correlate with specific stress responses in marine mammals are poorly understood. Therefore, in practice, a stress response is assumed if a physiological reaction such as a hearing loss or trauma is predicted; or if a significant behavioral response is predicted.

3.4.3.1.2.5 Behavioral Reactions

The response of a marine mammal to an anthropogenic sound may depend on the frequency, duration, temporal pattern and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The distance from the sound source and whether it is perceived as approaching or moving away can also affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sound was first conducted by Richardson and others (1995). More recent reviews (Nowacek et al. 2007; Southall et al. 2007) address studies conducted since 1995

and focus on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Except for some vocalization changes that may be compensating for auditory masking, all behavioral reactions are assumed to occur due to a preceding stress or cueing response; however, stress responses cannot be predicted directly due to a lack of scientific data (Section 3.4.3.1.2.4, Physiological Stress). Responses can overlap; for example, an increased respiration rate is likely to be coupled to a flight response. Differential responses between and within species are expected since hearing ranges vary across species and the behavioral ecologies of individual species are unlikely to completely overlap.

Southall et al. (2007) synthesized data from many past behavioral studies and observations to determine the likelihood of behavioral reactions at specific sound levels. While in general, the louder the sound source the more intense the behavioral response, it was clear that the proximity of a sound source and the animal's experience, motivation, and conditioning were also critical factors influencing the response (Southall et al. 2007). After examining all of the available data, the authors felt that the derivation of thresholds for behavioral response based solely on exposure level was not supported because context of the animal at the time of sound exposure was an important factor in estimating response. Nonetheless, in some conditions, consistent avoidance reactions were noted at higher sound levels, depending on the marine mammal species or group, allowing conclusions to be drawn. Most low-frequency cetaceans (mysticetes) observed in studies usually avoided sound sources at levels of less than or equal to 160 dB re 1 µPa. Published studies of mid-frequency cetaceans analyzed include sperm whales, belugas, bottlenose dolphins, and river dolphins. These groups showed no clear tendency, but for non-impulsive sounds, captive animals tolerated levels in excess of 170 dB re 1 µPa before showing behavioral reactions, such as avoidance, erratic swimming, and attacking the test apparatus. High-frequency cetaceans (observed from studies with harbor porpoises) exhibited changes in respiration and avoidance behavior at levels between 90 and 140 dB re 1 µPa, with profound avoidance behavior noted for levels exceeding this. Phocid seals showed avoidance reactions at or below 190 dB re 1 µPa; thus, seals may actually receive levels adequate to produce TTS before avoiding the source. Recent studies with beaked whales have shown them to be particularly sensitive to noise, with animals during three playbacks of sound breaking off foraging dives at levels below 142 dB re 1 µPa sound pressure level, although acoustic monitoring during actual sonar exercises revealed some beaked whales continuing to forage at levels up to 157 dB re 1 µPa sound pressure level (Tyack et al. 2011).

Behavioral Reactions to Impulsive Sound Sources

Mysticetes

Baleen whales have shown a variety of responses to impulsive sound sources, including avoidance, reduced surface intervals, altered swimming behavior, and changes in vocalization rates (Gordon et al. 2003; Richardson et al. 1995; Southall et al. 2007). While most bowhead whales did not show active avoidance until within 8 km of seismic vessels (Richardson et al. 1995), some whales avoided vessels by more than 20 km at received levels as low as 120 dB re 1 µPa root mean square. Additionally, Malme et al. (1988) observed clear changes in diving and respiration patterns in bowheads at ranges up to 73 km from seismic vessels, with received levels as low as 125 dB re 1 µPa.

Gray whales migrating along the U.S. west coast showed avoidance responses to seismic vessels by 10 percent of animals at 164 dB re 1 µPa, and by 90 percent of animals at 190 dB re 1 µPa, with similar results for whales in the Bering Sea (Malme et al. 1988; Malme et al. 1986). In contrast, noise from

seismic surveys was not found to impact feeding behavior or exhalation rates while resting or diving in western gray whales off the coast of Russia (Gailey et al. 2007; Yazvenko et al. 2007).

Humpback whales showed avoidance behavior at ranges of 5–8 km from a seismic array during observational studies and controlled exposure experiments in western Australia (McCauley et al. 1998). Todd et al. (1996) found no clear short-term behavioral responses by foraging humpbacks to explosions associated with construction operations in Newfoundland but did see a trend of increased rates of net entanglement and a shift to a higher incidence of net entanglement closer to the noise source.

Seismic pulses at average received levels of 131 dB re 1 μPa^2s caused blue whales to increase call production (Di lorio and Clark 2010). In contrast, McDonald et al. (1995) tracked a blue whale with seafloor seismometers and reported that it stopped vocalizing and changed its travel direction at a range of 10 km from the seismic vessel (estimated received level 143 dB re 1 µPa peak-to-peak). These studies demonstrate that even low levels of noise received far from the noise source can induce behavioral responses.

Odontocetes

Madsen et al. (2006) and Miller et al. (2009) tagged and monitored eight sperm whales in the Gulf of Mexico exposed to seismic airgun surveys. Sound sources were from approximately 2 to 7 nm away from the whales, and based on multipath propagation, received levels were as high as 162 dB SPL re 1 µPa with energy content greatest between 0.3 to 3.0 kHz (Madsen et al. 2006). The whales showed no horizontal avoidance, although the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing (Miller et al. 2009). The remaining whales continued to execute foraging dives throughout exposure, however swimming movements during foraging dives were 6 percent lower during exposure than control periods, suggesting subtle effects of noise on foraging behavior (Miller 2009).

Captive bottlenose dolphins sometimes vocalized after an exposure to impulsive sound from a seismic watergun (Finneran et al. 2002).

Pinnipeds

A review of behavioral reactions by pinnipeds to impulsive noise can be found in (Richardson et al. 1995; Southall et al. 2007). Blackwell et al. (2004) observed that ringed seals exhibited little or no reaction to pipe-driving noise with mean underwater levels of 157 dB re 1 µPa root mean square and in air levels of 112 dB re 20 µPa, suggesting that the seals had habituated to the noise. In contrast, captive California sea lions avoided sounds from an underwater impulsive source at levels of 165–170 dB re 1 µPa root mean square (Finneran et al. 2003c).

Experimentally, Götz and Janik (2011) tested underwater startle responses to a startling sound (sound with a rapid rise time and a 93 dB sensation level [the level above the animal's threshold at that frequency]) and a nonstartling sound (sound with the same level, but with a slower rise time) in wild-captured gray seals. The animals exposed to the startling treatment avoided a known food source, whereas animals exposed to the nonstartling treatment did not react or habituated during the exposure period. The results of this study highlight the importance of the characteristics of the acoustic signal in an animal’s response of habituation.

Behavioral Reactions to Sonar and other Active Acoustic Sources

Mysticetes

Specific to U.S. Navy systems using low-frequency sound, studies were undertaken in 1997–98 pursuant to the Navy's Low-Frequency Sound Scientific Research Program. These studies found only short-term responses to low frequency sound by mysticetes (fin, blue, and humpback whales), including changes in vocal activity and avoidance of the source vessel (Clark and Fristrup 2001; Croll et al. 2001; Fristrup et al. 2003; Miller et al. 2000; Nowacek et al. 2007). Baleen whales exposed to moderate low-frequency signals demonstrated no variation in foraging activity (Croll et al. 2001).

Five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives, although the alarm signal was long in duration, lasting several minutes, and purposely designed to elicit a reaction from the animals as a prospective means to protect them from ship strikes (Nowacek et al. 2004a). Although the received sound pressure level was similar in the Croll et al. and Nowacek et al. studies (133–150 dB re 1 µPa sound pressure level), the frequency, duration, and temporal pattern of signal presentation were different. Additionally, the right whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics, species differences, and individual sensitivity in producing a behavioral reaction.

Low-frequency signals of the Acoustic Thermometry of Ocean Climate sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark 2000). However, they did produce subtle effects that varied in direction and degree among the individual seals, again illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Blue whales exposed to mid-frequency sonar in the Southern California Bight were less likely to produce low frequency calls usually associated with feeding behavior (Melcón et al. 2012). It is not known whether the lower rates of calling actually indicated a reduction in feeding behavior or social contact since the study used data from remotely deployed, passive acoustic monitoring buoys. In contrast, blue whales increased their likelihood of calling when ship noise was present and decreased their likelihood of calling in the presence of explosive noise, although this result was not statistically significant (Melcón et al. 2012). Additionally, the likelihood of an animal calling decreased with the increased received level of mid-frequency sonar, beginning at a sound pressure level of approximately 110 to 120 dB re 1 µPa (Melcón et al. 2012). Blue whales responded to a mid-frequency sound source, with a source level between 160-210 dB re 1 µPa at 1 m and a received sound level up to 160 dB re 1 µPa, by exhibiting generalized avoidance responses and changes to dive behavior during controlled exposure experiments (Goldbogen et al. 2013). However, reactions were not consistent across individuals based on received sound levels alone, and likely were the result of a complex interaction between sound exposure factors such as proximity to sound source and sound type (mid-frequency sonar simulation vs. pseudo-random noise), environmental conditions, and behavioral state. Surface feeding whales did not show a change in behavior during controlled exposure experiments, but deep feeding and non-feeding whales showed temporary reactions that quickly abated after sound exposure. Distances of the sound source from the whales during controlled exposure experiments were sometimes less than a mile. These preliminary findings from Melcón et al. (2012) and Goldbogen et al. (2013) are consistent with the Navy's criteria and thresholds for predicting behavioral effects to mysticetes (including blue whales) from sonar and other active acoustic sources used in the quantitative acoustic effects analysis (see Section 3.4.3.1.5, Quantitative Analysis below). The behavioral risk function predicts a probability of a substantive behavioral reaction for individuals exposed to a received sound pressure level of 120 dB re 1µPa or

greater, with an increasing probability of reaction with increased received level as demonstrated in Melcón et al. (2012).

Odontocetes

From 2007 to 2011, behavioral response studies were conducted through the collaboration of various research organizations in the Bahamas, Southern California, the Mediterranean, Cape Hatteras, and Norwegian waters. These studies attempted to define and measure responses of beaked whales and other cetaceans to controlled exposures of sonar and other sounds to better understand their potential impacts. Results from the 2007–2008 study conducted near the Bahamas showed a change in diving behavior of an adult Blainville's beaked whale to playback of mid-frequency source and predator sounds (Boyd et al. 2008; Tyack et al. 2011). Reaction to mid-frequency sounds included premature cessation of clicking and termination of a foraging dive, and a slower ascent rate to the surface. Preliminary results from a similar behavioral response study in southern California waters have been presented for the 2010–2011 field season. De Ruiter et al. (2013) presented results from two Cuvier's beaked whales that were tagged and exposed to simulated mid-frequency active sonar during the 2010 and 2011 field seasons of the southern California behavioral response study. The 2011 whale was also incidentally exposed to mid-frequency active sonar from a distant naval exercise. Received levels from the mid-frequency active sonar signals from the controlled and incidental exposures were calculated as 84-144 and 78-106 dB re 1 µPa root mean squared, respectively. Both whales showed responses to the controlled exposures, ranging from initial orientation changes to avoidance responses characterized by energetic fluking and swimming away from the source. However, the authors did not detect similar responses to incidental exposure to distant naval sonar exercises at comparable received levels, indicating that context of the exposures (e.g., source proximity, controlled source ramp-up) may have been a significant factor. Cuvier's beaked whale responses suggested particular sensitivity to sound exposure as consistent with results for Blainville's beaked whale. Similarly, beaked whales exposed to sonar during British training exercises stopped foraging (Defense Science Technology Laboratory 2007), and preliminary results of controlled playback of sonar may indicate feeding/foraging disruption of killer whales and sperm whales (Miller et al. 2011).

In the 2007–2008 Bahamas study, playback sounds of a potential predator—a killer whale—resulted in a similar but more pronounced reaction, which included longer inter-dive intervals and a sustained straight-line departure of more than 20 km from the area. The authors noted, however, that the magnified reaction to the predator sounds could represent a cumulative effect of exposure to the two sound types since killer whale playback began approximately two hours after mid-frequency source playback. Pilot whales and killer whales off Norway also exhibited horizontal avoidance of a transducer with outputs in the mid-frequency range (signals in the 1 kHz – 2 kHz and 6 kHz – 7 kHz ranges) (Miller et al. 2011). Additionally, separation of a calf from its group during exposure to mid-frequency sonar playback was observed (Miller et al. 2011). In contrast, preliminary analyses suggest that none of the pilot whales or false killer whales in the Bahamas showed an avoidance response to controlled exposure playbacks (Southall et al. 2009).

Through analysis of the behavioral response studies, a preliminary overarching effect of greater sensitivity to all anthropogenic exposures was seen in beaked whales compared to the other odontocetes studied (Southall et al. 2009). Therefore, recent studies have focused specifically on beaked whale responses to active sonar transmissions or controlled exposure playback of simulated sonar on various military ranges (Claridge and Durban 2009; Defence Science and Technology Laboratory 2007; McCarthy et al. 2011; Moretti et al. 2009; Tyack et al. 2011). In the Bahamas, Blainville's beaked whales located on the range will move off-range during sonar use and return only after the sonar transmissions

have stopped, sometimes taking several days to do so (Claridge and Durban 2009; McCarthy et al. 2011; Moretti et al. 2009; Tyack et al. 2011).

In May 2003, killer whales in Haro Strait, Washington exhibited what were believed by some observers to be aberrant behaviors, during which time the USS *Shoup* was in the vicinity and engaged in mid-frequency active sonar operations. Sound fields modeled for the USS *Shoup* transmissions (National Marine Fisheries Service (Office of Protected Resources) Fromm 2009; 2005; U.S. Department of the Navy 2003) estimated a mean received sound pressure level of approximately 169.3 dB re 1µPa at the location of the killer whales at the closest point of approach between the animals and the vessel (estimated sound pressure levels ranged from 150 to 180 dB re 1µPa).

Research on sperm whales near the Grenadines (Caribbean) in 1983 coincided with the U.S. intervention in Grenada, where animals were observed scattering and leaving the area in the presence of military sonar, presumably from nearby submarines (Watkins et al. 1985; Watkins and Schevill 1975). The authors did not report received levels from these exposures and reported similar reactions from noise generated by banging on their boat hull. It was unclear if the sperm whales were reacting to the sonar signal itself or to a potentially new unknown sound in general. Additionally, sperm whales In the Caribbean stopped vocalizing when presented with sounds from nearby acoustic pingers (Watkins and Schevill 1975).

Researchers at the Navy's Marine Mammal Program facility in San Diego, California have conducted a series of controlled experiments on bottlenose dolphins and beluga whales to study TTS (Finneran et al. 2003a; Finneran et al. 2001; Finneran et al. 2005a; Finneran and Schlundt 2004; Schlundt et al. 2000). Ancillary to the TTS studies, scientists evaluated whether the marine mammals performed their trained tasks when prompted, during and after exposure to mid-frequency tones. Altered behavior during experimental trials usually involved refusal of animals to return to the site of the sound stimulus. This refusal included what appeared to be deliberate attempts to avoid a sound exposure or to avoid the location of the exposure site during subsequent tests (Finneran et al. 2002; Schlundt et al. 2000). Bottlenose dolphins exposed to 1-second intense tones exhibited short-term changes in behavior above received sound levels of 178 to 193 dB re 1 µPa root mean square, and beluga whales did so at received levels of 180 to 196 dB re 1 µPa and above. In some instances, animals exhibited aggressive behavior toward the test apparatus (Ridgway et al. 1997; Schlundt et al. 2000). While these studies were generally not designed to test avoidance behavior and animals were commonly reinforced with food, the controlled environment and ability to measure received levels provide insight on received levels at which animals will behaviorally responds to noise sources.

Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms, such as those used on fishing nets to help deter marine mammals from becoming caught or entangled (Kastelein et al. 2006; Kastelein et al. 2001) and emissions for underwater data transmission (Kastelein et al. 2005c). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein et al. 2006), again highlighting the importance in understanding species differences in the tolerance of underwater noise.

Pinnipeds

Different responses displayed by captive and wild phocid seals to sound judged to be “unpleasant” have been reported; where captive seals habituated (did not avoid the sound), and wild seals showed avoidance behavior (Götz and Janik 2010). Captive seals received food (reinforcement) during sound playback, while wild seals were exposed opportunistically. These results indicate that motivational state

(e.g., reinforcement via food acquisition) can be a factor in whether or not an animal habituates to novel or unpleasant sounds. Another study found that captive hooded seals reacted to 1–7 kHz sonar signals, in part with displacement to the areas of least sound pressure level, at levels between 160 and 170 dB re 1 µPa (Kvadsheim et al. 2010). Low-frequency signals of the Acoustic Thermometry of Ocean Climate sound source were not found to overtly affect elephant seal dives (Costa et al. 2003).

Captive studies with other pinnipeds have shown a reduction in dive times when presented with qualitatively unpleasant sounds. These studies indicated that the subjective interpretation of the pleasantness of a sound, minus the more commonly studied factors of received sound level and sounds associated with biological significance, can affect diving behavior (Götz and Janik 2010).

Behavioral Reactions to Vessels

Navy vessels are a small component of overall vessel traffic and vessel noise in areas where they operate. Data presented by the Center for Navy Analysis (Mintz and Filadelfo 2011) show that Navy vessel-hours constitute approximately 6 to 7 percent of large vessel-hours in the U.S. Exclusive Economic Zone and small percentages even within Navy concentration areas such as the range complexes (i.e., Virginia Capes [VACAPES], Hawaii, Southern California). In addition, Navy combatant vessels have been designed to generate minimal noise and use ship quieting technology to elude detection by enemy passive acoustic devices (Mintz and Filadelfo 2011; Southall 2005). Navy ships do not purposefully approach or follow marine mammals and are generally not expected to elicit avoidance or alarm behavior, except for sensitive species (e.g., harbor porpoises and beaked whales). Additionally, smaller Navy vessels that operate in inshore waters are expressly prohibited from approaching or following marine mammals.

Sound emitted from large vessels, such as cargo ships, is the principal source of low-frequency noise in the ocean today, and marine mammals are known to react to or be affected by that noise (Hatch and Wright 2007; Hildebrand 2005; Richardson et al. 1995). Limited evidence suggests that beaked whales respond to vessel noise, anthropogenic noise in general, and mid-frequency sonar at similar sound levels (Aguilar de Soto et al. 2006; Tyack 2009; Tyack et al. 2011). In short-term studies, researchers noted changes in resting and surface behavior states of cetaceans to whale watching vessels (Acevedo 1991; Aguilar de Soto et al. 2006; Arcangeli and Crosti 2009; Au and Green 2000; Christiansen et al. 2010; Erbe 2002; Noren et al. 2009; Stockin et al. 2008; Williams et al. 2009). Most studies examined the short-term response to vessel sound and vessel traffic (Magalhães et al. 2002; Richardson et al. 1995; Watkins 1981); however, the long-term and cumulative implications of ship sound on marine mammals is largely unknown (National Marine Fisheries Service 2007). Clark et al. (2009) provided a discussion on calculating the cumulative impacts of anthropogenic noise on baleen whales (see Section 3.4.3.1.2.3, Auditory Masking, for further discussion on this topic).

Mysticetes

Fin whales may alter their swimming patterns by increasing speed and heading away from the vessel, as well as changing their breathing patterns in response to a vessel approach (Jahoda et al. 2003). Vessels that remained 328 ft. (100 m) or farther from fin and humpback whales were largely ignored in one study in an area where whale watching activities are common (Watkins 1981). Only when vessels approached more closely did the fin whales in this study alter their behavior by increasing time at the surface and exhibiting avoidance behaviors. Other studies have shown when vessels are near, some but not all fin whales change their vocalizations, surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions (Au and Green 2000; Richter et al. 2003; Williams et al. 2002a).

Based on passive acoustic recordings and in the presence of sounds from passing vessels, Melcon et al. (2012) reported that blue whales had an increased likelihood of producing certain types of calls. At present it is not known if these changes in vocal behavior corresponded to changes in foraging or any other behaviors. In the Watkins (1981) study, humpback whales did not exhibit any avoidance behavior but did react to vessel presence. In a study of regional vessel traffic, (Baker et al. 1983) found that when vessels were in the area, the respiration patterns of the humpback whales changed. The whales also exhibited two forms of behavioral avoidance: horizontal avoidance (changing direction or speed) when vessels were between 1.24 and 2.48 mi. (2,000 m and 4,000 m) away, and vertical avoidance (increased dive times and change in diving pattern) when vessels were less than 1.24 mi. (2,000 m) away (Baker et al. 1983). Similarly, when approached by whale watching vessels in Hawaii, humpback whales responded by increasing swim speed, changing direction to avoid, and staying submerged for longer periods of time (Au and Green 2000). Recently, Gende et al. (2011) reported on observations of humpback whales in inland waters of Southeast Alaska subjected to frequent cruise ship transits (i.e., in excess of 400 transits in a 4-month season in 2009). The study was focused on determining if close encounter distance was a function of vessel speed. The reported observations, however, seem in conflict with other reports of avoidance at much greater distance so it may be that humpback whales in those waters are more tolerant of vessels (given their frequency) or are engaged in behaviors, such as feeding, that they are less willing to abandon. This example again highlights that context is critical for predicting and understanding behavioral reactions as concluded by Southall et al. (2007). Navy vessels avoid approaching large whales head on and maneuver to maintain a mitigation zone of 500 yd. (457.2 m) around observed large whales.

Sei whales have been observed ignoring the presence of vessels and passing close to the vessel (National Marine Fisheries Service 1998). In the presence of approaching vessels, blue whales perform shallower dives accompanied by more frequent surfacing but otherwise do not exhibit strong reactions (Calambokidis et al. 2009). Minke whales in the Antarctic did not show any apparent response to a survey vessel moving at normal cruising speeds (about 12 knots) at a distance of 5.5 nm; however, when the vessel drifted or moved at very slow speeds (about 1 knot), many whales approached it (Leatherwood et al. 1982).

North Atlantic right whales tend not to respond to the sounds of oncoming vessels (Nowacek et al. 2004a) and continue to use habitats in high vessel traffic areas (Nowacek et al. 2004a). Studies show that North Atlantic right whales demonstrate little if any reaction to sounds of vessels approaching or the presence of the vessels themselves (Nowacek et al. 2004a; Terhune and Verboom 1999). Although this may minimize potential disturbance from passing ships, it does increase the whales' vulnerability to potential ship strike. The regulated approach distance for right whales is 500 yd. (457 m) (FR 62 (30): 6729-6738, February 13, 1997).

Using historical records, Watkins (1986) showed that the reactions of four species of mysticetes to vessel traffic and whale watching activities in Cape Cod had changed over the 25-year period examined (1957-1982). Reactions of minke whales changed from initially more positive reactions, such as coming towards the boat or research equipment to investigate, to more uninterested reactions towards the end of the study. Fin whales, the most numerous species in the area, showed a trend from initially more negative reactions, such as swimming away from the boat with limited surfacing, to more uninterested (ignoring) reactions allowing boats to approach within 98.4 ft. (30 m). Right whales showed little change over the study period, with a roughly equal number of reactions judged to be negative and uninterested; no right whales were noted as having positive reactions to vessels. Humpback whales

showed a trend from negative to positive reactions with vessels during the study period. The author concluded that the whales had habituated to the human activities over time (Watkins 1986).

Mysticetes have been shown to both increase and decrease calling behavior in the presence of vessel noise. An increase in feeding call rates and repetition by humpback whales in Alaskan waters is associated with vessel noise (Doyle et al. 2008), while decreases in singing activity has been noted near Brazil due to boat traffic (Sousa-Lima and Clark 2008).

Odontocetes

Sperm whales generally react only to vessels approaching within several hundred meters; however, some individuals may display avoidance behavior, such as quick diving (Magalhães et al. 2002; Wursig et al. 1998). One study showed that after diving, sperm whales showed a reduced timeframe from when they emitted the first click than before vessel interaction (Richter et al. 2006). The smaller whale watching and research vessels generate more noise in higher-frequency bands and are more likely to approach odontocetes directly, and to spend more time near the individual whale. Most *Kogia* species and beaked whales react negatively to vessels by quick diving and other avoidance maneuvers (Wursig et al. 1998). Reactions to Navy vessels are not well documented, but smaller whale watching and research boats have been shown to cause these species to alter their breathing intervals and echolocation patterns.

Very little information is available on the behavioral impacts of vessels or vessel noise on beaked whales (Cox et al. 2006). However, a single observation of vocal disruption of a foraging dive by a tagged Cuvier's beaked whale was documented when a large noisy vessel was present, suggesting that vessel noise may disturb foraging beaked whales (Aguilar de Soto et al. 2006). Tyack et al. (2011) noted the result of a controlled exposure to pseudorandom noise suggests that beaked whales would respond to vessel noise at similar received levels to those noted previously for mid-frequency sonar.

Most delphinids react neutrally to vessels, although both avoidance and attraction behavior have been observed (Hewitt 1985; Wursig et al. 1998). Avoidance reactions include a decrease in resting behavior or change in travel direction (Bejder et al. 2006b). Incidents of attraction includes common, rough-toothed, and bottlenose dolphins bow riding and jumping in the wake of a vessel (Norris and Prescott 1961; Ritter 2002; Shane et al. 1986; Wursig et al. 1998). A study of vessel reactions by dolphin communities in the eastern tropical Pacific found that populations that were often the target of tuna purse-seine fisheries (spotted, spinner, and common dolphins) show evasive behavior when approached; however, populations that live closer to shore (within 100 nm; coastal spotted and bottlenose dolphins) that are not set on by purse-seine fisheries tend to be attracted to vessels (Archer et al. 2010).

Killer whales, the largest of the dolphins (family Delphinidae), are targeted by numerous small whale-watching vessels in the Pacific Northwest. These vessels have source levels that range from 145 to 169 dB re 1 µPa at 1 m and have the potential to result in behavioral disturbance, interfere with communication, and affect the killer whales' hearing (Erbe 2002). Killer whales foraged significantly less and traveled significantly more when boats were within 328 ft. (100 m) of the whales (Kruse 1991; Lusseau et al. 2009; Trites and Bain 2000; Williams et al. 2002a; Williams et al. 2009; Williams et al. 2002b). These short-term feeding activity disruptions may have important long-term population-level effects (Lusseau et al. 2009; Noren et al. 2009). The reaction of the killer whales to whale-watching vessels may be in response to the vessel pursuing them rather than to the noise of the vessel itself, or to the number of vessels in their proximity. For inland waters of Washington state, regulations were

promulgated in 2011 for commercial and private vessels, restricting approach to within 200 yd. (182.9 m) of killer whales, although these regulations were specifically developed to protect the endangered southern resident killer whales (FR 76 (72): 20870-20890, April 14, 2011). As stated previously, Navy mitigation measures are more protective, with a 500 yd. (457.2 m) avoidance zone of all sighted whales.

Similar behavioral changes (increases in traveling and other stress-related behaviors) have been documented in Indo-Pacific bottlenose dolphins in Zanzibar (Christiansen et al. 2010; Englund and Berggren 2002; Stensland and Berggren 2007). Short-term displacement of dolphins due to tourist boat presence has been documented (Carrera et al. 2008), while longer term or repetitive/sustained displacement for some dolphin groups due to chronic vessel noise has been noted (Haviland-Howell et al. 2007). Most studies of the behavioral reactions to vessel traffic of bottlenose dolphins have documented at least short-term changes in behavior, activities, or vocalization patterns when vessels are near, although the distinction between vessel noise and vessel movement has not been made clear (Acevedo 1991; Arcangeli and Crosti 2009; Berrow and Holmes 1999; Gregory and Rowden 2001; Janik and Thompson 1996; Lusseau 2004; Mattson et al. 2005; Scarpaci et al. 2000).

Indo-Pacific humpback dolphins have been observed to dive for longer periods in areas where vessels were present or approaching (Ng and Leung 2003). The influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating interpretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung 2003).

Both finless porpoises (Li et al. 2008) and harbor porpoises (Polacheck and Thorpe 1990) routinely avoid and swim away from large motorized vessels. The vaquita, which is closely related to the harbor porpoise in the Study Area, appears to avoid large vessels at about 2,995 ft. (913 m) (Jaramillo-Legorreta et al. 1999). The assumption is that the harbor porpoise would respond similarly to large Navy vessels.

Odontocetes have been shown to make short-term changes to vocal parameters such as intensity (Holt et al. 2008) as an immediate response to vessel noise, as well as increase the pitch, frequency modulation, and length of whistling (May-Collado and Wartzok 2008). Likewise, modification of multiple vocalization parameters was shown in belugas residing in an area known for high levels of commercial traffic. These animals decreased their call rate, increased certain types of calls, and shifted upward in frequency content in the presence of small vessel noise (Lesage et al. 1999). Another study detected a measurable increase in the amplitude of their vocalizations when ships were present (Scheifele et al. 2005). Killer whales are also known to modify their calls during increased noise. For example, the source level of killer whale vocalizations was shown to increase with higher background noise levels associated with vessel traffic (the Lombard effect) (Holt et al. 2008). In addition, calls with a high-frequency component have higher source levels than other calls, which may be related to behavioral state, or may reflect a sustained increase in background noise levels (Holt et al. 2011). On the other hand, long-term modifications to vocalizations may be indicative of a learned response to chronic noise, or of a genetic or physiological shift in the populations. This type of change has been observed in killer whales off the northwestern coast of the United States between 1973 and 2003. This population increased the duration of primary calls once a threshold in observed vessel density (e.g., whale watching) was reached, which is suggested as being a long-term response to increased masking noise produced by the vessels (Foote et al. 2004).

Pinnipeds

Little is known about pinniped reactions to underwater non-impulsive sounds (Southall et al. 2007) including vessel noise. In a review of reports on reactions of pinnipeds to small craft and ships, Richardson et al. (1995) noted that information on pinniped reactions is limited and most reports are based on anecdotal observations. Specific case reports in Richardson et al. (1995) vary based on factors such as routine anthropogenic activity, distance from the vessel, engine type, wind direction, and ongoing subsistence hunting. As with reactions to sound reviewed by Southall et al. (Southall et al. 2007), pinniped responses to vessels are affected by the context of the situation and by the animal's experience. In summary, pinniped reactions to vessels are variable and reports include a wide spectrum of possibilities from avoidance and alert, to cases where animals in the water are attracted, and cases on land where there is lack of significant reaction suggesting "habituation" to or "tolerance" of vessels (Richardson et al. 1995).

A study of reactions of harbor seals hauled out on ice to cruise ship approaches in Disenchantment Bay, Alaska, revealed that animals are more likely to flush and enter the water when cruise ships approach within 1,640 ft. (500 m) and four times more likely when the cruise ship approaches within 328 ft. (100 m) (Jansen et al. 2010). Navy vessels would generally not operate in vicinity of nearshore natural areas that are pinniped haul-out or rookery locations.

Manatees

The West Indian manatee responds to vessel movement via acoustic and possibly visual cues by moving away from the approaching vessel, increasing its swimming speed, and moving toward deeper water (Miksis-Olds et al. 2007; Nowacek et al. 2004b). The degree of response varies with the individual manatee and may be more pronounced in deeper water, where they are more easily able to locate the direction of the approaching vessel (Nowacek et al. 2004b). This disturbance is a temporary response to the approaching vessel. West Indian manatees have also been shown to seek out areas with a lower density of vessels (Buckingham et al. 1999). West Indian manatees exhibit a clear behavioral response to vessels within distances of 82 to 164 ft. (25 to 50 m), but it is unclear at what distance the manatees first detect the presence of vessels (Nowacek et al. 2004b). Vessel traffic and recreation activities that disturb West Indian manatees may cause them to leave preferred habitats and may alter biologically important behaviors, such as feeding, suckling, or resting (Haubold et al. 2006).

In manatees, call rates and call amplitude were affected by noise that shared dominant frequencies of watercraft, with rates decreasing during feeding/socializing, and differential effects seen on call type based on the presence/absence of calves (Miksis-Olds and Tyack 2009). These changes in vocalizations varied with the frequency of the noise, the type of call being produced, and the behavioral/social context; taken together, these changes may indicate that responses are dependent on behavioral and environmental contexts to vessel noise.

Behavioral Reactions to Aircraft and Missile Overflights

The following paragraphs summarize what is known about the reaction of various marine mammal species to overhead flights of many types of fixed-wing aircraft and helicopters. Thorough reviews of the subject and available information is presented in Richardson et al. (1995) and Luksenburg and Parsons (2009) (Efroymson et al. 2001; Holst et al. 2011). The most common responses of cetaceans to overflights were short surfacing durations, abrupt dives, and percussive behavior (breaching and tail slapping) (Nowacek et al. 2007). Other behavioral responses such as flushing and fleeing the area of the source of the noise have also been observed (Holst et al. 2011; Manci et al. 1988). Richardson et al. (1995) noted that marine mammal reactions to aircraft overflight largely consisted of opportunistic and

anecdotal observations lacking clear distinction between reactions potentially caused by the noise of the aircraft and the visual cue an aircraft presents. In addition, it was suggested that variations in the responses noted were due to generally other undocumented factors associated with overflights (Richardson et al. 1995). These factors could include aircraft type (single engine, multi-engine, jet turbine), flight path (centered on the animal, off to one side, circling, level and slow), environmental factors such as wind speed, sea state, cloud cover, and locations where native subsistence hunting continues.

Mysticetes

Mysticetes either ignore or occasionally dive in response to aircraft overflights (Efroymson et al. 2001; Koski et al. 1998). Richardson et al. (1985; Richardson et al. 1995) reported that while data on the reactions of mysticetes are meager and largely anecdotal, there is no evidence that single or occasional aircraft flying above mysticetes causes long-term displacement of these mammals. In general, overflights above 1,000 ft. (304.8 m) do not cause a reaction and National Oceanic and Atmospheric Administration has promulgated a regulation for Hawaiian waters and the Hawaii Humpback Whale National Marine Sanctuary adopting this stand-off distance (FR 64 (228): 66566-66579, November 29, 1999). For right whales, the stand-off distance for aircraft is 500 yd. (427 m) (FR 62 (30): 6729-6738, February 13, 1997).

Bowhead whales in the Beaufort Sea exhibited a transient behavioral response to fixed-wing aircraft and vessels. Reactions were frequently observed at less than 1,000 ft. (304.8 m) above sea level, infrequently observed at 1,500 ft. (457.2 m), and not observed at all at 2,000 ft. (609.6 m) (Richardson et al. 1985). Bowhead whales reacted to helicopter overflights by diving, breaching, changing direction or behavior, and altering breathing patterns. Behavioral reactions decreased in frequency as the altitude of the helicopter increased to 492 ft. (150 m) or higher. The bowheads exhibited fewer behavioral changes than did the odontocetes in the same area (Patenaude et al. 2002). It should be noted that bowhead whales in this study may have more acute responses to anthropogenic activity than many other marine mammals since these animals were presented with restricted egress due to limited open water between ice floes. Additionally, these animals are hunted by native Alaskans, which could lead to animals developing additional sensitivity to human noise and presence.

Odontocetes

Variable responses to aircraft have been observed in toothed whales, though overall little change in behavior has been observed during flyovers. Some toothed whales dove, slapped the water with their flukes or flippers, or swam away from the direction of the aircraft during overflights; others did not visibly react (Richardson et al. 1995).

During standard marine mammal surveys at an altitude of 750 ft., some sperm whales remained on or near the surface the entire time the aircraft was in the vicinity, while others dove immediately or a few minutes after being sighted. Other authors have corroborated the variability in sperm whales' reactions to fixed-wing aircraft or helicopters (Green et al. 1992; Richter et al. 2006; Richter et al. 2003; Smultea et al. 2008a; Wursig et al. 1998). In one study, sperm whales showed no reaction to a helicopter until they encountered the downdrafts from the rotors (Richardson et al. 1995). A group of sperm whales responded to a circling aircraft (altitude of 800 to 1,100 ft.) by moving closer together and forming a defensive fan-shaped semicircle, with their heads facing outward. Several individuals in the group turned on their sides, apparently to look up toward the aircraft (Smultea et al. 2008b; Smultea et al. 2001). Whale-watching aircraft apparently caused sperm whales to turn more sharply but did not affect blow interval, surface time, time to first click, or the frequency of aerial behavior (Richter et al. 2003).

Navy aircraft do not hover over or fly at low altitude to follow whales and so are not expected to evoke this type of response.

Smaller delphinids generally react to overflights either neutrally or with a startle response (Wursig et al. 1998). The same species that show strong avoidance behavior to vessel traffic (*Kogia* species and beaked whales) show similar reactions to aircraft (Wursig et al. 1998). Beluga whales reacted to helicopter overflights by diving, breaching, changing direction or behavior, and altering breathing patterns to a greater extent than mysticetes in the same area (Patenaude et al. 2002). These reactions increased in frequency as the altitude of the helicopter dropped below 492 ft. (150 m).

Pinnipeds

Richardson et al. (1995) noted that data on pinniped reactions to aircraft overflight largely consisted of opportunistic and anecdotal observations. The summary by Richardson et al. (1995) of this variable data noted that responsiveness generally was dependent on the altitude of the aircraft, the abruptness of the associated aircraft sound, and life cycle stage (breeding, molting, etc.). Hauled out pinnipeds exposed to aircraft sight and sound reacted by becoming alert and in many cases rushing into the water. Stampedes resulting in mortality to pups (by separation or crushing) have been noted in some cases, although it is rare (Holst et al. 2011).

Reactions of walruses on land varied in severity and included minor head raising at a distance of 8,200 ft. (2.5 km), orienting toward or entering the water at less than 492 ft. and 4,270 ft. in altitude (less than 150 m and 1.3 km), to full flight reactions at horizontal ranges of less than 3,280 ft. (1 km) at altitudes as high as 3,280- 4,920 ft. (1,000–1,500 m)(Richardson et al. 1995). It was noted that adult females, calves and juveniles were more likely to enter the water than males and that stampedes can result when disturbance is severe. Alternatively, some herds may habituate to overflights. Reactions of walruses at sea or on pack ice varied but included avoidance behaviors such as rapid diving and leaving the ice.

Helicopters are used in studies of several species of seals hauled out and are considered an effective means of observation (Bester et al. 2002; Gjertz and Børset 1992), although they have been known to elicit behavioral reactions such as fleeing (Hoover 1988). In other studies, harbor seals showed no reaction to helicopter overflights (Gjertz and Børset 1992).

Ringed seals near an oil production island in Alaska reacted to approaching Bell 212 helicopters generally by increasing vigilance, although one seal left its basking site for the water after a helicopter approached within approximately 328 ft. (100 m) (Blackwell et al. 2004). Seals near the oil production platform were thought to be habituated and showed no reactions to industrial noise in water or in air, including impact pipe-driving, during the rest of the observations.

For California sea lions and Steller sea lions at a rocky haulout off Crescent City in northern California, helicopter approach to landing typically caused the most severe response (National Marine Fisheries Services 2010). Responses were also dependent on the species with Steller sea lions being more "skittish" and California sea lions more tolerant. Depending on the spacing between subsequent approaches, animals hauled out in between and fewer animals reacted upon subsequent exposures (National Marine Fisheries Services 2010).

Pinniped reactions to rocket launches and overflight at San Nicholas Island were studied from August 2001 to October 2008 (Holst et al. 2011). California sea lions startled and increased vigilance for up to

two minutes after a rocket overflight, with some individuals moving down the beach or returning to the water. Northern elephant seals showed little reaction to any overflight. Harbor seals had the most pronounced reactions of the three species observed with most animals within approximately 2.5 mi. (4 km) of the rocket trajectory leaving their haul-out sites for the water and not returning for several hours. The authors concluded that the effects of the rocket launches were minor with no effects on local populations evidenced by the growing populations of pinnipeds on San Nicholas Island (Holst et al. 2011).

Manatees

There are few data on the effects of aircraft overflight on the West Indian manatee. Rathbun studied the reaction of West Indian manatees to both fixed-wing aircraft and helicopters used during census surveys (Rathbun 1988). The manatees did not react to a fixed-wing aircraft moving at approximately 81 miles per hour (mph) (130 kilometers per hour [km/h]) at 525 ft. altitude; however, animals did react to a helicopter below approximately 328 ft. moving at speeds of 0 (hovering) to 12.4 mph (0 to 20 km/h) by startling from rest and diving to deeper waters.

3.4.3.1.2.6 Repeated Exposures

Repeated exposures of an individual to multiple sound-producing activities over a season, year, or life stage could cause reactions with costs that can accumulate over time to cause long-term consequences for the individual. Conversely, some animals habituate to or become tolerant of repeated exposures over time, learning to ignore a stimulus that in the past has not accompanied any overt threat.

Repeated exposure to acoustic and other anthropogenic stimuli has been studied in several cases, especially as related to vessel traffic and whale watching. Common dolphins in New Zealand responded to dolphin-watching vessels by interrupting foraging and resting bouts, and took longer to resume behaviors in the presence of the vessel (Stockin et al. 2008). The authors speculated that repeated interruptions of the dolphins' foraging behaviors could lead to long-term implications for the population. Bejder et al. (2006a) studied responses of bottlenose dolphins to vessel approaches and found stronger and longer lasting reactions in populations of animals that were exposed to lower levels of vessel traffic overall. The authors indicated that lesser reactions in populations of dolphins regularly subjected to high levels of vessel traffic could be a sign of habituation, or it could be that the more sensitive animals in this population previously abandoned the area of higher human activity.

Marine mammals exposed to high levels of human activities may leave the area, habituate to the activity, or tolerate the disturbance and remain in the area. Marine mammals that are more tolerant may stay in a disturbed area, whereas individuals that are more sensitive may leave for areas with less human disturbance. However, animals that remain in the area throughout the disturbance may be unable to leave the area for a variety of physiological or environmental reasons. Terrestrial examples of this abound as human disturbance and development displace more sensitive species, and tolerant animals move in to exploit the freed resources and fringe habitat. Longer-term displacement can lead to changes in abundance or distribution patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Bejder et al. 2006b; Blackwell et al. 2004; Teilmann et al. 2006). Gray whales in Baja California abandoned a historical breeding lagoon in the mid-1960s due to an increase in dredging and commercial shipping operations. Whales did repopulate the lagoon after shipping activities had ceased for several years (Bryant et al. 1984). Over a shorter time scale, studies on the Atlantic Undersea Test and Evaluation Center instrumented range in the Bahamas have shown that some Blainville's beaked whales may be resident during all or part of the year in the area, and that individuals may move off of the range for several days during and following a sonar event. However

animals are thought to continue feeding at short distances (a few kilometers) from the range out of the louder sound fields (less than 157 dB re 1 µPa) (McCarthy et al. 2011; Tyack et al. 2011). Mysticetes in the northeast tended to adjust to vessel traffic over a number of years, trending towards more neutral responses to passing vessels (Watkins 1986), indicating that some animals may habituate or otherwise learn to cope with high levels of human activity. Nevertheless, the long-term consequences of these habitat utilization changes are unknown, and likely vary depending on the species, geographic areas, and the degree of acoustic or other human disturbance.

Moore and Barlow (2013) have noted a decline in beaked whales in a broad area of the Pacific Ocean area out to 300 nm from the coast and extending from the Canadian-U.S. border to the tip of Baja Mexico. There are scientific caveats and limitations to the data used for that analysis, as well as oceanographic and species assemblage changes not thoroughly addressed in Moore and Barlow (2013), although the authors suggest Navy sonar as one possible explanation for the apparent decline in beaked whale numbers over that broad area. In the small portion of the Pacific coast overlapping the Navy's Southern California Range Complex, long-term residency by individual Cuvier's beaked whales and documented higher densities of beaked whales provide indications that the proposed decline in numbers elsewhere along the Pacific coast is not apparent where the Navy has been intensively training and testing with sonar and other systems for decades. While it is possible that a downward trend in beaked whales may have gone unnoticed at the range complex (due to a lack of survey precision) or that beaked whale densities may have been higher before the Navy began using sonar more than 60 years ago, there is no data available to suggest that beaked whale numbers have declined on the range where Navy sonar use has routinely occurred. As Moore and Barlow (2013) point out, it remains clear that the Navy range in Southern California continues to support high densities of beaked whales.

3.4.3.1.2.7 Stranding

When a marine mammal (alive or dead) swims or floats onto shore and becomes beached or incapable of returning to sea, the event is termed a stranding (Geraci et al. 1999; Geraci and Lounsbury 2005; Perrin and Geraci 2002). Animals outside of their “normal” habitat are also sometimes considered “stranded” even though they may not have beached themselves. Under U.S. law, a stranding is an event in the wild that: (A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance” (16 United States Code [U.S.C.] § 1421h).

Marine mammals are subjected to a variety of natural and anthropogenic factors, acting alone or in combination, which may cause a marine mammal to strand (Geraci et al. 1999; Geraci and Lounsbury 2005). Even for the fractions of more thoroughly investigated strandings involving post-stranding data collection and necropsies, the cause (or causes) for the majority of strandings remain undetermined. Natural factors related to strandings include, for example, the availability of food, predation, disease, parasitism, climatic influences, and aging (Bradshaw et al. 2006; Culik 2002; Geraci et al. 1999; Geraci and Lounsbury 2005; Hoelzel 2002; National Research Council 2006; Perrin and Geraci 2002; Walker et al. 2005). Anthropogenic factors include, for example, pollution (Elfes et al. 2010; Hall et al. 2006a; Hall et al. 2006b; Jepson et al. 2005; Marine Mammal Commission 2010; Tabuchi et al. 2006), vessel strike (Berman-Kowalewski et al. 2010; de Stephanis and Urquiola 2006; Geraci and Lounsbury 2005; Jensen and Silber 2004; Laist et al. 2001), fisheries interactions (Read et al. 2006), entanglement (Baird and

Gorgone 2005; Saez et al. 2012), and noise (Cox et al. 2006; National Research Council 2003; Richardson et al. 1995).

Along the coasts of the continental United States and Alaska between 2001 and 2009, there were on average approximately 1,400 cetacean strandings and 4,300 pinniped strandings (5,700 total) per year (National Marine Fisheries Service 2011). Several mass strandings (strandings that involve two or more individuals of the same species, excluding a single cow-calf pair) that have occurred over the past two decades have been associated with naval operations, seismic surveys, and other anthropogenic activities that introduced sound into the marine environment. An in-depth discussion of strandings is in the Navy's Technical Report on Marine Mammal Strandings associated with U.S. Navy Sonar Activities (U.S. Department of the Navy 2013a).

Sonar use during exercises involving U.S. Navy (most often in association with other nations' defense forces) has been identified as a contributing cause or factor in five specific mass stranding events: Greece in 1996; the Bahamas in March 2000; Madeira Island (Portugal) in 2000; the Canary Islands in 2002; and Spain in 2006 (Marine Mammal Commission 2006b). These five mass strandings have resulted in about 40 known, scientifically verifiable sonar-related deaths among cetaceans consisting mostly of beaked whales (International Council for the Exploration of the Seas 2005).

In these circumstances, exposure to non-impulsive acoustic energy has been considered a potential indirect cause of the death of marine mammals (Cox et al. 2006). One hypothesis is that strandings may result from tissue damage caused by "gas and fat embolic syndrome" (Fernández et al. 2005; Jepson et al. 2003; Jepson et al. 2005). Models of nitrogen saturation in diving marine mammals have been used to suggest that altered dive behavior might result in the accumulation of nitrogen gas such that the potential for nitrogen bubble formation is increased (Houser et al. 2001; Zimmer and Tyack 2007). If so, this mechanism might explain the findings of gas and bubble emboli in stranded beaked whales. It is also possible that stranding is a behavioral response to a sound under certain conditions and that the subsequently observed physiological effects (e.g., overheating, decomposition, or internal hemorrhaging from being on shore) were the result of the stranding rather than a direct physical impact from exposure to sonar (Cox et al. 2006).

As the International Council for the Exploration of the Sea (2005) noted, taken in context of marine mammal populations in general, sonar is not a major threat or a significant portion of the overall ocean noise budget. This has also been demonstrated by monitoring in areas where the Navy operates (Bassett et al. 2010; Baumann-Pickering et al. 2010; McDonald et al. 2006; Tyack et al. 2011). Regardless of the direct cause of strandings, the Navy considers potential sonar related strandings important and continues to fund research and work with scientists to better understand circumstances that may result in strandings.

During a Navy training event on 4 March 2011 at the Silver Strand Training Complex in San Diego, California, three or possibly four dolphins were killed in an explosion. During an underwater detonation training event, a pod of 100–150 long-beaked common dolphins were observed moving towards the 700-yard (640-m) exclusion zone around the explosive charge, monitored by personnel in a safety boat and participants in a dive boat. Approximately five minutes remained on a time-delay fuse connected to a single 8.76 lb. explosive charge (C-4 and detonation cord). Although the dive boat was placed between the pod and the explosive in an effort to guide the dolphins away from the area, that effort was unsuccessful and three long-beaked common dolphins near the explosion died. In addition to the three dolphins found dead on 4 March 2011 at the event site, the remains of a fourth dolphin, with injuries

consistent with blast injury, were discovered on 7 March 2011 near Oceanside, California (3 days later and approximately 42.3 mi. (68.1 km) from Silver Strand where the training event occurred), which might also have been related to this event (Danil and St. Ledger 2011). Association of the fourth stranding with the training event is uncertain because dolphins strand on a regular basis in the San Diego area. Details such as the dolphins' depth and distance from the explosive at the time of the detonation could not be estimated from the 250 yard (228.6 m) standoff point of the observers in the dive boat or the safety boat.

These dolphin mortalities are the only known occurrence of a U.S. Navy training or testing event involving impulse energy (underwater detonation) that caused mortality or injury to a marine mammal. Despite this being a rare occurrence, Navy has reviewed training requirements, safety procedures, and possible mitigation measures and implemented changes to reduce the potential for this to occur in the future. Discussions of procedures associated with these and other training and testing events are presented in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), which details all mitigations.

In comparison to potential strandings or injury resulting from events associated with Navy activities, marine mammal strandings and injury from commercial vessel ship strike (Berman-Kowalewski et al. 2010), impacts from urban pollution (Murata et al. 2008), and annual fishery-related bycatch (Baird and Gorgone 2005; Forney and Kobayashi 2007; Saez et al. 2012) have been estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals) (Culik 2002; International Council for the Exploration of the Sea 2005; Read et al. 2006). This does not negate the potential influence of mortality or additional stressors to small, regionalized sub-populations that may be at greater risk from human related impacts (fishing, vessel strike, and sound) than populations with larger distributions.

3.4.3.1.3 Long-Term Consequences to the Individual and the Population

Long-term consequences to a population are determined by examining changes in the population growth rate. Individual effects that could lead to a reduction in the population growth rate include mortality or injury (that removes animals from the reproductive pool), hearing loss (which depending on severity could impact navigation, foraging, predator avoidance, or communication), chronic stress (which could make individuals more susceptible to disease), displacement of individuals (especially from preferred foraging or mating grounds), and disruption of social bonds (due to masking of conspecific signals or displacement) (Section 3.0.5.7.1.1, Flowchart). However, the long-term consequences of any of these effects are difficult to predict because individual experience and time can create complex contingencies, especially for intelligent, long-lived animals like marine mammals. While a lost reproductive opportunity could be a measureable cost to the individual, the outcome for the animal, and ultimately the population, can range from insignificant to significant. Any number of factors, such as maternal inexperience, years of poor food supply, or predator pressure, could produce a cost of a lost reproductive opportunity, but these events may be "made up" during the life of a normal healthy individual. The same holds true for exposure to human-generated sound sources. These biological realities must be taken into consideration when assessing risk, uncertainties about that risk, and the feasibility of preventing or recouping such risks. All too often, the long-term consequence of relatively trivial events like short-term masking of a conspecific's social sounds, or a single lost feeding opportunity, is exaggerated beyond its actual importance by focus on the single event and not the important variable, which is the individual and its lifetime parameters of growth, reproduction, and survival.

The linkage between a stressor such as sound and its immediate behavioral or physiological consequences for the individual, and then the subsequent effects on that individual's vital rates (growth, survival, and reproduction), and the consequences, in turn, for the population have been reviewed in National Research Council (2005). The Population Consequences of Acoustic Disturbance model (National Research Council 2005) proposes a quantitative method for determining how changes in the vital rates of individuals (i.e., a biologically significant consequence to the individual) translates into biologically significant consequences to the population. Population models are well known from many fields in biology including fisheries and wildlife management. These models accept inputs for the population size and changes in vital rates of the population such as the mean values for survival age, lifetime reproductive success, and recruitment of new individuals into the population. The time-scale of the inputs in a population model for long-lived animals such as marine mammals is on the order of seasons, years, or life stages (e.g., neonate, juvenile, reproductive adult), and are often concerned only with the success of individuals from one time period or stage to the next. Unfortunately, for acoustic and explosive impacts on marine mammal populations, many of the inputs required by population models are not known.

The best assessment of long-term consequences from training and testing activities will be to monitor the populations over time within the Study Area. A recent U.S. workshop on Marine Mammals and Sound (Fitch et al. 2011) indicated a critical need for baseline biological data on marine mammal abundance, distribution, habitat, and behavior over sufficient time and space to evaluate impacts from human-generated activities on long-term population survival. The Navy has developed monitoring plans for protected marine mammals and sea turtles occurring on Navy ranges with the goal of assessing the impacts of training and testing activities on marine species and the effectiveness of the Navy's current mitigation practices (see Section 3.0.2.2.2, Monitoring During Training and Testing Events, for a summary of results from past Navy monitoring). Continued monitoring efforts over time will be necessary to begin to evaluate the long-term consequences of exposure to noise sources.

3.4.3.1.4 Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on Marine Mammals

If proposed Navy activities introduce sound or explosive energy into the marine environment, an analysis of potential impacts on marine mammals is conducted. To do this, information about the numerical sound and energy levels that are likely to elicit certain types of physiological and behavioral reactions is needed. Thresholds and criteria are not presented for polar bears or walruses. Although they may occur in the Study Area, they are unlikely to occur in areas overlapping with use of explosive or sonar and other active acoustic sources.

3.4.3.1.4.1 Mortality and Injury from Explosives

There is a considerable body of laboratory data on injuries from impulsive sound exposure, usually from explosive pulses, obtained from tests with a variety of lab animals (e.g., mice, rats, dogs, pigs, sheep, and other species). Onset mortality (a severe lung injury with mortality occurring in 1 percent of those having this injury), onset slight lung injury, and onset slight gastrointestinal tract injury represent a series of effects with decreasing likelihood of serious injury or lethality. Primary impulse injuries from explosive blasts are the result of differential compression and rapid re-expansion of adjacent tissues of different acoustic properties (e.g., between gas-filled and fluid-filled tissues or between bone and soft tissues). These injuries usually manifest themselves in the gas-containing organs (lung and gut) and auditory structures (e.g., rupture of the eardrum across the gas-filled spaces of the outer and inner ear) (Craig and Hearn 1998; Craig Jr. 2001).

Criteria and thresholds for predicting mortality and injury to marine mammals from explosions were initially developed for the U.S. Navy shock trials of the USS Seawolf submarine (Craig and Hearn 1998) and USS Winston S. Churchill surface ship (Craig Jr. 2001). Similar criteria and thresholds also were used for the shock trial of the U.S. Navy amphibious transport dock ship USS *Mesa Verde* (U.S. Department of the Navy 2008) and were subsequently adopted by NMFS in their MMPA Final Rule authorizing the USS *Mesa Verde* shock trial (National Marine Fisheries Service 2008c). Functional hearing ranges are not applied for lethal and injurious exposures. These criteria and their origins are explained in greater detail in the Criteria and Thresholds for U.S. Navy Acoustic Effects Analysis Technical Report (Finneran and Jenkins 2012).

Mortality and Slight Lung Injury

In air or submerged, the most commonly reported internal bodily injury was hemorrhaging in the fine structure of the lungs. Biological damage is governed by the impulse of the underwater blast (pressure integrated over time), not peak pressure or energy (Richmond et al. 1973; Yelverton and Richmond 1981; Yelverton et al. 1973; Yelverton et al. 1975). Therefore, impulse was used as a metric upon which internal organ injury could be predicted.

Explosive thresholds for onset mortality and slight lung injury are indexed to 75 and 93 lb. (34 and 42 kg) for mammals, respectively (Richmond et al. 1973). The regression curves based on these experiments were plotted so that a prediction of mortality to larger animals could be determined as a function of impulse and mass (Craig Jr. 2001). After correction for atmospheric and hydrostatic pressures and based on the cube root scaling of body mass, as used in the Goertner injury model (Goertner 1982), the minimum impulse for predicting onset of extensive lung injury for “1 Percent Mortality” (defined as where most survivors had moderate blast injuries and should survive on their own) and slight lung injury for “0 Percent Mortality” (defined as no mortality, slight blast injuries) (Yelverton and Richmond 1981) were derived for each species. The Navy uses the minimum impulse level predictive of extensive lung injury, the exposure level likely to result in one percent mortality of animals in a population (99 percent would be expected to recover from the injury) as the onset of mortality. The scaling of lung volume to depth is conducted for all species, since data are from experiments with terrestrial animals held near the water's surface and marine mammals’ gaseous cavities compress with depth making them less vulnerable to impulse injury. The received impulse necessary for onset mortality or slight lung injury must be delivered over a time period that is the lesser of the positive pressure duration, or 20 percent of the natural period of the assumed-spherical lung adjusted for the size and depth of the animal. Therefore, as depth increases or animal size decreases, the impulse delivery time to experience an effect decreases (Goertner 1982).

Species-specific calf masses are used for determining impulse-based thresholds because they most closely represent effects on individual species. The Criteria and Thresholds for Navy Acoustic Effects Analysis Technical Report (Finneran and Jenkins 2012) provides a nominal conservative body mass for each species based on newborn weights. In some cases, body masses were extrapolated from similar species rather than the listed species. The scaling of lung volume to depth is conducted for all species since data is from experiments with terrestrial animals held near the water's surface. Because the thresholds for onset of mortality and onset of slight lung injury are proportional to the cube root of body mass, the use of all newborn, or calf, weights rather than representative adult weights results in an over-estimate of effects to animals near an explosion. The range to onset mortality for a newborn compared to an adult animal of the same species can range from less than twice to over four times as far from an explosion, depending on the differences in calf versus adult sizes for a given species and the size of the explosion. Considering that injurious high pressures due to explosions propagate away from

detonations in a roughly spherical manner, the volumes of water in which the threshold for onset mortality may be exceeded are generally less than a fifth for an adult animal versus a calf.

The use of onset mortality and onset slight lung injury is a conservative method to estimate potential mortality and recoverable (non-mortal, non-PTS) injuries. When analyzing impulse-based effects, all animals within the range to these thresholds are assumed to experience the effect. The onset mortality and onset slight lung injury criteria is based on the impulse at which these effects are predicted for one percent of animals, and then the portion of animals affected would increase closer to the explosion. As discussed above, due to these conservative criteria used to predict these effects, it is likely that fewer animals would be affected than predicted under the Navy's acoustic analysis. Therefore, these criteria conservatively over-estimate the number of animals that could be killed or injured.

Onset of Gastrointestinal Tract Injury

Evidence indicates that gas-containing internal organs, such as lungs and intestines, are the principal damage sites from shock waves in submerged terrestrial mammals (Clark and Ward 1943; Greaves et al. 1943; Richmond et al. 1973; Yelverton et al. 1973). Furthermore, slight injury to the gastrointestinal tract may be related to the peak pressure of the shock wave and would be independent of the animal's size and mass (Goertner 1982).

There are instances where injury to the gastrointestinal tract could occur at a greater distance from the source than slight lung injury, especially near the surface. Gastrointestinal tract injury from small test charges (described as "slight contusions") was observed at peak pressure levels as low as 104 pounds per square inch (psi), equivalent to a sound pressure level of 237 dB re 1 µPa (Richmond et al. 1973). This criterion was previously used by the Navy and NMFS for ship shock trials (FR 73 (143): 43130-43138, July 24, 2008)(National Marine Fisheries Service 2008c; U.S. Department of the Navy 1998, 2001, 2008).

3.4.3.1.4.2 Frequency Weighting

Frequency-weighting functions are used to adjust the received sound level based on sensitivity of the animal to the frequency of the sound. The weighting functions de-emphasize sound exposures at frequencies to which marine mammals are not particularly sensitive. This effectively makes the acoustic thresholds frequency-dependent, which means they are applicable over a wide range of frequencies and therefore applicable for a wide range of sound sources. Frequency-weighting functions, called "M-weighting" functions, were proposed by Southall et al. (2007) to account for the frequency bandwidth of hearing in marine mammals. These M-weighting functions were derived for each marine mammal hearing group based on an algorithm using the range of frequencies that are within 80 dB of an animal or group's best hearing sensitivity at any frequency (Southall et al., 2007). The Southall et al. (2007) M-weighting functions are nearly flat between the lower and upper cutoff frequencies, and thus were believed to represent a conservative approach to assessing the effects of noise (Figure 3.4-4). For the purposes of this analysis, the Navy will refer to these as Type I auditory weighting functions. Phocid seal thresholds and weighting functions

Frequency Weighting Example:

A common dolphin, a mid-frequency cetacean (see Table 3.4-2), receives a 10 kHz ping from a sonar with a sound exposure level (SEL) of 180 dB re 1 μPa^2-s. To discern if this animal may suffer a TTS, the received level must first be adjusted using the appropriate Type II auditory weighting function for mid-frequency cetaceans (Figure 3.4-5). At 10 kHz, the weighting factor for mid-frequency cetaceans is -3 dB, which is then added to the received level (180 dB re 1μPa^2-s + (-3 dB) = 177 dB re 1μPa^2-s) to yield the weighted received level. This is compared to the non-impulsive mid-frequency cetacean TTS threshold (178 dB re 1 μPa^2-s; Table 3.4-3). Since the adjusted received level is less than the threshold, TTS is not likely for this animal from this exposure.

were applied to sirenians (manatees and dugongs) based on the similarities of their hearing ranges and auditory threshold curves (Gerstein et al. 1999).

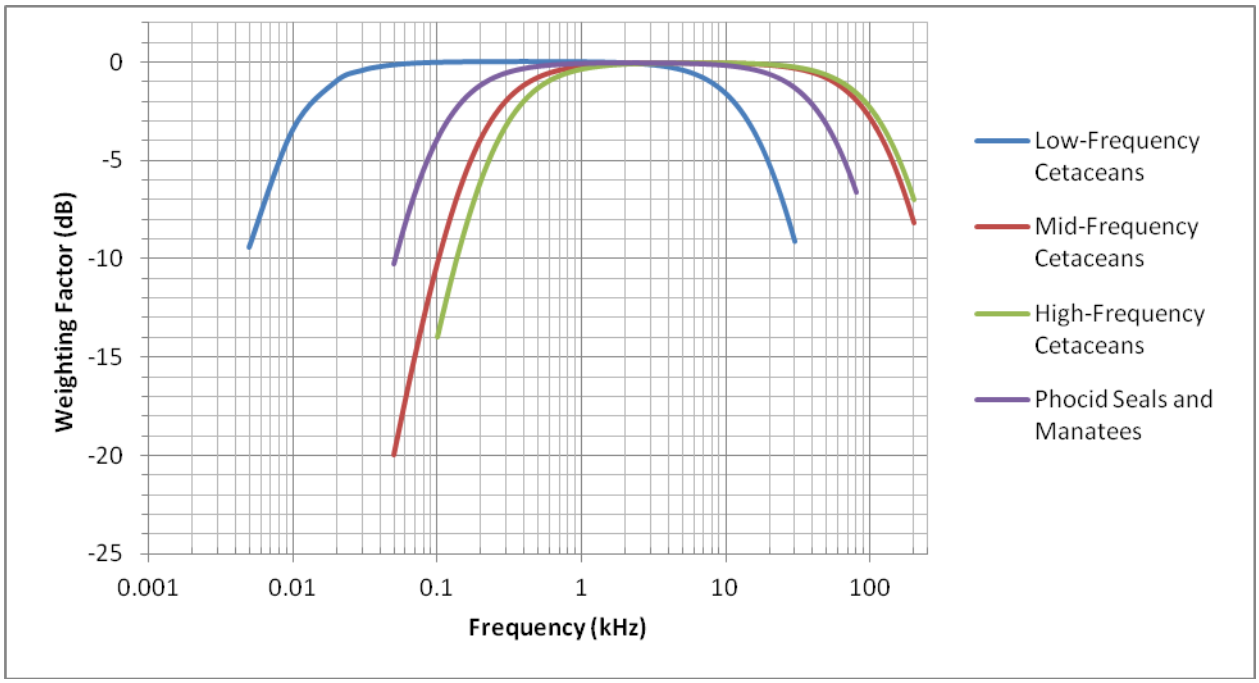


Figure 3.4-4: Type I Auditory Weighting Functions Modified from Southall et al. (2007) M-Weighting Functions

While all data published since 2007 were reviewed to determine if any adjustments to the weighting functions were required, only two published experiments suggested that modification of the mid-frequency cetacean auditory weighting function was necessary (see Finneran and Jenkins (2012) for more details on that modification not otherwise provided below). The first experiment measured TTS in a bottlenose dolphin after exposure to pure tones with frequencies from 3–28 kHz (Finneran 2010). These data were used to derive onset-TTS values as a function of exposure frequency, and demonstrate that the use of a single numeric threshold for onset-TTS, regardless of frequency, is not correct. The second experiment examined how subjects perceived the loudness of sounds at different frequencies to derive equal loudness contours (Finneran and Schlundt 2011). These data are important because human auditory weighting functions are based on equal loudness contours. The dolphin equal loudness contours provide a means to generate auditory weighting functions in a manner directly analogous to the approach used to develop safe exposure guidelines for people working in noisy environments (National Institute for Occupational Safety and Health 1998). Taken together, the recent higher-frequency TTS data and equal loudness contours provide the underlying data necessary to develop new weighting functions, referred to as Type II auditory weighting functions, to improve accuracy and avoid underestimating the impacts on animals at higher frequencies (Figure 3.4-5). To generate the new Type II weighting functions, Finneran and Schlundt (2011) substituted lower- and upper-frequency values which differ from the values used by Southall et al. (2007). The new weighting curve predicts appreciably higher (almost 20 dB) susceptibility for frequencies above 3 kHz for bottlenose dolphins, a mid-frequency cetacean. Since data below 3 kHz are not available, the original weighting functions from Southall et al. (2007) were substituted below this frequency. Low- and high-frequency cetacean weighting functions were extrapolated from the dolphin data as well because of the suspected similarities of greatest susceptibility at best frequencies of hearing. Similar type II weighting curves were

not developed for pinnipeds since their hearing is markedly different from cetaceans, and because they do not hear as well at higher frequencies. Their weighting curves do not require the same adjustment (see Finneran and Jenkins 2012 for additional details).

The Type II auditory weighting functions (Figure 3.4-5) are applied to the received sound level before comparing it to the appropriate sound exposure level thresholds for TTS or PTS, or the explosive behavioral response threshold. For some criteria, received levels are not weighted before being compared to the thresholds to predict effects. These include the peak pressure criteria for predicting TTS and PTS from underwater explosions; the acoustic impulse metrics used to predict onset-mortality and slight lung injury from underwater explosions; and the thresholds used to predict behavioral responses from harbor porpoises and beaked whales from sonar and other active acoustic sources.

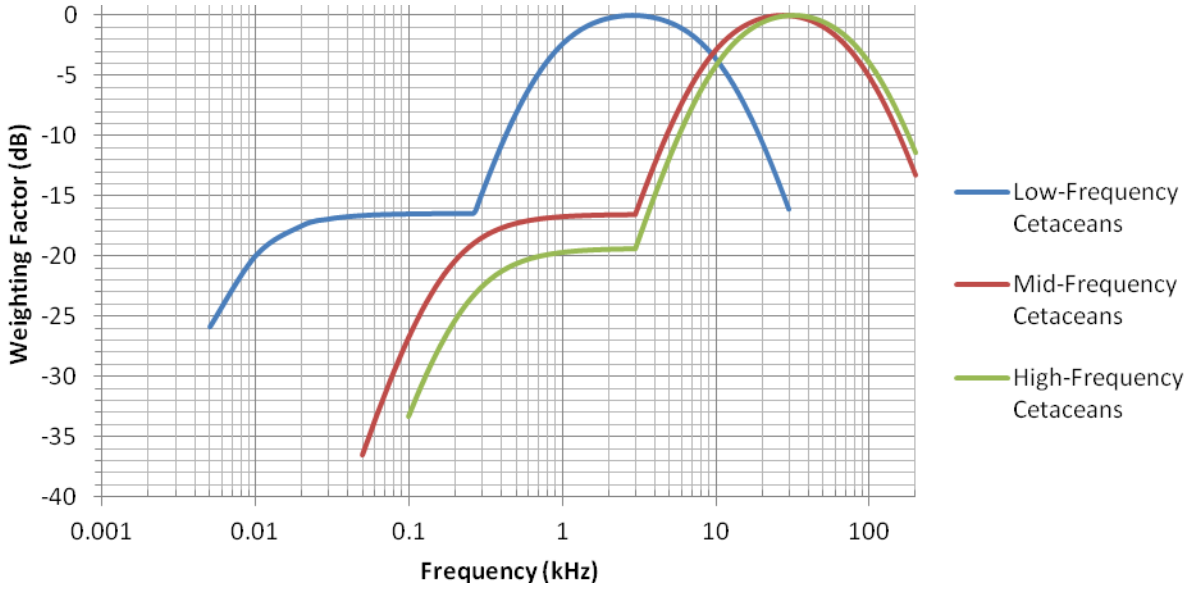


Figure 3.4-5: Type II Weighting Functions for Low-, Mid-, and High-Frequency Cetaceans

3.4.3.1.4.3 Summation of Energy from Multiple Sources

In most cases, an animal's received level will be the result of exposure to a single sound source. In some scenarios, however, multiple sources will be operating simultaneously, or nearly so, creating the potential for accumulation of energy from multiple sources. Energy is summed for multiple exposures of similar source types. For sonars, including use of multiple systems within any scenario, energy will be summed for all exposures within a cumulative exposure band, with the cumulative exposure bands defined in four bands: 0–1.0 kHz (low-frequency sources); 1.1–10.0 kHz (mid-frequency sources); 10.1–100.0 kHz (high-frequency sources); and above 100.0 kHz (very high-frequency sources). Sources operated at frequencies above 200 kHz are considered to be inaudible to all groups of marine mammals and are not analyzed in the quantitative modeling of exposure levels. After the energy has been summed within each frequency band, the band with the greatest amount of energy is used to evaluate the onset of PTS or TTS. For explosives, including use of multiple explosives in a single scenario, energy is summed across the entire frequency band.

3.4.3.1.4.4 Hearing Loss: Temporary and Permanent Threshold Shift

Criteria for physiological effects from sonar and other active acoustic sources are based on TTS and PTS with thresholds based on cumulative sound exposure levels (Table 3.4-4). The onset of TTS or PTS from exposure to underwater explosions is predicted using sound exposure level-based thresholds in conjunction with peak pressure thresholds. The horizontal ranges are then compared, with the threshold producing the longest range being the one used to predict effects. For multiple exposures within any 24-hour period, the received sound exposure level for individual events are accumulated for each marine mammal.

Since no studies have been designed to intentionally induce PTS in marine mammals due to the moral and ethical issues inherent in such a study, onset-PTS levels for these animals must be estimated using empirical TTS data obtained in marine mammals and relationships between TTS and PTS established in terrestrial mammals.

TTS and PTS thresholds are based on TTS onset values for impulsive and non-impulsive sounds obtained from representative species of mid- and high-frequency cetaceans and pinnipeds. These data are then extended to the other marine mammals for which data are not available. The Criteria and Thresholds for Navy Acoustic Effects Analysis Technical Report (Finneran and Jenkins 2012) provides a detailed explanation of the selection of criteria and derivation of thresholds for temporary and permanent hearing loss for marine mammals. Table 3.4-3 and Table 3.4-4 provide a summary of acoustic thresholds for TTS and PTS for marine mammals.

Table 3.4-3: Acoustic Criteria and Thresholds for Predicting Physiological Effects on Marine Mammals from Sonar and Other Active Acoustic Sources

Group	Species	Physiological	
		Onset TTS	Onset PTS
Low-Frequency Cetaceans	All mysticetes	178 dB re 1µPa^2-s SEL (Type II weighting)	198 dB re 1µPa^2-s SEL (Type II weighting)
Mid-Frequency Cetaceans	Dolphins, beaked whales, and medium and large toothed whales	178 dB re 1µPa^2-s SEL (Type II weighting)	198 dB re 1µPa^2-s SEL (Type II weighting)
High-Frequency Cetaceans	Harbor porpoise and *Kogia* spp.	152 dB re 1µPa^2-s SEL (Type II weighting)	172 dB re 1µPa^2-s SEL (Type II weighting)
Phocid Seals (In-Water)	Harbor, bearded, hooded common, spotted, ringed, harp, ribbon, & gray seals	183 dB re 1µPa^2-s SEL (Type I weighting)	197 dB re 1µPa^2-s SEL (Type I weighting)
Manatees	West Indian manatee		

dB re 1µPa^2-s: decibel referenced to 1 micro pascal-squared seconds; PTS: permanent threshold shift; SEL: sound exposure level; SPL: sound pressure level; TTS: temporary threshold shift

Table 3.4-4: Criteria and Thresholds for Predicting Physiological Effects on Marine Mammals from Explosives

Group	Species	Onset TTS	Onset PTS	Onset Slight GI Tract Injury	Onset Slight Lung Injury[1]	Onset Mortality[1]
Low-Frequency Cetaceans	All mysticetes	172 dB re 1 μPa^2-s SEL (Type II weighting) or 224 dB re 1 µPa Peak SPL (unweighted)	187 dB re 1 μPa^2-s SEL (Type II weighting) or 230 dB re 1 µPa Peak SPL (unweighted)	237 dB re 1 µPa (unweighted)	Equation 1	Equation 2
Mid-Frequency Cetaceans	Most dolphins, beaked whales, med and large toothed whales	172 dB re 1 μPa^2-s SEL (Type II weighting) or 224 dB re 1 µPa Peak SPL (unweighted)	187 dB re 1 μPa^2-s SEL (Type II weighting) or 230 dB re 1 µPa Peak SPL (unweighted)			
High-Frequency Cetaceans	Porpoises and *Kogia* spp.	146 dB re 1 μPa^2-s SEL (Type II weighting) or 195 dB re 1 µPa Peak SPL (unweighted)	161 dB re 1 μPa^2-s SEL (Type II weighting) or 201 dB re 1 µPa Peak SPL (unweighted)			
Phocid Seals (In-Water)	Harbor, bearded, hooded common, spotted, ringed, harp, ribbon, and gray seals	177 dB re 1μPa^2-s (Type I weighting) or 212 dB re 1 µPa Peak SPL (unweighted)	192 dB re 1μPa^2-s (Type I weighting) or 218 dB re 1 µPa Peak SPL (unweighted)			
Sirenia	Manatees					

(1) $$= 39.1 M^{1/3} \left(1 + \frac{D_{Rm}}{10.081}\right)^{1/2} Pa - \sec$$

(2) $$= 91.4 M^{1/3} \left(1 + \frac{D_{Rm}}{10.081}\right)^{1/2} Pa - \sec$$

dB re 1 µPa: decibel referenced to 1 micro pascal; dB re 1μPa^2-s: decibel referenced to 1 micro pascal-squared seconds; Drm: depth of the receiver (animal) in meters; GI: gastrointestinal injury; M: mass of the animals in kg; PTS: permanent threshold shift; SEL: sound exposure level; SPL: sound pressure level; TTS: temporary threshold shift

[1] Impulse calculated over a delivery time that is the lesser of the initial positive pressure duration or 20 percent of the natural period of the assumed-spherical lung adjusted for animal size and depth.

Temporary Threshold Shift for Sonar and Other Active Acoustic Sources

TTS values for mid-frequency cetaceans exposed to non-impulsive sound are derived from multiple studies (Finneran et al. 2010a; Finneran et al. 2005a; Mooney et al. 2009a; Schlundt et al. 2000) from two species, bottlenose dolphins and beluga whales. Especially notable are data for frequencies above 3 kHz, where bottlenose dolphins exhibited lower TTS onset thresholds than at 3 kHz (Finneran and Schlundt 2010). This difference in TTS onset at higher frequencies is incorporated into the weighting functions (Section 3.4.3.1.4.2 above Frequency Weighting).

Lucke et al. (2009) measured TTS in a harbor porpoise exposed to a small seismic air gun and those results are reflected in the impulse sound TTS thresholds described below. The beluga whale (the only species for which both impulsive and non-impulsive TTS data exist) has a (weighted) non-impulsive TTS onset value 6 dB above the (weighted) impulsive threshold (Finneran et al. 2002; Schlundt et al. 2000). Therefore, 6 dB was added to the harbor porpoise's impulsive TTS threshold demonstrated by Lucke et al. (2009) to derive the non-impulse TTS threshold used in the current Navy modeling for high-frequency cetaceans. This value was similar to what Kastelein et al. (2012b) found for harbor porpoises exposed to higher sound levels or longer durations of exposure time, when they used octave band noise centered at 4 kHz to extrapolate an onset TTS threshold for three different received levels and six durations.The Kastelein et al. (2012b) study was the first direct measurement of TTS from non-impulsive sound for harbor porpoises.

There are no direct measurements of TTS or hearing abilities for low-frequency cetaceans. The Navy uses mid-frequency cetacean thresholds to assess PTS and TTS for low-frequency cetaceans, since mid-frequency cetaceans are the most similar to the low-frequency cetacean group.

Pinniped TTS criteria are based on data provided by Kastak et al. (2005) for representative species of both of the pinniped hearing groups: harbor seals (Phocidae) and California sea lions (Otariidae and Odobenidae). Kastak et al. (2005) used octave band noise centered at 2.5 kHz to extrapolate an onset TTS threshold. More recently Kastelein et al. (2012a) used octave band noise centered at 4 kHz to obtain TTS thresholds in the same two species resulting in similar levels causing onset-TTS as those found in Kastak et al. (2005). Based on similarities of manatee hearing ranges (Gerstein et al. 1999) to phocid seal hearing ranges, the phocid TTS threshold is applied to manatees.

The appropriate frequency weighting function for each species group is applied when using the sound exposure level-based thresholds to predict TTS.

Temporary Threshold Shift for Explosives

The TTS sound exposure level thresholds for cetaceans are consistent with the thresholds approved by NMFS for the USS *Mesa Verde* ship shock trial (FR 73 (143): 43130-43138, July 24, 2008) and are more representative of TTS induced from impulses (Finneran et al. 2002) rather than pure tones (Schlundt et al. 2000). In most cases, a total weighted sound exposure level is more conservative than the greatest sound exposure level in any single 1/3-octave band, which was used prior to the USS *Mesa Verde* shock trial. There are no data on TTS obtained directly from low-frequency cetaceans, so mid-frequency cetacean impulse threshold criteria from Finneran et al. (2002) have been used. High-frequency cetacean TTS thresholds are based on research by Lucke et al. (2009), who exposed harbor porpoises to pulses from a single air gun.

Pinniped thresholds were not included for prior ship shock trials, as pinnipeds were not expected to occur at the shock trial sites due to their distance from shore, and TTS thresholds for previous Navy Environmental Impact Statements (EISs)/Overseas Environmental Impact Statements (OEISs) also were not differentiated between cetaceans and pinnipeds (FR 73 (143): 43130-43138, July 24, 2008). TTS values for impulse sound have not been obtained for pinnipeds, but there are TTS data for octave band sound from representative species of both major pinniped hearing groups (Kastak et al. 2005). Impulse sound TTS criteria for pinnipeds were estimated by applying the difference between mid-frequency cetacean TTS onset for impulse and non-impulse sounds to the pinniped non-impulse TTS data (Kastak et al. 2005), a methodology originally developed by Southall et al. (2007). Therefore, the TTS threshold for sounds from explosions for pinnipeds is 6 dB less than the non-impulsive onset-TTS threshold

derived from Kastak et al. (2005). Based on similarities of manatee hearing ranges (Gerstein et al. 1999) to phocid seal hearing ranges, the phocid TTS threshold for explosions is applied to manatees as well.

The appropriate frequency weighting function for each species group is applied when using the sound exposure level-based thresholds to predict TTS.

Permanent Threshold Shift for Sonar and Other Active Acoustic Sources

There are no direct measurements of PTS onset in marine mammals. Well-understood relationships between terrestrial mammalian TTS and PTS have been applied to marine mammals. Threshold shifts up to 40–50 dB have been induced in terrestrial mammals without resultant PTS (Miller et al. 1963; Ward et al. 1958; Ward et al. 1959b). These data would suggest that 40 dB of TTS would be a reasonable limit for approximating the beginning of PTS for marine mammals exposed to continuous sound. Data from terrestrial mammal testing (Ward et al. 1958; Ward et al. 1959b) show growth of TTS by 1.5 to 1.6 dB for every 1 dB increase in exposure level. The difference between measurable TTS onset (6 dB) and the selected 40 dB upper safe limit of TTS yields a difference in TTS of 34 dB which, when divided by a TTS growth function of 1.6 indicates that an increase in exposure of 21 dB would result in 40 dB of TTS. For simplicity and additional conservatism, the number was rounded down to 20 dB (Southall et al. 2007).

Therefore, exposures to sonar and other active acoustic sources with levels 20 dB above those producing TTS are assumed to produce PTS. For example, an onset-TTS threshold of 195 dB re 1 μPa^2-s would have a corresponding onset-PTS threshold of 215 dB re 1 μPa^2-s. This extrapolation process is identical to that recently proposed by Southall et al. (2007). The method predicts greater effects than have actually been observed in tests on a bottlenose dolphin (Schlundt et al. 2006) and is therefore protective.

Kastak et al. (2007) obtained different TTS growth rates for pinnipeds than Finneran and colleagues obtained for mid-frequency cetaceans. NMFS recommended reducing the estimated PTS criteria for both groups of pinnipeds, based on the difference in TTS growth rate reported by Kastak et al. (2007) (14 dB instead of 20 dB).

The appropriate frequency weighting function for each species group is applied when using the sound exposure level-based thresholds to predict PTS.

Permanent Threshold Shift for Explosives

Since marine mammal PTS data from impulsive exposures do not exist, onset-PTS levels for these animals are estimated by adding 15 dB to the sound exposure level-based TTS threshold and by adding 6 dB to the peak pressure-based thresholds. These relationships were derived by Southall et al. (2007) from impulse noise TTS growth rates in chinchillas. The appropriate frequency weighting function for each species group is applied when using the sound exposure level-based thresholds to predict PTS.

3.4.3.1.4.5 Behavioral Responses

Behavioral response criteria are used to estimate the number of animals that may exhibit a behavioral response. In this analysis, animals may be behaviorally harassed in each modeled scenario (using the Navy Acoustic Effects Model) or within each 24-hour period, whichever is shorter. Therefore, the same animal could have a behavioral reaction multiple times over the course of a year.

Sonar and Other Active Acoustic Sources

Potential behavioral effects from in-water sound from sonar and other active acoustic sources were predicted using the behavioral response functions for most marine mammal species. The received sound level is weighted with the Type I auditory weighting functions (Figure 3.4-4) before the behavioral response function is applied. The harbor porpoise and beaked whales are the exception. They have unique criteria based on specific data that show these animals to be especially sensitive to sound. Harbor porpoise and beaked whale non-impulsive behavioral criteria are used unweighted – without weighting the received level before comparing it to the threshold.

Behavioral Response Functions

The Navy worked with NMFS to define a mathematical function used to predict potential behavioral effects to mysticetes (Figure 3.4-7) and odontocetes (Figure 3.4-8) from mid-frequency sonar (National Marine Fisheries Service 2008a). This analysis assumes that the probability of eliciting a behavioral response to sonar and other active acoustic sources on individual animals would be a function of the received sound pressure level (dB re 1 µPa). The behavioral response function applied to mysticetes (Figure 3.4-7) differs from that used for odontocetes and pinnipeds (Figure 3.4-6) in having a shallower slope, which results in the inclusion of more behavioral impacts at lower received levels, consistent with observational data from North Atlantic right whales (Nowacek et al. 2007). Although the response functions differ, the intercepts on each figure highlight that each function has a 50 percent probability of harassment at a received level of 165 dB sound pressure level. These analyses assume that sound poses a negligible risk to marine mammals if they are exposed to sound pressure levels below a certain basement value.

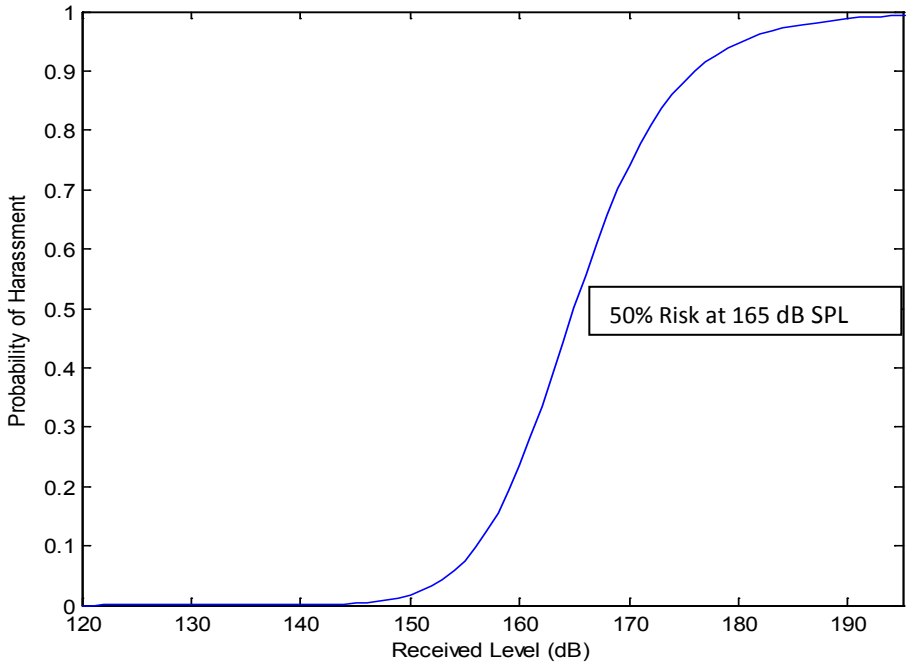


Figure 3.4-6: Behavioral Response Function Applied to Odontocetes and Pinnipeds (BRF_2) (excluding Beaked Whales and Harbor Porpoises)
dB: decibel; SPL: sound pressure level; %: percent

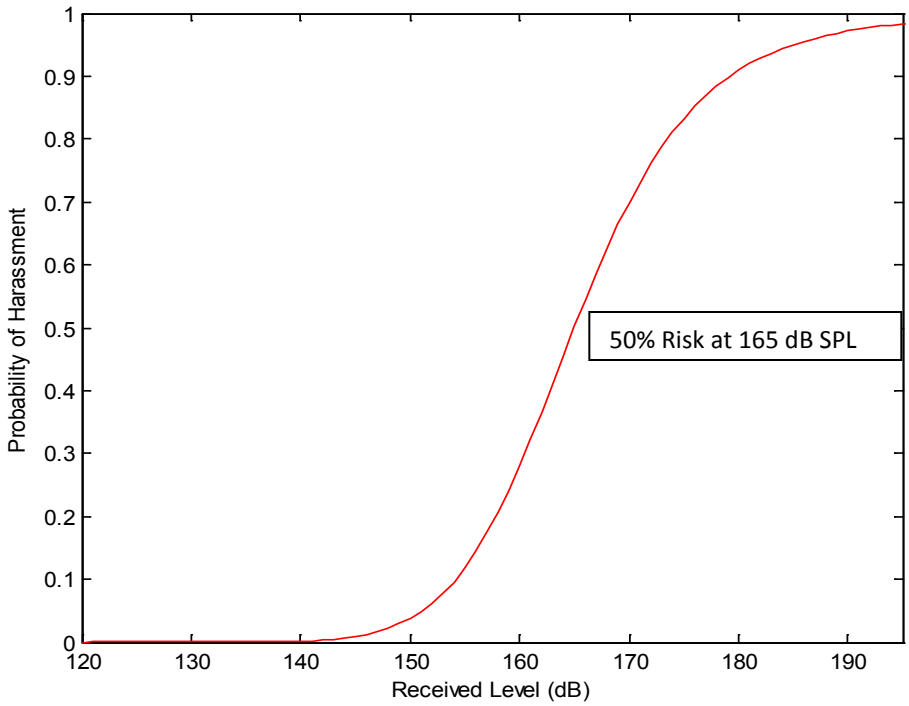


Figure 3.4-7: Behavioral Response Function Applied to Mysticetes (BRF_1)
dB: decibel; SPL: sound pressure level; %: percent

The values used in this analysis are based on three sources of data: behavioral observations during TTS experiments conducted at the Navy Marine Mammal Program (Finneran et al. 2001, 2003b; Finneran et al. 2005a; Finneran and Schlundt 2004); reconstruction of sound fields produced by the USS *Shoup* associated with the behavioral responses of killer whales observed in Haro Strait (Fromm 2009; National Marine Fisheries Service Office of Protected Resources 2005; U.S. Department of the Navy 2003); and observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components documented in Nowacek et al. (2004a).

In some circumstances, some individuals will continue normal behavioral activities in the presence of high levels of human-made noise. In other circumstances, the same individual or other individuals may avoid an acoustic source at much lower received levels (Richardson et al. 1995; Southall et al. 2007; Wartzok et al. 2003). These differences within and between individuals appear to result from a complex interaction of experience, motivation, and learning that are difficult to quantify and predict. Therefore, the behavioral response functions represent a relationship that is deemed generally accurate, but may not be true in specific circumstances.

Specifically, the behavioral response function treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, many other variables such as the marine mammal's gender, age, and prior experience; the activity it is engaged in during a sound exposure; its distance from a sound source; the number of sound sources; and whether the sound sources are approaching or moving away from the animal can be critically important in determining whether and how a marine mammal will respond to a sound source (Southall et al. 2007). At present, available data do not allow for incorporation of these other variables in the current behavioral response functions;

however, the response function represents the best use of the data that are available. Furthermore, the behavioral response functions do not differentiate between different types of behavioral reactions (e.g., area avoidance, diving avoidance, or alteration of natural behavior) or provide information regarding the predicted consequences of the reaction.

The behavioral response function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors that would qualify as harassment (as that term is defined by the MMPA applicable to military readiness activities, such as the Navy's testing and training with mid-frequency active sonar) at a given received level of sound. For example, at 165 dB sound pressure level (dB re 1 µPa root mean square), the risk (or probability) of harassment is defined according to this function as 50 percent. This means that 50 percent of the individuals exposed at that received level would be predicted to exhibit a significant behavioral response.

Harbor Porpoises

The information currently available regarding this species suggests a very low threshold level of response for both captive and wild animals. Threshold levels at which both captive (Kastelein et al. 2000; Kastelein et al. 2005c) and wild harbor porpoises (Johnston 2002) responded to sound (e.g., acoustic harassment devices, acoustic deterrent devices, or other non-impulsive sound sources) are very low, approximately 120 dB re 1 µPa. Therefore, a sound pressure level of 120 dB re 1 µPa is used in this analysis as a threshold for predicting behavioral responses in harbor porpoises (Table 3.4-5).

Table 3.4-5: Summary of Behavioral Thresholds for Marine Mammals

Group	Behavioral Thresholds for Sonar and Other Active Acoustic Sources	Behavioral Thresholds for Explosions
Low-Frequency Cetaceans	SPL: BRF_1 (Type I weighting)	167 dB re 1 μPa^2-s SEL (Type II Weighting)
Mid-Frequency Cetaceans	SPL: BRF_2 (Type I weighting)	167 dB re 1 μPa^2-s SEL (Type II Weighting)
High-Frequency Cetaceans	SPL: BRF_2 (Type I weighting)	141 dB re 1 μPa^2-s SEL (Type II Weighting)
Phocid Seals (In-Water)	SPL: BRF_2 (Type I weighting)	172 dB re 1 μPa^2-s SEL (Type I Weighting)
Manatees	SPL: BRF_2 (Type I weighting)	172 dB re 1 μPa^2-s SEL (Type I Weighting)
Beaked Whales	(unweighted) SPL: 140 dB re 1µPa	167 dB re 1 μPa^2-s SEL (Type II Weighting)
Harbor Porpoises	(unweighted) SPL: 120 dB re 1µPa	141 dB re 1 μPa^2-s SEL (Type II Weighting)

BRF: Behavioral Response Function; dB re 1 µPa: decibel referenced to 1 micro pascal; dB re 1μPa^2-s: decibel referenced to 1 micro pascal-squared seconds; SEL: Sound Exposure Level; SPL: Sound Pressure Level

Beaked Whales

The inclusion of a special behavioral response criterion for beaked whales of the family Ziphiidae is new to these Phase II criteria. It has been speculated for some time that beaked whales might have unusual sensitivities to sound due to a few strandings in conjunction with mid-frequency sonar use, even in areas where other species were more abundant (D'Amico et al. 2009), but there were not sufficient data to support a separate treatment for beaked whales until recently. With the recent publication of results from Blainville's beaked whale monitoring and experimental exposure studies on the instrumented

Atlantic Undersea Test and Evaluation Center range in the Bahamas (McCarthy et al. 2011; Tyack et al. 2011), there are now statistically strong data suggesting that beaked whales tend to avoid both actual naval mid-frequency sonar in real anti-submarine training scenarios as well as sonar-like signals and other signals used during controlled sound exposure studies in the same area. Tyack et al. (2011) report that, in reaction to sonar playbacks, most beaked whales stopped echolocation, made a long slow ascent, and moved away from the sound. During an exercise using mid-frequency sonar, beaked whales avoided the area at a distance from the sonar where the received level was "around 140 dB" (sound pressure level) and once the exercise ended, beaked whales re-inhabited the center of the exercise area within two to three days (Tyack et al. 2011). The Navy therefore adopted a 140 dB re 1 µPa sound pressure level threshold for significant behavioral effects for all beaked whales (family: Ziphiidae) (Table 3.4-5).

Since the development of the criterion, analysis of the data the 2010 and 2011 field seasons of the southern California Behavioral Responses Study has been published. The study, DeRuiter et al. (2013), provides similar evidence of Cuvier's beaked whale sensitivities to sound based on two controlled exposures. Two whales, one in each season, were tagged and exposed to simulated mid-frequency active sonar at distances of 3.4 – 9.5 km. The 2011 whale was also incidentally exposed to mid-frequency active sonar from a distant naval exercise (approximately 118 km away). Received levels from the mid-frequency active sonar signals during the controlled and incidental exposures were calculated as 84-144 and 78-106 dB re 1 µPa root mean squared, respectively. Both whales showed responses to the controlled exposures, ranging from initial orientation changes to avoidance responses characterized by energetic fluking and swimming away from the source. However, the authors did not detect similar responses to incidental exposure to distant naval sonar exercises at comparable received levels, indicating that context of the exposures (e.g., source proximity, controlled source ramp-up) may have been a significant factor. Because the sample size was limited (controlled exposures during a single dive in both 2010 and 2011), baseline behavioral data was obtained from different stocks and geographic areas (i.e., Hawaii and Mediterranean Sea), and the responses exhibited to controlled exposures were not exhibited by an animal exposed to some of the same received levels of real sonar exercises. The Navy relied on the studies at the Atlantic Undersea Test and Evaluation Center that analyzed beaked whale responses to actual naval exercises using mid-frequency active sonar to inform the acoustic criterion to predict potential behavioral responses by beaked whales to proposed training and testing activities using sonar and other active acoustic sources.

Explosives

If more than one explosive event occurs within any given 24-hour period within a training or testing activity, criteria are applied to predict the number of animals that may have a behavioral reaction. For events with multiple explosions, the behavioral threshold used in this analysis is 5 dB less than the TTS onset threshold (in sound exposure level) (Table 3.4-5). This value is derived from observed onsets of behavioral response by test subjects (bottlenose dolphins) during non-impulse TTS testing (Schlundt et al. 2000).

Some multiple explosion events, such as certain naval gunnery exercises, may be treated as a single event because a few explosions occur closely spaced within a very short time (a few seconds). For single explosions at received sound levels below hearing loss thresholds, the most likely behavioral response is a brief alerting or orienting response. Since no further sounds follow the initial brief impulses, significant behavioral reactions would not be expected to occur. This reasoning was applied to previous shock trials (63 FR 230; 66 FR 87; 73 FR 143) and is extended to the criteria used in this analysis.

Since impulse events can be quite short, it may be possible to accumulate multiple received impulses at sound pressure levels considerably above the energy-based criterion and still not be considered a behavioral take. The Navy treats all individual received impulses as if they were one second long for the purposes of calculating cumulative sound exposure level for multiple impulse events. For example, five air gun impulses, each 0.1 second long, received at 178 dB sound pressure level would equal a 175 dB sound exposure level, and would not be predicted as leading to a significant behavioral response. However, if the five 0.1 second pulses are treated as a five-second exposure, it would yield an adjusted value of approximately 180 dB, exceeding the threshold. For impulses associated with explosions that have durations of a few microseconds, this assumption greatly overestimates effects based on sound exposure level metrics such as TTS, PTS, and behavioral responses.

Appropriate weighting values will be applied to the received impulse in one-third octave bands and the energy summed to produce a total weighted sound exposure level value. For impulsive behavioral criteria, the new weighting functions (Figure 3.4-5) are applied to the received sound level before being compared to the threshold.

Pile Driving and Airgun Criteria and Thresholds

Existing NMFS risk criteria are applied to the unique sounds generated by impact pile driving, vibratory pile installation and removal, and airguns (Table 3.4-6).

Table 3.4-6: Pile Driving and Airgun Thresholds Used in this Analysis to Predict Effects on Marine Mammals

Species Groups	Underwater Vibratory Pile Driving Criteria (Sound Pressure Level, dB re 1 µPa)		Underwater Impact Pile Driving and Airgun Criteria (Sound Pressure Level, dB re 1 µPa)	
	Level A Injury Threshold	Level B Disturbance Threshold	Level A Injury Threshold	Level B Disturbance Threshold
Cetaceans (Whales, Dolphins, Porpoises)	180 dB rms	120 dB rms	180 dB rms	160 dB rms
Pinnipeds (Seals)	190 dB rms	120 dB rms	190 dB rms	160 dB rms

dB: decibel; dB re 1 µPa: decibel referenced to 1 micro pascal; rms: root mean square

Note: Root mean square calculation for impact pile driving is based on the duration defined by 90 percent of the cumulative energy in the impulse. Root mean square for vibratory pile driving is calculated based on a representative time series long enough to capture the variation in levels – usually on the order of a few seconds.

3.4.3.1.5 Quantitative Analysis

The Navy performed a quantitative analysis to estimate the number of marine mammals that could be affected by acoustic sources or explosives used during Navy training and testing activities. Inputs to the quantitative analysis included marine mammal density estimates; marine mammal depth occurrence distributions; oceanographic and environmental data; marine mammal hearing data; and criteria and thresholds for levels of potential effects. The quantitative analysis consists of computer modeled estimates and a post-model analysis to determine the number of potential mortalities and harassments. The model calculates sound energy propagation from sonars, other active acoustic sources, and explosives during naval activities; the sound or impulse received by animat dosimeters representing marine mammals distributed in the area around the modeled activity; and whether the sound or impulse received by a marine mammal exceeds the thresholds for effects. The model estimates are then further analyzed to consider animal avoidance and implementation of mitigation measures, resulting in final estimates of potential effects due to Navy training and testing.

Various computer models and mathematical equations can be used to predict how energy spreads from a sound source (e.g. sonar or underwater detonation) to a receiver (e.g. dolphin or sea turtle). See the Acoustic and Explosives Primer (Section 3.0.4) for background information about how sound travels through the water. Basic underwater sound models calculate the overlap of energy and marine life using assumptions that account for the many, variable, and often unknown factors that can influence the result. Assumptions in previous and current Navy models have intentionally erred on the side of overestimation when there are unknowns or when the addition of other variables was not likely to substantively change the final analysis. For example, because the ocean environment is extremely dynamic and information is often limited to a synthesis of data gathered over wide areas and requiring many years of research, known information tends to be an average of a seasonal or annual variation. El Niño Southern Oscillation events of the ocean-atmosphere system are an example of dynamic change where unusually warm or cold ocean temperatures are likely to redistribute marine life and alter the propagation of underwater sound energy. Previous Navy modeling therefore made some assumptions indicative of a maximum theoretical propagation for sound energy (such as a perfectly reflective ocean surface and a flat seafloor).

More complex computer models build upon basic modeling by factoring in additional variables in an effort to be more accurate by accounting for such things as bathymetry and an animal's likely presence at various depths.

- The Navy Acoustics Effects Model accounts for the variability of the sound propagation data in both distance and depth when computing the received sound level on the animals. Previous models captured the variability in sound propagation over a range and used a conservative approach to account for only the maximum received sound level within the water column.
- Navy Acoustics Effects Model bases the distribution of animats (virtual representation of an animal) over the operational area on density maps, which provide a more natural distribution of animals. Previous models assumed a uniform distribution of animals over the operational area.
- Navy Acoustics Effects Model distributes animats throughout the three dimensional water space proportional to the known time that animals of that species spend at varying depths. Previous models assumed animals were placed at the depth where the maximum sound received level occurred for each distance from a source.
- Navy Acoustics Effects Model conducts a statistical analysis to compute the estimated effects on animals. Previous models assumed all animals within a defined distance would be affected by the sound.

The Navy has developed a set of data and new software tools for quantification of estimated marine mammal impacts from Navy activities. This new approach is the resulting evolution of the basic model previously used by Navy and reflects a more complex modeling approach as described below. Although this more complex computer modeling approach accounts for various environmental factors affecting acoustic propagation, the current software tools do not consider the likelihood that a marine mammal would attempt to avoid repeated exposures to a sound or avoid an area of intense activity where a training or testing event may be focused. Additionally, the software tools do not consider the implementation of mitigation (e.g., stopping sonar transmissions when a marine mammal is within a certain distance of a ship or mitigation zone clearance prior to detonations). In both of these situations, naval activities are modeled as though an activity would occur regardless of proximity to marine mammals and without any horizontal movement by the animal away from the sound source or human activities. Therefore, the final step of the quantitative analysis of acoustic effects is to consider the

implementation of mitigation and the possibility that marine mammals would avoid continued or repeated sound exposures.

The quantified results of the marine mammal acoustic effect analysis presented in this section and in the Requests for Letters of Authorization under the MMPA differ from the quantified results presented in the AFTT Draft EIS/OEIS. Presentation of the results in this new manner for MMPA, ESA, and other regulatory analyses is well within the framework of the previous NEPA analyses presented in the AFTT Draft EIS/OEIS. These differences are due to three factors: (1) refinement of training and testing model inputs; (2) additional post-model analysis of acoustic effects to include animal avoidance of repeated sound exposures, avoidance of areas of activity by sensitive species before use of a sound source or explosive, and implementation of mitigation; and (3) changes to the tempo or location of certain proposed activities. This additional post-model analysis of acoustic effects was performed to clarify potential misunderstanding of the numbers presented as modeling results in the AFTT Draft EIS/OEIS. Some comments indicated that the readers believed the acoustic effects to marine mammals presented in the AFTT Draft EIS/OEIS were representative of the actual expected effects, although the AFTT Draft EIS/OEIS did not account for animal avoidance of an area prior to commencing sound-producing activities, animal avoidance of repeated explosive noise exposures, and the protections due to standard Navy mitigations. Therefore, the numbers presented in this section have been refined to better quantify the expected effects by fully accounting for animal avoidance and implementation of standard Navy mitigations.

The revised model estimates (without consideration of avoidance or mitigation) are presented in a revised technical report (Marine Species Modeling Team 2013).

The sections below describe the steps of the quantitative analysis of acoustic effects.

3.4.3.1.5.1 Marine Mammal Density

A quantitative analysis of impacts on a species requires data on the abundance and distribution of the species population in the potentially impacted area. The most appropriate metric for this type of analysis is density, which is the number of animals present per unit area.

There is no single source of density data for every area of the world, species, and season because of the fiscal costs, resources, and effort involved in providing survey coverage to sufficiently estimate density. Therefore, to characterize the marine species density for large areas such as the Study Area, the Navy compiled data from several sources. To compile and structure the most appropriate database of marine species density data, the Navy developed a protocol to select the best available data sources based on species, area, and time (season). The resulting Geographic Information System database called the Navy Marine Species Density Database includes seasonal density values for every marine mammal and sea turtle species present within the Study Area (U.S. Department of the Navy 2012a).

The Navy Marine Species Density Database includes a compilation of the best available density data from several primary sources and published works including survey data from NMFS within the U.S. Exclusive Economic Zone. In this analysis, marine mammal density data were used as an input in the Navy Acoustic Effects Model in their original temporal (seasonal) and spatial resolution. Seasons are defined as winter (December–February), spring (March–May), summer (June–August), and fall (September– November). The density grid cell spatial resolution varied, depending on the original data source used, from 10 km^2 to 0.5 $degrees^2$ (latitude/longitude). Where data sources overlap, there might be a sudden increase or decrease in density due to different derivation methods or survey data utilized.

This is an artifact of attempting to use the best available data for each geographic region. The density data were used as-is in order to preserve the original values. Any attempt to smooth the data sets would either increase or decrease adjacent values and would inflate the error of those values by an unknown amount.

The Navy modeled acoustic impacts within representative locations where training and testing has historically occurred in the past and is expected to occur in the future. Within the Study Area, the expected geographic extent of some species did not overlap with any area where potential acoustic impacts were modeled. Therefore, since there were no expected impacts from the modeled sources, the following species were excluded from quantitative analysis:

- Bowhead whale
- Beluga whale
- Narwhal
- Walrus
- Polar bear

These species are included for further qualitative assessment of impacts from other nonmodeled sources such as vessel noise, aircraft overflight noise, weapons firing, launch and non-explosive impact noise.

All species density distributions matched the expected distributions from published literature and the NMFS stock assessments, with the exception of long-beaked common dolphin and harbor porpoise. The NMFS stock assessment does not consider long-beaked common dolphin to occur within the U.S. Atlantic Exclusive Economic Zone. However, the Navy Marine Species Density Database predicts a possible low occurrence within the Study Area, extending into the U.S. Exclusive Economic Zone. Since long-beaked common dolphin is a rare or uncommon species in the western Atlantic and the Study Area extends beyond the NMFS survey coverage area, the Navy decided to include this species in the acoustic analysis for completeness since there may be a possible low probability of occurrence within the Study Area.

The harbor porpoise density distribution comprised multiple data sources. The Sea Mammal Research Unit Limited density data source did not match the expected distribution within the NMFS stock assessment survey coverage area. This was a function of the parameters defined for the harbor porpoise habitat model used in the density estimate. The parameters were defined to encompass several distinct harbor porpoise populations across the northern Atlantic and adjacent waters and may not accurately represent the population occurring within the Study Area. Therefore, using the best available definition of the harbor porpoise distribution extent, the Navy corrected and defined the extent to match the distribution published in the NMFS Stock Assessment Report. See U.S. Department of the Navy (2012a) for further details on this correction.

3.4.3.1.5.2 Upper and Lower Frequency Limits

The Navy has adopted a single frequency cutoff at each end of a functional hearing group's frequency range based on the most liberal interpretations of their composite hearing abilities. These are not the same as the values used to calculate weighting curves but exceed the demonstrated or anatomy-based hypothetical upper and lower limits of hearing within each group. Table 3.4-7 provides the lower and upper frequency limits for each species group. Sounds with frequencies below the lower frequency limit,

or above the upper frequency limit, are not analyzed with respect to auditory effects for a particular group.

Table 3.4-7: Lower and Upper Cutoff Frequencies for Marine Mammal Functional Hearing Groups Used in this Acoustic Analysis

Functional Hearing Group	Limit (Hz)	
	Lower	Upper
Low-Frequency Cetaceans	5	30,000
Mid-Frequency Cetaceans	50	200,000
High-Frequency Cetaceans	100	200,000
Phocid Seals (In-Water) and Sirenians	50	80,000

Hz: hertz

3.4.3.1.5.3 Navy Acoustic Effects Model

The Navy developed a set of software tools and compiled data for estimating acoustic impacts on marine mammals (without consideration of mitigation or avoidance behavior). These databases and tools collectively form the Navy Acoustic Effects Model. Details of this model's processes and the description and derivation of the inputs are presented in a technical report titled *Determination of Acoustic Effects on Marine Mammals and Sea Turtles* for the AFTT EIS/OEIS (Marine Species Modeling Team 2013).

The Navy Acoustic Effects Model improves upon previous modeling efforts in several ways. First, unlike earlier methods that modeled sources individually, the Navy Acoustic Effects Model has the capability to run all sources within a scenario simultaneously, providing a more realistic depiction of the potential effects of an activity. Second, previous models calculated sound received levels within set volumes of water and spread animals uniformly across the volumes; in the Navy Acoustic Effects Model, animats (virtual animals) are distributed nonuniformly based on higher resolution species-specific density, depth distribution, and group size information, and animats serve as dosimeters, recording energy received at their location in the water column. Third, a fully three-dimensional environment is used for calculating sound propagation and animat exposure in the Navy Acoustic Effects Model, rather than a two-dimensional environment where the worst case sound pressure level across the water column is always encountered. Finally, current efforts incorporate site-specific bathymetry, sound speed profiles, wind speed, and bottom properties into the propagation modeling process rather than the flat-bottomed provinces used during earlier modeling (Marine Species Modeling Team 2013). The following paragraphs provide an overview of the Navy Acoustic Effects Model process and its more critical data inputs.

Using the best available information on the predicted density of marine mammals in the area being modeled, the Navy Acoustic Effects Model derives an abundance (total number of individuals) and distributes the resulting number of animats into an area bounded by the maximum distance that energy propagates out to a criterion threshold value (energy footprint). For example, for non-impulsive sources, all animats that are predicted to occur within a range that could receive sound pressure levels greater than or equal to 120 dB re 1 µPa are distributed. These animats are distributed based on density differences across the area, the group (pod) size, and known depth distributions (dive profiles) . Animats change depths every four minutes but do not otherwise mimic actual animal behaviors, such as avoidance or attraction to a stimulus (horizontal movement), or foraging, social, or traveling behaviors.

Schecklman et al. (2011) argue that static distributions underestimate acoustic exposure compared to a model with fully three-dimensionally moving animals. However, their static method is different from the Navy Acoustic Effects Model in several ways. First, they distribute the entire population at depth with respect to the species-typical depth distribution histogram, and those animats remain static at that position throughout the entire simulation. In the Navy Acoustic Effects Model, animats are placed horizontally dependent on nonuniform density information, and then move up and down over time within the water column by integrating species-typical depth distribution information. Second, for the static method, they calculate acoustic received level for designated volumes of the ocean and then sum the animats that occur within that volume, rather than using the animats themselves as dosimeters, as in the Navy Acoustic Effects Model. Third, Schecklman et al. (2011) ran 50 iterations of the moving distribution to arrive at an average number of exposures, but because they rely on uniform horizontal density (and static depth density), only a single iteration of the static distribution is realized. In addition to moving the animats vertically, the Navy Acoustic Effects Model overpopulates the animats over a nonuniform density and then resamples the population a number of times to arrive at an average number of exposures as well. Tests comparing fully moving distributions and static distributions with vertical position changes at varying rates were compared during development of the Navy Acoustic Effects Model. For position updates occurring more frequently than every five minutes, the number of estimated exposures were similar between the Navy Acoustic Effects Model and the fully moving distribution; however, computational time was much longer for the fully moving distribution.

The Navy Acoustic Effects Model calculates the likely propagation for various levels of energy (sound or pressure) resulting from each non-impulse or impulse source used during a training or testing event. This is done by taking into account the actual bathymetric relief and bottom types (e.g., reflective), and estimated sound speeds and sea surface roughness at an event's location. Platforms (such as a ship using one or more sound sources) are modeled as moving across an area whose size is representative of what would normally occur during a training or testing scenario. The model uses typical platform speeds and event durations. Moving source platforms either travel along a predefined track or move along straight-line tracks from a random initial course, reflecting at the edges of a predefined boundary. Static sound sources are stationary in a fixed location for the duration of a scenario. Modeling locations were chosen based on historical data where activities have been ongoing and in an effort to include as much environmental variation within the Study Area as is reasonably available and can be incorporated into the model.

The Navy Acoustic Effects Model then records the energy received by each animat within the energy footprint of the event and calculates the number of animats having received levels of energy exposures that fall within defined impact thresholds. Predicted effects on the animats within a scenario are then tallied and the highest order effect (based on severity of criteria; e.g., PTS over TTS) predicted for a given animat is assumed. Each scenario or each 24-hour period for scenarios lasting greater than 24 hours is independent of all others, and therefore, the same individual marine animal could be impacted during each independent scenario or 24-hour period. In few instances, although the activities themselves all occur within the Study Area, sound may propagate beyond the boundary of the Study Area. Any exposures occurring outside the boundary of the Study Area are included in the model-estimated impacts for each alternative. The Navy Acoustic Effects Model provides the initial estimated impacts on marine species with a static horizontal distribution (based on application of multiple conservative assumptions, which are assumed to overestimate impacts), which are then further analyzed to account for pre-activity avoidance by sensitive species, mitigation (considering sound source and platform), and avoidance of repeated sound exposures by marine mammals, producing the final predictions of impacts

used in the Navy's MMPA take requests and ESA risk analyses (Section 3.4.3.1.9.2, Avoidance Behavior and Mitigation Measures as Applied to Explosives, provides further information on additional analyses).

3.4.3.1.5.4 Model Assumptions and Limitations

There are limitations to the data used in the Navy Acoustic Effects Model, and the results must be interpreted with consideration for these known limitations. Output from the Navy Acoustic Effects Model relies heavily on the quality of both the input parameters and impact thresholds and criteria. When there was a lack of definitive data to support an aspect of the modeling (such as lack of well described diving behavior for all marine species), conservative assumptions believed to overestimate the number of exposures were chosen:

- Animats are modeled as being underwater and facing the source and therefore always predicted to receive the maximum sound level at their position within the water column (e.g., the model does not account for conditions such as body shading, porpoising out of the water, or an animal raising its head above water). Some odontocetes have been shown to have directional hearing, with best hearing sensitivity facing a sound source and higher hearing thresholds for sounds propagating toward the rear or side of an animal (Kastelein et al. 2005a; Mooney et al. 2008; Popov and Supin 2009).
- Animats do not move horizontally (but change their position vertically within the water column), which may overestimate physiological effects such as hearing loss, especially for slow moving or stationary sound sources in the model.
- Animats are stationary horizontally and therefore do not avoid the sound source, unlike in the wild where animals would most often avoid exposures at higher sound levels, especially those exposures that may result in PTS.
- Animats are assumed to receive the full impulse of the initial positive pressure wave due to an explosion, although the impulse-based thresholds (onset mortality and onset slight lung injury) assume an impulse delivery time adjusted for animal size and depth. Therefore, these impacts are overestimated at farther distances and increased depths.
- Multiple exposures within any 24-hour period are considered one continuous exposure for the purposes of calculating the temporary or permanent hearing loss, because there are not sufficient data to estimate a hearing recovery function for the time between exposures.
- Mitigation measures implemented during many training and testing activities were not considered in the model (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). In reality, sound-producing activities would be reduced, stopped, or delayed if marine mammals are detected within the mitigation zones around sound sources.

Because of these inherent model limitations and simplifications, model-estimated results must be further analyzed, considering such factors as the range to specific effects, avoidance, and the likelihood of successfully implementing mitigation measures. This analysis uses a number of factors in addition to the acoustic model results to predict acoustic effects on marine mammals (Section 3.4.3.1.8.2, Avoidance Behavior and Mitigation Measures as Applied to Sonar and Active Acoustic Sources, provides further information on additional analyses).

3.4.3.1.5.5 Marine Mammal Avoidance of Sound Exposures

Marine mammals may avoid sound exposures by either avoiding areas with high levels of anthropogenic activity or moving away from a sound source. Because the Navy Acoustic Effects Model does not consider horizontal movement of animats, including avoidance of human activity or sounds, it over-estimates the number of marine mammals that would be exposed to sound sources that could cause

injury. Therefore, the potential for avoidance is considered in the post-model analysis. The consideration of avoidance during use of sonar and other active acoustic sources and during use of explosives is described below and discussed in more detail in Sections 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) and in Section 3.4.3.1.9 (Impacts from Explosives). A detailed explanation of this analysis is also provided in the technical report *Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for Atlantic Fleet Training and Testing* (U.S. Department of the Navy 2013b).

Avoidance of Human Activity

Cues preceding the commencement of an event (e.g., multiple vessel presence and movement, aircraft overflight) may result in some animals departing the immediate area, even before active sound sources begin transmitting. Harbor porpoises and beaked whales have been observed to be especially sensitive to human activity, which is accounted for by using a low threshold for behavioral disturbance due to exposure to sonars and other active acoustic sources. Both finless porpoises (Li et al. 2008) and harbor porpoises (Barlow et al. 1988; Evans et al. 1994; Palka and Hammond 2001; Polacheck and Thorpe 1990) routinely avoid and swim away from large motorized vessels. The vaquita, which is closely related to the harbor porpoise, appears to avoid large vessels at about 2,995 ft. (913 m) (Jaramillo-Legorreta et al. 1999). The assumption is that the harbor porpoise would respond similarly to large Navy vessels. Beaked whales have also been documented to exhibit avoidance of human activity (Pirotta et al. 2012; Tyack et al. 2011).

Therefore, for certain naval activities preceded by high levels of vessel activity (multiple vessels) or hovering aircraft, harbor porpoises and beaked whales are assumed to avoid the activity area prior to the start of a sound-producing activity. Model-estimated effects during these types of activities are adjusted so that high level sound impacts to harbor porpoises and beaked whales (those causing PTS during use of sonar and other active acoustic sources and those causing mortality due to explosives) are considered to be TTS and recoverable injury, respectively, due to animals moving away from the activity and into a lower effect range.

Avoidance of Repeated Exposures

Marine mammals would likely avoid repeated high level exposures to a sound source that could result in injury (i.e., PTS). Therefore, the model-estimated effects are adjusted to account for marine mammals swimming away from a sonar or other active sources and away from multiple explosions to avoid repeated high level sound exposures. Avoidance of repeated sonar exposures is discussed further in Section 3.4.3.1.8.2 (Avoidance Behavior and Mitigation Measures as Applied to Sonar and Other Active Acoustic Sources), and avoidance of repeated explosive exposures is discussed further in Section 3.4.3.1.9.2 (Avoidance Behavior and Mitigation Measures as Applied to Explosives).

3.4.3.1.5.6 Implementing Mitigation to Reduce Sound Exposures

The Navy implements mitigation measures (described in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) during sound-producing activities, including halting or delaying use of a sound source or explosives when marine mammals are observed in the mitigation zone. The Navy Acoustic Effects Model estimates acoustic effects without taking into account any shutdown or delay of the activity when marine mammals are detected; therefore, the model overestimates impacts to marine mammals within mitigation zones. The post-model analysis considers and quantifies the potential for mitigation to reduce the likelihood or risk of PTS due to sonar and other active acoustic sources and injuries and mortalities due to explosives. A detailed explanation of this analysis is provided in the

technical report *Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for Atlantic Fleet Training and Testing* (U.S. Department of the Navy 2013b).

Two factors are considered when quantifying the effectiveness of mitigation: (1) the sightability of each species that may be present in the mitigation zone, which is affected by species-specific characteristics, and (2) the extent to which the type of mitigation proposed for a sound-producing activity (e.g., active sonar) allows for observation of the mitigation zone prior to and during the activity. The mitigation zones proposed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) encompass the estimated ranges to injury (including the range to mortality for explosives) for a given source.

Mitigation is considered in the quantified reduction of model-predicted effects when the mitigation zone can be fully or mostly observed prior to and during a sound-producing activity. Mitigation for each activity is considered in its entirety, taking into account the different ways an event may take place (some events may have more than one scenario involving different mitigation zones, platforms, or number of Lookouts). The ability to observe the range to mortality (for explosive activities only) and the range to potential injury (for all sound-producing activities) was estimated for each training or testing event. Mitigation was considered in the acoustic analysis as follows:

- If the entire mitigation zone can be continuously visually observed based on the platform(s), number of Lookouts, and size of the range to effects zone, the mitigation is considered fully effective (Effectiveness = 1).
- If over half of the mitigation zone can be continuously visually observed or if there is one or more of the scenarios within the activity for which the mitigation zone cannot be continuously visually observed (but the range to effects zone can be visually observed for the majority of the scenarios), the mitigation is considered mostly effective (Effectiveness = 0.5).
- If less than half of the mitigation zone can be continuously visually observed or if the mitigation zone cannot be continuously visually observed during most of the scenarios within the activity due to the type of surveillance platform(s), number of Lookouts, and size of the mitigation zone, the mitigation is not considered in the quantified reduction of model predicted acoustic effects.

The ability of Navy Lookouts to detect marine mammals in or approaching the mitigation zone is dependent on the animal's presence at the surface and the characteristics of the animal that influence its sightability. The Navy considered what applicable data were available to numerically approximate the sightability of marine mammals and determined that the standard "detection probability" referred to as g(0) was most appropriate. The abundance of marine mammals is typically estimated using line-transect analyses (Buckland et al. 2001), in which g(0) is the probability of detecting an animal or group of animals on the transect line (the straight-line course of the survey ship or aircraft). This detection probability is derived from systematic line-transect marine mammal surveys based on species-specific estimates for vessel and aerial platforms. Estimates of g(0) are available from peer-reviewed marine mammal line-transect survey reports, generally provided through research conducted by the National Marine Fisheries Service Science Centers. The g(0) values used in this analysis are provided in Section 5.3.1.2.4.1 (Detection Probabilities of Marine Mammals in the Study Area).

There are two separate components of g(0): perception bias and availability bias (Marsh and Sinclair 1989). Perception bias accounts for marine mammals that are on the transect line and detectable, but were simply missed by the observer. Various factors influence the perception bias component of g(0), including species-specific characteristics (e.g., behavior and appearance, group size, and blow characteristics), viewing conditions during the survey (e.g., sea state, wind speed, wind direction, wave height, and glare), observer characteristics (e.g., experience, fatigue, and concentration), and platform

characteristics (e.g., pitch, roll, speed, and height above water). To derive estimates of perception bias, typically an independent observer is present who looks for marine mammals missed by the primary observers. Mark-recapture methods are then used to estimate the probability that animals are missed by the primary observers. Availability bias accounts for animals that are missed because they are not at the surface at the time the survey platform passes by, which generally occurs more often with deep diving whales (e.g., sperm whale and beaked whale). The availability bias portion of g(0) is independent of prior marine mammal detection experience since it only reflects the probability of an animal being at the surface within the survey track and therefore available for detection.

Some g(0) values are estimates of perception bias only, some are estimates of availability bias only, and some reflect both, depending on the species and data currently available. The Navy used g(0) values with both perception and availability bias components if those data were available. If both components were not available for a particular species, the Navy determined that g(0) values reflecting perception bias or availability bias, but not both, still represented the best statistically derived factor for assessing the likelihood of marine mammal detection by Navy Lookouts.

As noted above, line-transect surveys and subsequent analyses are typically used to estimate cetacean abundance. To systematically sample portions of an ocean area (such as the coastal waters off California or the east coast), marine mammal surveys are designed to uniformly cover the survey area and are conducted at a constant speed (generally 10 knots for ships and 100 knots for aircraft). Survey transect lines typically follow a pattern of straight lines or grids. Generally there are two primary observers searching for marine mammals. Each primary observer looks for marine mammals in the forward 90-degree quadrant on their side of the survey platform. Based on data collected during the survey, scientists determine the factors that affected the detection of an animal or group of animals directly along the transect line.

Visual marine mammal surveys (used to derive g(0)) are conducted during daylight[1]. Marine mammal surveys are typically scheduled for a season when weather at sea is more likely to be good; however, observers on marine mammal surveys will generally collect data in sea-state conditions up to Beaufort 6 and do encounter rain and fog at sea, which may also reduce marine mammal detections (Barlow 2006). For most species, g(0) values are based on the detection probability in conditions from Beaufort 0 to Beaufort 5, which reflect the fact that marine mammal surveys are often conducted in less than ideal conditions (Barlow 2003; Barlow and Forney 2007). The ability to detect some species (e.g., beaked whales, *Kogia* spp., and Dall's porpoise) decreases dramatically with increasing sea states, so g(0) estimates for these species are usually restricted to observations in sea-state conditions of Beaufort 0 to 2 (Barlow 2003).

Navy training and testing events differ from systematic line-transect marine mammal surveys in several respects. These differences suggest the use of g(0), as a sightability factor to quantitatively adjust model-predicted effects based on mitigation, is likely to result in an underestimate of the protection afforded by the implementation of mitigation as follows:

- Mitigation zones for Navy training and testing events are significantly smaller (typically less than 1,000 yd. radius) than the area typically searched during line-transect surveys, which includes the maximum viewable distance out to the horizon.
- In some cases, Navy events can involve more than one vessel or aircraft (or both) operating in proximity to each other or otherwise covering the same general area. Additional vessels and

[1] At night, passive acoustic data may still be collected during a marine mammal survey.

aircraft can result in additional watch personnel observing the mitigation zone (e.g., ship shock trials). This would result in more observation platforms and observers looking at the mitigation zone than the two primary observers used in marine mammal surveys upon which g(0) is based.

- A systematic marine mammal line-transect survey is designed to sample broad areas of the ocean, and generally does not retrace the same area during a given survey. Therefore, in terms of g(0), the two primary observers have only a limited opportunity to detect marine mammals that may be present during a single pass along the trackline (i.e., deep diving species may not be present at the surface as the survey transits the area). In contrast, many Navy training and testing activities involve area-focused events (e.g., anti-submarine warfare tracking exercise), where participants are likely to remain in the same general area during an event. In other cases Navy training or testing activities are stationary (i.e., pierside sonar testing or use of dipping sonar), which allow Lookouts to focus on the same area throughout the activity. Both of these circumstances result in a longer observation period of a focused area with more opportunities for detecting marine mammals than are offered by a systematic marine mammal line-transect survey that only passes through an area once.

Although Navy Lookouts on ships have hand-held binoculars and on some ships, pedestal-mounted binoculars very similar to those used in marine mammal surveys, there are differences between the scope and purpose of marine mammal detections during research surveys along a trackline and Navy Lookouts observing the water near a Navy training or testing activity to facilitate implementation of mitigation. The distinctions require careful consideration when comparing the Navy Lookouts to marine mammal surveys.[2]

- A marine mammal observer is responsible for detecting marine mammals in their quadrant of the trackline out to the limit of the available optics. Although Navy Lookouts are responsible for observing the water for safety of ships and aircraft, during specific training and testing activities, they need only detect marine mammals in the relatively small area that surrounds the mitigation zone (in most cases less than 1,000 yd. from the ship) for mitigation to be implemented.
- Navy Lookouts, personnel aboard aircraft and on watch onboard vessels at the surface will have less experience detecting marine mammals than marine mammal observers used for line-transect survey. However, Navy personnel responsible for observing the water for safety of ships and aircraft do have significant experience looking for objects (including marine mammals)

[2] Barlow and Gisiner (2006) provide a description of typical marine mammal survey methods from ship and aircraft and then provide "a crude estimate" of the difference in detection of beaked whales between trained marine mammal observers and seismic survey mitigation, which is not informative with regard to Navy mitigation procedures for the following reasons. The authors note that seismic survey differs from marine mammal surveys in that, "(1) seismic surveys are also conducted at night; (2) seismic surveys are not limited to calm sea conditions; (3) mitigation observers are primarily searching with unaided eyes and 7x binoculars; and (4) typically only one or possibly two observers are searching." When Navy implements mitigation for which adjustments to modeling output were made, the four conditions Barlow and Gisiner (2006) note are not representative of Navy procedures nor necessarily a difference in marine mammal line-transect survey procedures. The Navy accounts for reduced visibility (i.e., activities that occur at night, etc.) by assigning a lower value to the mitigation effectiveness factor. On Navy ships, hand-held binoculars are always available, and pedestal mounted binoculars, very similar to those used in marine mammal surveys, are generally available to Navy Lookouts on board vessels over 60 ft. Also, like marine mammal observers, Navy Lookouts are trained to use a methodical combination of unaided eye and optics as they search the surface around a vessel. The implication that marine mammal surveys only occur in "calm sea conditions" is not accurate since the vast majority of marine mammal surveys occur in conditions up to sea states of Beaufort 5. The specific g(0) values analyzed by Barlow and Gisiner (2006) were derived from survey data for Cuvier's and *Mesoplodon* beaked whales detected in sea states of Beaufort 0-2 during daylight hours. However, marine mammal surveys are not restricted to sea states of Beaufort 0-2 and many species' g(0) values are based on conditions up to and including Beaufort 5; therefore, the conclusions reached by Barlow and Gisiner (2006) regarding the effect of sea state conditions on sightability do not apply to other species. Finally, when Lookouts are present, there are always more than the "one or two personnel" described by Barlow and Gisiner (2006) observing the area ahead of a Navy vessel (additional bridge watch personnel are also observing the water around the vessel).

on the water's surface and Lookouts are trained using the NMFS-approved Marine Species Awareness Training.

Although there are distinct differences between marine mammal surveys and Navy training and testing, the use of g(0) as an approximate sightability factor for quantitatively adjusting model-predicted impacts due to mitigation (mitigation effectiveness x g(0)) is an appropriate use of the best available science based on the way it has been applied. Consistent with the Navy's impact assessment processes, the Navy applied g(0) in a conservative manner (erring on the side of overestimating the number of impacts) to quantitatively adjust model-predicted effects to marine mammals within the applicable mitigation zones during Navy training and testing activities. Conservative application of g(0) includes:

- In addition to a sightability factor (based on g(0)), the Navy also applied a mitigation effectiveness factor to acknowledge the uncertainty associated with applying the g(0) values derived from marine mammal surveys to specific Navy training and testing activities where the ability to observe the whole mitigation zone is less than optimal (generally due to the size of the mitigation zone).
- For activities that can be conducted at night, the Navy assigned a lower value to the mitigation effectiveness factor. For example, if an activity can take place at night half the time, then the mitigation effectiveness factor was only given a value of 0.5.
- The Navy did not quantitatively adjust model-predicted effects for activities that were given a mitigation effectiveness factor of zero. A mitigation effectiveness factor of zero was given to activities where less than half of the mitigation zone can be continuously visually observed or if the mitigation zone cannot be continuously visually observed during most of the scenarios within the activity due to the type of surveillance platform(s), number of Lookouts, and size of the mitigation zone. However, some protection from applied mitigation measures would be afforded during these activities, even though it is not accounted for in the quantitative reduction of model-predicted impacts.
- The Navy did not quantitatively adjust model-predicted effects based on detections made by other personnel that may be involved with an event (such as range support personnel aboard a torpedo retrieval boat or support aircraft), even though information about marine mammal sightings are shared among units participating in the training or testing activity. In other words, the Navy only quantitatively adjusted the model-predicted effects based on the required number of Lookouts.
- The Navy only quantitatively adjusted model-predicted effects within the range to mortality (explosives only) and injury (all sound-producing activities), and not for the range to TTS or other behavioral effects (See Table 5.3-2 for a comparison of the range to effects for PTS, TTS, and the recommended mitigation zone). Despite employing the required mitigation measures during an activity that will also reduce some TTS exposures, the Navy did not quantitatively adjust the model-predicted TTS effects as a result of implemented mitigation.
- The total model-predicted number of animals affected is not reduced by the post-model mitigation analysis, since all reductions in mortality and injury effects are then added to and counted as TTS effects.
- Mitigation involving a power-down or cessation of sonar, or delay in use of explosives, as a result of a marine mammal detection, protects the observed animal and all unobserved (below the surface) animals in the vicinity. The quantitative adjustments of model-predicted impacts, however, assume that only animals on the water surface, approximated by considering the

species-specific g(0) and activity-specific mitigation effectiveness factor, would be protected by the applied mitigation (i.e., a power down or cessation of sonar or delaying the event). The quantitative post-model mitigation analysis, therefore, does not capture the protection afforded to all marine mammals that may be near or within the mitigation zone.

The Navy recognizes that g(0) values are estimated specifically for line-transect analyses; however, g(0) is still the best statistically derived factor for assessing the likely marine mammal detection abilities of Navy Lookouts. Based on the points summarized above, as a factor used in accounting for the implementation of mitigation, g(0) is therefore considered to be the best available scientific basis for the Navy's representation of the sightability of a marine mammal as used in this analysis.

The post-model acoustic effects quantification process is summarized in Table 3.4-8. In brief, the mitigation effectiveness score for an event is multiplied by the estimated sightability of each species to quantify the number of animals originally modeled as a mortality (explosives only) or injury (all sound-producing activities) exposure but would, in reality, be observed by Lookouts prior to or during a sound-producing activity. Observation of marine mammals prior to or during a sound-producing activity would be followed by stop or delay of the sound-producing activity, which would reduce actual marine mammal sound exposures. The consideration of mitigation during use of sonar and other active acoustic sources and during use of explosives is discussed in more detail in Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) and Section 3.4.3.1.9 (Impacts from Explosions).

The incorporation of mitigation factors for the reduction of predicted exposures used a conservative approach (erring on the side of overestimating the number of exposures) since reductions as a result of implemented mitigation were only applied to those events having a very high likelihood of detecting marine mammals. It is important to note that there are additional protections offered by mitigation measures that will further reduce exposures to marine mammals, but are not considered in the quantitative adjustment of the model-predicted effects.

3.4.3.1.6 Marine Mammal Monitoring During Navy Training

The current behavioral exposure criteria under the response function also assumes there will be a range of reactions from minor or inconsequential to severe. Section 3.0.2.2 (Navy Integrated Comprehensive Monitoring Program) summarizes the monitoring data that has been collected thus far within the Study Area. Results of monitoring may provide indications that the severity of reactions has also been overestimated.

Table 3.4-8: Post-Model Acoustic Impact Analysis Process

Is the Sound Source Sonar/Other Active Acoustic Source or Explosives?	
Sonar and Other Active Acoustic Sources	**Explosives**
S-1. Is the activity preceded by multiple vessel activity or hovering helicopter?	**E-1. Is the activity preceded by multiple vessel activity or hovering helicopter?**
Species sensitive to human activity (i.e., harbor porpoises and beaked whales) are assumed to avoid the activity area, putting them out of the range to Level A harassment. Model-estimated PTS to these species during these activities are unlikely to actually occur and, therefore, are considered to be TTS (animal is assumed to move into the range of potential TTS). The activities preceded by multiple vessel movements or hovering helicopters are listed in Table 3.4-11 in 3.4.3.2 (Avoidance Behavior and Mitigation Measures as Applied to Sonar and Other Active Acoustic Sources).	Species sensitive to human activity (i.e., harbor porpoises and beaked whales) are assumed to avoid the activity area, putting them out of the range to mortality. Model-estimated mortalities to these species during these activities are unlikely to actually occur and, therefore, are considered to be injuries (animal is assumed to move into the range of potential injury). The activities preceded by multiple vessel movements or hovering helicopters are listed in Table 3.4-23 in Section 3.4.3.1.9.2 (Avoidance Behavior and Mitigation as Applied to Explosives).
S-2. Can Lookouts observe the activity-specific mitigation zone (see Chapter 5) up to and during the sound-producing activity?	**E-2. Can Lookouts observe the activity-specific mitigation zone (see Chapter 5) up to and during the sound-producing activity?**
If Lookouts are able to observe the mitigation zone up to and during a sound-producing activity, the sound-producing activity would be halted or delayed if a marine mammal is observed and would not resume until the animal is thought to be out of the mitigation zone (per the mitigation measures in Chapter 5). Therefore, model-estimated PTS exposures are reduced by the portion of animals that are likely to be seen [Mitigation Effectiveness (1, 0.5, or 0) x Sightability, g(0)]. Any animals removed from the model-estimated PTS are instead assumed to be TTS (animal is assumed to move into the range of TTS). The g(0) value is associated with the platform (vessel or aircraft) with the dedicated Lookout(s). For activities with lookouts on both platforms, the higher g(0) is used for analysis. The g(0) values are provided in Table 5.3-1. The Mitigation Effectiveness values are provided in Table 3.4-12 in Section 3.4.3.1.8.2 (Avoidance Behavior and Mitigation Measures as Applied to Sonar and Other Active Acoustic Sources).	If Lookouts are able to observe the mitigation zone up to and during an explosion, the explosive activity would be halted or delayed if a marine mammal is observed and would not resume until the animal is thought to be out of the mitigation zone (per the mitigation measures in Chapter 5). Therefore, model-estimated mortalities and injuries are reduced by the portion of animals that are likely to be seen [Mitigation Effectiveness (1, 0.5, or 0) x Sightability, g(0)]. Any animals removed from the model-estimated mortalities or injuries are instead assumed to be injuries or behavioral disturbances, respectively (animals are assumed to move into the range of a lower effect). The g(0) value is associated with the platform (vessel or aircraft) with the dedicated Lookout(s). For activities with lookouts on both platforms, the higher g(0) is used for analysis. The g(0) values are provided in Table 5.3-1. The Mitigation Effectiveness values for explosive activities are provided in Table 3.4-24 in Section 3.4.3.1.9.2 (Avoidance Behavior and Mitigation as Applied to Explosives).

Table3.4-8: Post-Model Acoustic Impact Analysis Process (Continued)

Is the Sound Source Sonar/Other Active Acoustic Source or Explosives?	
Sonar and Other Active Acoustic Sources	**Explosives**
S-3. Does the activity cause repeated sound exposures which an animal would likely avoid?	**E-3. Does the activity cause repeated sound exposures which an animal would likely avoid?**
The Navy Acoustic Effects Model assumes that animals do not move away from a sound source and receive a maximum sound exposure level. In reality, an animal would likely avoid repeated sound exposures that would cause PTS by moving away from the sound source. Therefore, only the initial exposures resulting in model-estimated PTS to high-frequency cetaceans, low frequency cetaceans, and phocids are expected to actually occur (after accounting for mitigation in step S-3). Model estimates of PTS beyond the initial pings are considered to actually be TTS, as the animal is assumed to move out of the range to PTS and into the range of TTS. Marine mammals in the mid-frequency hearing group would have to be close to the most powerful moving source (less than 10 m) to experience PTS. These model-estimated PTS exposures of mid-frequency cetaceans are unlikely to actually occur and, therefore, are considered to be TTS (animal is assumed to move into the range of TTS).	The Navy Acoustic Effects Model assumes that animals do not move away from multiple explosions and receive a maximum sound exposure level. In reality, an animal would likely avoid repeated sound exposures that would cause PTS by moving away from the site of multiple explosions. Therefore, only the initial exposures resulting in model-estimated PTS are expected to actually occur (after accounting for mitigation in step E-2). Model estimates of PTS are reduced to account for animals moving away from an area with multiple explosions, out of the range to PTS, and into the range of TTS. Activities with multiple explosions are listed in Table 3.4 25 in Section 3.4.3.1.9.2 (Avoidance Behavior and Mitigation as Applied to Explosives).

m: meters; PTS: permanent threshold shift; TTS: temporary threshold shift

3.4.3.1.7 Application of the Marine Mammal Protection Act and Endangered Species Act to Potential Acoustic and Explosive Effects

3.4.3.1.7.1 Marine Mammal Protection Act

The MMPA prohibits the unauthorized harassment of marine mammals and provides the regulatory processes for authorization for any such incidental harassment that might occur during an otherwise lawful activity. Harassment that may result from Navy training and testing activities described in this EIS/OEIS is unintentional and incidental to those activities.

For military readiness activities, MMPA Level A harassment includes any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild. Injury, as defined in this EIS/OEIS, is the destruction or loss of biological tissue from a species. The destruction or loss of biological tissue will result in an alteration of physiological function that exceeds the normal daily physiological variation of the intact tissue. For example, increased localized histamine production, edema, production of scar tissue, activation of clotting factors, white blood cell response, etc., may be expected following injury. Therefore, this EIS/OEIS assumes that all injury is qualified as a physiological effect and, to be consistent with prior actions and rulings, all injuries (slight to severe) are considered MMPA Level A harassment.

PTS is non-recoverable and, by definition, results from the irreversible impacts on auditory sensory cells, supporting tissues, or neural structures within the auditory system. PTS therefore qualifies as an injury and is classified as Level A harassment under the wording of the MMPA. The smallest amount of PTS

(onset-PTS) is taken to be the indicator for the smallest degree of injury that can be measured. The acoustic exposure associated with onset-PTS is used to define the outer limit of the MMPA Level A exposure zone. Model predicted slight lung injury and gastrointestinal tract injuries are also considered MMPA Level A harassment in this analysis.

Public Law 108-136 (2004) amended the MMPA definitions of Level B harassment for military readiness activities to be "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behaviors are abandoned or significantly altered." Unlike MMPA Level A harassment, which is solely associated with physiological effects, both physiological and behavioral effects may cause MMPA Level B harassment.

TTS is recoverable and is considered to result from the temporary, noninjurious fatigue of hearing-related tissues. The smallest measurable amount of TTS (onset-TTS) is taken as the best indicator for slight temporary sensory impairment. Because it is considered non-injurious, the acoustic exposure associated with onset-TTS is used to define the outer limit of the portion of the MMPA Level B exposure zone attributable to physiological effects. Short-term reduction in hearing acuity could be considered a temporary decrement similar in scope to a period of hearing masking or behavioral disturbance. As such, it is considered by the Navy and NMFS as a Level B effect overlapping the range of sounds producing behavioral effects.

The harassment status of slight behavior disruption has been addressed in workshops, previous actions, and rulings (National Oceanic and Atmospheric Administration 2008). The conclusion is that a momentary behavioral reaction of an animal to a brief, time-isolated acoustic event does not qualify as MMPA Level B harassment. This analysis uses behavioral criteria to predict the number of animals likely to experience a significant behavioral reaction, and therefore an MMPA Level B harassment.

NMFS also includes mortality as a possible outcome to consider in addition to MMPA Level A and Level B harassment. An individual animal predicted to experience simultaneous multiple injuries, multiple disruptions, or both, is counted as a single take (National Oceanic and Atmospheric Administration 2008). NMFS has generally identified a 24-hour period as the amount of time in which an individual can be harassed no more than once. Behavioral harassment, under the risk function presented in this analysis, uses the highest received sound pressure level over a 24-hour period as the metric for determining the probability of a behavioral harassment.

3.4.3.1.7.2 Endangered Species Act

Generalized information on definitions and the application of the ESA are presented in Section 3.0 (Introduction) along with the acoustic conceptual framework used in this analysis. Consistent with NMFS analysis for Section 7 consultation under the ESA (see National Marine Fisheries Service 2007), the spatial and temporal overlap of activities with the presence of listed species is assessed in this EIS/OEIS. The definitions used by the Navy in making the determination of effect under Section 7 of the ESA are based on the U.S. Fish and Wildlife Service and NMFS *Endangered Species Consultation Handbook* (United States Fish and Wildlife Service and National Marine Fisheries Service 1998), and recent NMFS Biological Opinions involving many of the same activities and species.

- "No effect" is the appropriate conclusion when a listed species or its designated critical habitat will not be affected, either because the species will not be present or because the project does

not have any elements with the potential to affect the species or modify designated critical habitat. “No effect” does not include a small effect or an effect that is unlikely to occur.

- If a stressor and species presence overlap, but predicted effects are insignificant (in size) or discountable (extremely unlikely), a “may affect, but not likely to adversely affect” determination is appropriate. "May affect" is appropriate when animals are within a range where they could potentially detect or otherwise be affected by the sound (e.g., the sound is above background ambient levels).
    - Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.
    - Discountable effects are those extremely unlikely to occur and based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
- If a stressor and species presence overlap, and a predicted effect is not insignificant, discountable, or beneficial, a “may affect, likely to adversely affect” determination is appropriate.

There are no harassment or injury criteria established for marine mammals under the ESA because the ESA requires an assessment starting with mere exposure potential. Acoustic modeling is used to predict the number of ESA-listed marine mammals exposed to sound resulting from Navy training and testing activities, without any behavioral or physiological criteria applied.

3.4.3.1.8 Impacts from Sonar and Other Active Acoustic Sources

Sonar and other active acoustic sources proposed for use are transient in most locations as active sonar activities move throughout the Study Area. Sonar and other active acoustic sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. General categories of sonar systems are described in Section 2.3.7 (Classification of Acoustic and Explosive Sources).

Exposure of marine mammals to non-impulsive sources such as active sonar is not likely to result in primary blast injuries or barotraumas. Sonar induced acoustic resonance and bubble formation phenomena are also unlikely to occur under realistic conditions in the ocean environment, as discussed in Section 3.4.3.1.2.1 (Direct Injury). Direct injury from sonar and other active acoustic sources would not occur under conditions present in the natural environment and therefore is not considered further in this analysis.

Research and observations of auditory masking in marine mammals is discussed in Section 3.4.3.1.2.3 (Auditory Masking). Anti-submarine warfare sonar can produce intense underwater sounds in the Study Area associated with the Proposed Action. These sounds are likely within the audible range of most cetaceans but are normally very limited in the temporal, frequency, and spatial domains. The duration of individual sounds is short; sonar pulses can last up to a few seconds each, but most are shorter than 1 second. The duty cycle is low, with most tactical anti-submarine warfare sonar typically transmitting about once per minute. Furthermore, events are geographically and temporally dispersed, and most events are limited to a few hours. Tactical sonar has a narrow frequency band (typically less than one-third octave). These factors reduce the likelihood of sources causing significant auditory masking in marine mammals.

Some object-detecting sonar (i.e., mine warfare sonar) has a high duty cycle producing up to a few pings per second. Such sonar typically employs high frequencies (above 10 kHz) that attenuate rapidly in the water, thus producing only a small area of potential auditory masking. Higher-frequency mine warfare

sonar systems are typically outside the hearing and vocalization ranges of mysticetes (Section 3.4.2.3, Vocalization and Hearing of Marine Mammals); therefore, mysticetes are unlikely to be able to detect the higher frequency mine warfare sonar, and these systems would not interfere with their communication or detection of biologically relevant sounds. Odontocetes may experience some limited masking at closer ranges as the frequency band of many mine warfare sonars overlap the hearing and vocalization abilities of some odontocetes; however, the frequency band of the sonar is narrow, limiting the likelihood of auditory masking. With any of these activities, the limited duration and dispersion of the activities in space and time reduce the potential for auditory masking effects from proposed activities on marine mammals.

The most probable effects from exposure to sonar and other active acoustic sources are PTS, TTS, and behavioral harassment (Sections 3.4.3.1.2.2, Hearing Loss, and 3.4.3.1.2.5, Behavioral Reactions). The Navy Acoustic Effects Model is used to produce initial estimates of the number of animals that may experience these effects; these estimates are further refined by considering animal avoidance of sound-producing activities and implementation of mitigation. These are discussed below in the following sections.

Another concern is the number of times an individual marine mammal is exposed and potentially reacts to a sonar or other active acoustic source over the course of a year or within a specific geographic area. Animals that are resident during all or part of the year near Navy ports or on fixed Navy ranges are the most likely to experience multiple exposures. Repeated and chronic noise exposures to marine mammals and their observed reactions are discussed in this analysis where applicable.

3.4.3.1.8.1 Range to Effects

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the acoustic criteria (Section 3.4.3.1.4, Thresholds and Criteria for Predicting Acoustic and Explosive Impacts) and the acoustic propagation calculations from the Navy Acoustic Effects Model (Section 3.4.3.1.5.3, Navy Acoustic Effects Model). Although the Navy uses various sonar and active acoustic sources, the sonar bins provided below (i.e., MF1, MF4, and MF5) represent three of the most powerful sources. These sonar bins are often the dominant source in the activity in which they are included, especially for smaller unit-level training exercises and many testing activities. Therefore, these ranges provide realistic maximum distances over which the specific effects would be possible.

The range to specific effects are used to assess model results and determine adequate mitigation ranges to avoid higher level effects, especially physiological effects. Additionally, these data can be used to analyze the likelihood of an animal being able to avoid an oncoming sound source by simply moving a short distance (i.e., within a few hundred meters). Figure 3.4-8 shows a representation of effects with distance from a hypothetical sonar source; notice the proportion of animals that are likely to have a behavioral response (yellow block; “response-function”) decreases with increasing distance from the source.

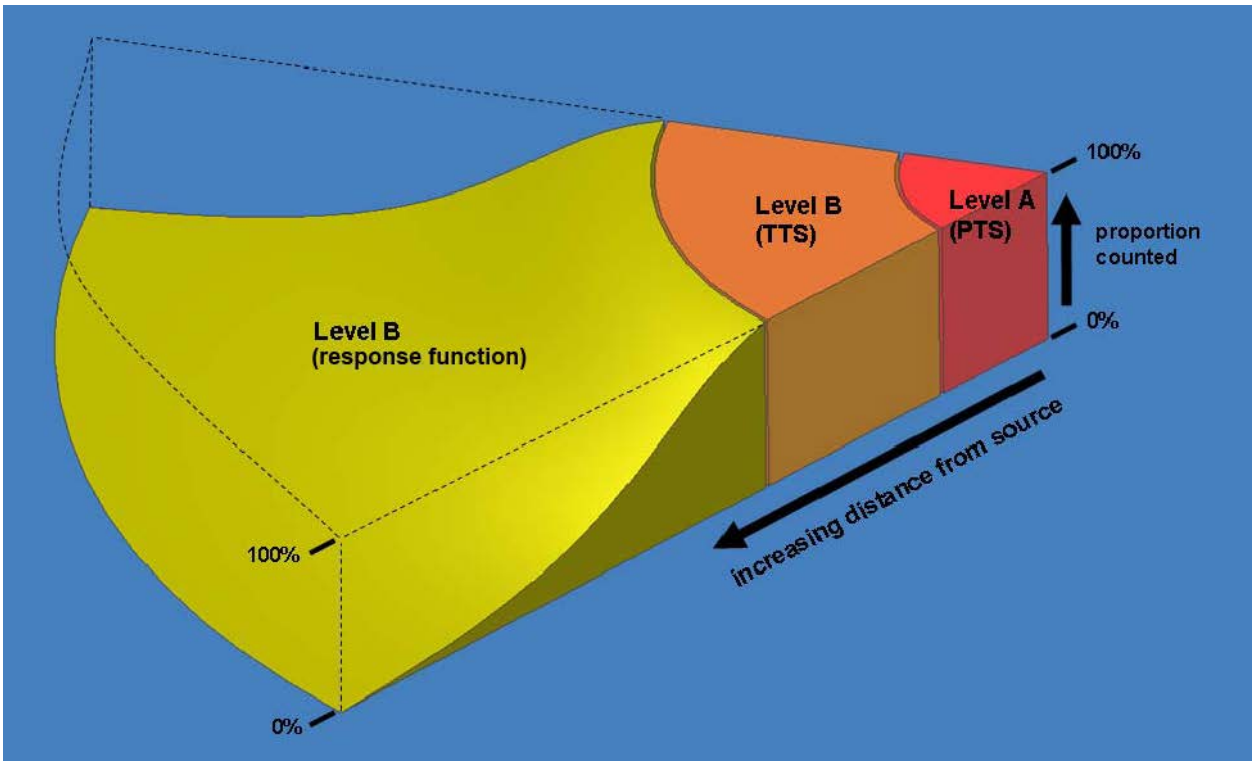


Figure 3.4-8: Hypothetical Range to Specified Effects for a Sonar Source
PTS: permanent threshold shift; TTS: temporary threshold shift; %: percent

The ranges to the PTS threshold (i.e., range to the onset of PTS: the maximum distance to which PTS would be expected) are shown in Table 3.4-9 relative to the marine mammal's functional hearing group. For a SQS-53 sonar transmitting for 1 second at 3 kHz and a representative source level of 235 dB re 1 μPa^2-s at 1 m, the range to PTS for the most sensitive species (the high-frequency cetaceans) extends from the source to a range of 100 m (110 yd.). Since any hull mounted sonar, such as the SQS-53, engaged in anti-submarine warfare training would be moving at between 10–15 knots (5.1–7.7 m/second) and nominally pinging every 50 seconds, the vessel will have traveled a minimum distance of approximately 260 m (280 yd.) during the time between those pings (10 knots is the speed used in the Navy Acoustic Effects Model). As a result, there is little overlap of PTS footprints from successive pings, indicating that in most cases, an animal predicted to receive PTS would do so from a single exposure (i.e., ping). For all other functional hearing groups (low-frequency cetaceans, mid-frequency cetaceans, and phocid seals and manatees) single-ping PTS zones are within 100 m of the sound source. A scenario could occur where an animal does not leave the vicinity of a ship or travels a course parallel to the ship within the PTS zone; however, as indicated in Table 3.4-9, the distances required make PTS exposure less likely. For a Navy vessel moving at a nominal 10 knots, it is unlikely a marine mammal could maintain the speed to parallel the ship and receive adequate energy over successive pings to suffer PTS. For all sources except hull-mounted sonar (e.g., SQS-53 and BQQ-10) ranges to PTS are well within 50 m (55 yd.), even for multiple pings (up to five pings) and the most sensitive functional hearing group (high-frequency cetaceans).

Table 3.4-9: Approximate Ranges to Permanent Threshold Shift Criteria for Each Functional Hearing Group for a Single Ping from Three of the Most Powerful Sonar Systems within Representative Ocean Acoustic Environments

Functional Hearing Group	Ranges to the Onset of PTS for One Ping (meters)[1]		
	Sonar Bin MF1 (e.g., SQS-53; ASW Hull Mounted Sonar)	Sonar Bin MF4 (e.g., AQS-22; ASW Dipping Sonar)	Sonar Bin MF5 (e.g., SSQ-62; ASW Sonobuoy)
Low-Frequency Cetaceans	70	10	≤ 2
Mid-Frequency Cetaceans	10	≤ 2	≤ 2
High-Frequency Cetaceans	100	20	10
Phocid Seals and Manatees	80	10	≤ 2

ASW: anti-submarine warfare; PTS: permanent threshold shift

[1] Approximate ranges are based on spherical spreading (Transmission Loss = 20 log R, where R = range in meters).

Table 3.4-10 illustrates the ranges to the onset of TTS (i.e., the maximum distances to which TTS would be expected) for one, five, and ten pings from four representative sonar systems. Due to the lower acoustic thresholds for TTS versus PTS, ranges to TTS are longer. Therefore, it is possible for animals to remain in these areas over several successive pings and potentially suffer TTS.

Table 3.4-10: Approximate Ranges to the Onset of Temporary Threshold Shift for Four Representative Sonar Systems Over a Representative Range of Ocean Environments

Functional Hearing Group	Approximate Ranges to the Onset of TTS (meters)[1]											
	Sonar Bin MF1 (e.g., SQS-53; ASW Hull Mounted Sonar)			Sonar Bin MF4 (e.g., AQS-22; ASW Dipping Sonar)			Sonar Bin MF5 (e.g., SSQ-62; ASW Sonobuoy)			Sonar Bin HF4 (e.g., SQQ-32; MIW Sonar)		
	One Ping	Five Pings	Ten Pings	One Ping	Five Pings	Ten Pings	One Ping	Five Pings	Ten Pings	One Ping	Five Pings	Ten Pings
Low-Frequency Cetaceans	560–2,280	1,230–6,250	1,620–8,860	220–240	490–1,910	750–2,700	110–120	240–310	340–1,560	100–160	150–730	150–820
Mid-Frequency Cetaceans	150–180	340–440	510–1,750	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
High-Frequency Cetaceans	2,170–7,570	4,050–15,350	5,430–19,500	90	180–190	260–950	< 50	< 50	< 50	< 50	< 50	< 50
Phocid Seals and Manatees	72–1,720	200–3,570	350–4,850	< 50	100	150	< 50	< 50	< 50	< 50	< 50	< 50

ASW: anti-submarine warfare; MIW: mine warfare; TTS: temporary threshold shift

[1] Ranges to TTS represent the model predictions in different areas and seasons within the Study Area. The zone in which animals are expected to receive TTS extends from onset-PTS to the distance indicated.

The distances over which the sound pressure level from four representative sonar sources is within the indicated 10-dB bins, and the percentage of animals that may exhibit a significant behavioral response under the mysticete and odontocete behavioral response function, are shown in Table 3.4-11 and Table 3.4-12, respectively. Section 3.4.3.1.4.5 (Behavioral Responses) provides details on the derivation and use of the behavioral response function as well as the step function thresholds for harbor porpoises and beaked whales of 120 dB re 1 µPa and 140 dB re 1 µPa, respectively.

Range to 120 dB re 1 µPa varies by system but can exceed 180 km (100 nm) for the most powerful hull-mounted sonar; however, only a very small percentage of animals would be predicted to react at received levels between 120 and 130 dB re 1 µPa, with the exception of harbor porpoises. All harbor porpoises that are predicted to receive 120 dB re 1 µPa or greater would be assumed to exhibit a behavioral response. Likewise, beaked whales would be predicted to have behavioral reactions at distances to approximately 79 km (43 nm).

3.4.3.1.8.2 Avoidance Behavior and Mitigation Measures as Applied to Sonar and Active Acoustic Sources

As discussed above (Section 3.4.3.1.5.4, Model Assumptions and Limitations), within the Navy Acoustic Effects Model, animats (virtual animals) do not move horizontally or react in any way to avoid sound at any level. In reality, various researchers have demonstrated that cetaceans can perceive the location and movement of a sound source (e.g., vessel, seismic source, etc.) relative to their own location and react with responsive movement away from the source, often at distances of a kilometer or more (Au and Perryman 1982; Jansen et al. 2010; Richardson et al. 1995; Tyack et al. 2011; Watkins 1986; Wursig et al. 1998). Section 3.4.3.1.2.5 (Behavioral Reactions) reviews research and observations of marine mammals' reactions to sound sources including sonar, ships, and aircraft. At close ranges and high sound levels approaching those that could cause PTS, avoidance of the area immediately around the sound source is the assumed behavioral response for most cases. Additionally, the Navy Acoustic Effects Model does not account for the implementation of mitigation, which would prevent many of the model-estimated PTS effects. Therefore, the model-estimated PTS effects due to sonar and other active acoustic sources are further analyzed considering avoidance and implementation of mitigation measures described in Section 3.4.3.1.5 (Quantitative Analysis) and in the technical report *Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for Atlantic Fleet Training and Testing* (U.S. Department of the Navy 2013b).

If sound-producing activities are preceded by multiple vessel traffic or hovering aircraft, harbor porpoises and beaked whales are assumed to move beyond the range to PTS before sound transmission begins, as discussed in Section 3.4.3.1.5.5 (Marine Mammal Avoidance of Sound Exposures). Table 3.4-9 shows the ranges to PTS for several sonar systems, including the most powerful system, the AN/SQS-53 in bin MF1. The range to PTS for all systems is generally much less than 50 m, with the exception of low-frequency cetaceans, high-frequency cetaceans, and phocids exposed to bin MF1 (range to PTS less than or equal to 100 m). Because the Navy Acoustic Effects Model does not include avoidance behavior, the model-estimated effects are based on unlikely behavior for these species- that they would tolerate staying in an area of high human activity. Harbor porpoises and beaked whales that were model-estimated to experience PTS due to sonar and other active acoustic sources are assumed to actually move into the range of TTS prior to the start of the sound-producing activity for the activities listed in Table 3.4-13. For activities where multiple vessel traffic or hovering aircraft do not proceed the sound transmissions, model predicted PTS was not reduced based on this factor.

Table 3.4-11: Range to 10-dB Bins and Percentage of Behavioral Harassments in Each Bin for Low-Frequency Cetaceans under the Mysticete Behavioral Risk Function for Four Representative Sonar Systems

Received Level in 10-dB Bins	Sonar Bin MF1 (e.g., SQS-53; ASW Hull Mounted Sonar)		Sonar Bin MF4 (e.g., AQS-22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ-62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ-32; MIW Sonar)	
	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels
120 <= SPL <130	179,213 – 137,850	0.00%	60,983 – 22,117	0.00%	19,750 – 11363	0.00%	3,338 – 1,875	0.00%
130 <= SPL <140	137,850 – 78,100	0.30%	22,117 – 15,525	0.62%	11,363 – 4463	4.06%	1,875 – 1,013	1.73%
140 <= SPL <150	78,100 – 66,475	2.33%	15,525 – 5,300	31.36%	4,463 – 1,375	39.59%	1,013 – 300	38.25%
150 <= SPL <160	66,475 – 15,825	76.00%	5,300 – 1,475	50.12%	1,375 – 150	53.90%	300 – 100	42.97%
160 <= SPL <170	15,825 – 6,188	16.38%	1,475 – 150	17.63%	150 – <50	2.44%	100 – <50	17.06%
170 <= SPL <180	6,188 – 1,888	4.46%	150 – <50	0.27%	<50	0.00%	<50	0.00%
180 <= SPL <190	1,888 – 250	0.51%	<50	0.00%	<50	0.00%	<50	0.00%
190 <= SPL <200	250 – <50	0.01%	<50	0.00%	<50	0.00%	<50	0.00%

ASW: anti-submarine warfare; dB: decibel; m: meter; MIW: mine warfare; SPL: sound pressure level; <: less than; %: percent

Table 3.4-12: Range to 10-dB Bins and Percentage of Behavioral Harassments in Each Bin for Mid-Frequency Cetaceans under the Odontocete Behavioral Risk Function for Four Representative Sonar Systems

Received Level in 10-dB Bins	Sonar Bin MF1 (e.g., SQS-53; ASW Hull Mounted Sonar)		Sonar Bin MF4 (e.g., AQS-22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ-62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ-32; MIW Sonar)	
	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance Over Which Levels Occur (m)	Percentage of Behavioral Harassments Occurring at Given Levels
120 <= SPL <130	179,525 – 139,300	0.00%	61,433 – 22,208	0.00%	20,638 – 11,917	0.00%	4,388 – 3,375	0.00%
130 <= SPL <140	139,300 – 78,263	0.05%	22,208 – 15,563	0.11%	11,917 – 4,913	0.68%	3,375 – 1,913	0.09%
140 <= SPL <150	78,263 – 66,525	1.02%	15,563 – 5,425	15.91%	4,913 – 1,738	19.95%	1,913 – 1,013	4.78%
150 <= SPL <160	66,525 – 16,338	66.88%	5,425 – 1,475	54.68%	1,738 – 150	75.99%	1,013 – 400	42.12%
160 <= SPL <170	16,338 – 6,388	24.26%	1,475 – 150	28.82%	150 – <50	3.38%	400 – 100	48.72%
170 <= SPL <180	6,388 – 1,888	7.04%	150 – <50	0.47%	<50	0.00%	100 – <50	4.29%
180 <= SPL <190	1,888 – 250	0.73%	<50	0.00%	<50	0.00%	<50	0.00%
190 <= SPL <200	250 – <50	0.01%	<50	0.00%	<50	0.00%	<50	0.00%

ASW: anti-submarine warfare; dB: decibel; m: meter; MIW: mine warfare; SPL: sound pressure level; <: less than; %: percent

Note: Odontocete Behavioral Risk Function is also used for high-frequency cetaceans, phocid seals, and manatees

Table 3.4-13: Activities Using Sonar and Other Active Acoustic Sources Preceded by Multiple Vessel Movements or Hovering Helicopters

ACTIVITY
Training
Airborne Mine Countermeasure – Mine Detection
Civilian Port Defense
Composite Training Unit Exercise
Group Sail
Integrated Anti-Submarine Warfare Course
Joint Task Force Exercise/Sustainment Exercise
Kilo Dip
Mine Countermeasures Exercise – Ship Sonar
Tactical Development Exercise
Tracking Exercise/Torpedo Exercise – Helo
Testing
Airborne Mine Hunting Test
Anti-Submarine Warfare Mission Package Testing
Anti-Submarine Warfare Tracking Test – Helo
Countermeasure Testing[1]
Mine Countermeasure Mission Package Testing
Mine Countermeasure/Neutralization Testing
Mine Detection/Classification Testing
Naval Surface Warfare Center: Mine Detection and Classification Testing
Naval Surface Warfare Center: Stationary Source Testing
Naval Surface Warfare Center: Unmanned Underwater Vehicle Demonstration
Naval Surface Warfare Center: Unmanned Underwater Vehicle Testing
Naval Undersea Warfare Center: Towed Equipment Testing
Naval Undersea Warfare Center: Unmanned Underwater Vehicle Demonstration
Naval Undersea Warfare Center: Unmanned Underwater Vehicle Testing
South Florida Ocean Measurement Facility: Surface Testing Activities
South Florida Ocean Measurement Facility: Unmanned Underwater Vehicle Demonstration
Sonobuoy Lot Acceptance Testing
Torpedo (Explosive) Testing
Torpedo (Non-Explosive) Testing

[1]A score of 0.5 was applied for this activity.

The Navy Acoustic Effects Model does not consider mitigation, discussed in detail in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). As explained in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), to account for the implementation of mitigation measures, the acoustic effects analysis assumes a model-estimated PTS would not occur if an animal at the water surface would likely be observed during those activities with dedicated Lookouts up to and during use of the sound source, considering the mitigation effectiveness (see Table 3.4-14) and sightability of a species based on g(0) (see Table 5.3-1). The range to PTS is generally less than 50 m (55 yd.), and the largest single ping range to PTS for the most powerful sonar system is approximately 100 m (109 yd.), so Lookouts need only to detect animals before they are within a very close range of a sound source to prevent PTS. The model-estimated PTS values are reduced by the portion of animals that are likely to be seen (Mitigation Effectiveness x Sightability); these animals are instead assumed to be present within the range to TTS. A detailed explanation of this analysis is provided in the technical report *Post-Model Quantitiative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for Atlantic Fleet Training and Testing* (U.S. Department of the Navy 2013b).

Table 3.4-14: Consideration of Mitigation in Acoustic Effects Analysis for Sonar and Other Active Acoustic Sources

Activity[1]	Mitigation Effectiveness Factor for Acoustic Analysis	Mitigation Platform[2]
Training		
Airborne Mine Countermeasure – Mine Detection	1	Aircraft
Civilian Port Defense	1	Vessel
Composite Unit Training Exercise	1	Vessel
Integrated Anti-Submarine Warfare Course	1	Vessel
Joint Task Force Exercise/Sustainment Exercise	1	Vessel
Group Sail	1	Vessel
Mine Countermeasures Exercise – Ship Sonar	1	Vessel
Mine Neutralization – Remotely Operated Vehicle	1	Vessel
Tactical Development Exercise	1	Vessel
Submarine Sonar Maintenance	0.5	Vessel
Surface Ship Object Detection	1	Vessel
Surface Ship Sonar Maintenance	1	Vessel
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft Sonobuoy	0.5	Aircraft
Tracking Exercise/Torpedo Exercise – Surface	0.5	Vessel
Tracking Exercise/Torpedo Exercise – Helo	0.5	Aircraft
Testing		
Airborne Mine Hunting Test	1	Aircraft
Anti-Submarine Warfare Tracking Test – Helo	1	Aircraft
Anti-Submarine Warfare Mission Package Testing	0.5	Aircraft
At-Sea Sonar Testing	0.5	Vessel
Combat System Ship Qualification Trials: In-Port	1	Vessel
Combat System Ship Qualification Trials: Undersea Warfare	0.5	Vessel
Countermeasure Testing	0.5	Vessel
Kilo Dip	1	Aircraft
Mine Countermeasure/Neutralization Testing	1	Vessel
Mine Detection/Classification Testing	1	Vessel
Naval Surface Warfare Center: Mine Detection and Classification Testing	1	Vessel
Naval Surface Warfare Center: Stationary Source Testing	1	Vessel
Naval Undersea Warfare Center: Pierside Integrated Swimmer Defense	1	Vessel
Naval Undersea Warfare Center: Semi-Stationary Equipment Testing	1	Vessel
Naval Undersea Warfare Center: Towed Equipment Testing	1	Vessel
Pierside Integrated Swimmer Defense	1	Vessel
Pierside Sonar Testing	1	Vessel
South Florida Ocean Measurement Facility: Surface Testing Activities	1	Vessel
Sonobuoy Lot Acceptance Testing	1	Vessel
Submarine Sonar Testing/Maintenance	0.5	Vessel
Surface Combatant Sea Trials: Anti-Submarine Warfare Testing	1	Vessel
Surface Combatant Sea Trials: Pierside Sonar Testing	1	Vessel
Surface Ship Sonar Testing/Maintenance	1	Vessel
Torpedo (Non-Explosive) Testing	0.5	Vessel

[1] If less than half of the mitigation zone can be continuously visually observed or if the mitigation zone cannot be continuously visually observed during most of the scenarios within the activity due to the type of surveillance platform(s), number of Lookouts, and size of the mitigation zone, mitigation is not considered in the acoustic effects analysis of that activity and the activity is not listed in this table.

[2] The activity is scored based on the ability of the individual platform to implement the mitigation.

Animal avoidance of the area immediately around the sonar or other active acoustic system, coupled with mitigation measures designed to avoid exposing animals to high energy levels, would make the majority of model-estimated PTS exposures of mid-frequency cetaceans unlikely. The maximum ranges to the onset of PTS are discussed in Section 3.4.3.1.8.1 (Range to Effects) above and shown in Table 3.4-9. The range to PTS for mid-frequency cetaceans (Table 3.4-9) does not exceed 50 m (55 yd.) in any environment or for any sonar or other active acoustic source. In fact, the single ping range to PTS for mid-frequency cetaceans due to the AN/SQS-53 is 10 m, and the PTS range for five pings is about 20 m. The most powerful source, the AN/SQS-53, can span as much as 270 degrees; however, an animal would need to maintain a position within a 20 m radius in front of or along the bow of the ship for over 3 minutes (given the time between five pings) to experience PTS. Additionally, odontocetes have demonstrated directional hearing, with best hearing sensitivity facing a sound source (Kastelein et al. 2005a; Mooney et al. 2008; Popov and Supin 2009). An odontocete avoiding a source would receive sounds along a less sensitive hearing axis, potentially reducing impacts. All model-estimated PTS exposures of mid-frequency cetaceans, therefore, are considered to actually be TTS due to the likelihood that an animal would be observed if it is present within the very short range to PTS effects.

Marine mammals in other functional hearing groups (i.e., low-frequency and high-frequency cetaceans; phocid seals; and manatees), if present but not observed by Lookouts, are assumed to leave the area near the sound source after the first few pings, thereby reducing sound exposure levels and the potential for PTS. Based on nominal marine mammal swim speeds and normal operating parameters for Navy vessels, it was determined that an animal can easily avoid PTS zones within the timeframe it takes an active sound source to generate one to two pings. As a conservative measure, and to account for activities where there may be a pause in sound transmission, PTS was accounted for over three to four pings of an activity. Additionally, as stated above, during avoidance behaviors, sound exposure of odontocetes (including high-frequency cetaceans) may be minimized due to directional hearing. During the first few pings of an event, or after a pause in sonar activities, if animals are caught unaware and it was not possible to implement mitigation measures (e.g., animals are at depth and not visible at the surface) it is possible they could receive enough acoustic energy to suffer PTS. Only these initial exposures, at the beginning of the activity or after a pause in sound transmission, are expected to actually occur. The remaining model-estimated PTS exposures are considered to actually be TTS exposures due to avoidance.

3.4.3.1.8.3 Predicted Impacts from Sonar and Other Active Acoustic Sources

Table 3.4-15 through Table 3.4-18 present the predicted impacts on marine mammals separated between training and testing activities, and between annual and nonannual events. Nonannual events, those events that may only take place a few times over the five-year period and do not reoccur every year, are considered separately because these impacts would not be assessed each year. These predicted effects are the result of the acoustic analysis, including acoustic effects modeling followed by consideration of animal avoidance of multiple exposures, avoidance by sensitive species of areas with a high level of activity, and Navy mitigation measures.

It is important to note that acoustic impacts presented in Table 3.4-15 through Table 3.4-18 are the total number of impacts and not necessarily the number of individuals impacted. As discussed in Section 3.4.3.1.5.3 (Navy Acoustic Effects Model), an animal could be predicted to receive more than one acoustic impact over the course of a year.

Table 3.4-15: Predicted Impacts per Year from Annually Recurring Sonar and Other Active Acoustic Training Activities

	No Action Alternative			Alternatives 1 & 2		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Mysticetes						
Blue Whale*	26	31	0	50	97	0
Bryde's Whale	181	217	0	326	629	0
Minke Whale	11,770	16,175	2	19,497	40,866	10
Fin Whale*	879	972	0	1,608	2,880	1
Humpback Whale*	320	402	0	514	1,128	1
North Atlantic Right Whale*	33	22	0	51	60	0
Sei Whale*	1,954	2,112	0	3,582	6,604	1
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	76,776	4,746	0	161,590	15,781	0
Atlantic White-Sided Dolphin	16,820	427	0	30,014	1,183	0
Bottlenose Dolphin	131,994	7,844	0	260,189	24,116	0
Clymene Dolphin	8,222	459	0	17,929	1,655	0
Common Dolphin	206,604	9,725	0	429,199	35,731	0
False Killer Whale	280	15	0	653	60	0
Fraser's Dolphin	1,027	42	0	2,044	161	0
Killer Whale	6,269	286	0	12,984	1,069	0
Melon-Headed Whale	9,774	458	0	19,216	1,659	0
Pantropical Spotted Dolphin	25,744	1,701	0	64,668	6,291	0
Pilot Whale	46,324	1,931	0	94,552	6,672	0
Pygmy Killer Whale	702	34	0	1,364	123	0
Risso's Dolphin	104,045	4,762	0	220,716	17,779	0
Rough-Toothed Dolphin	465	26	0	964	94	0
Spinner Dolphin	7,668	508	0	18,396	2,015	0
Striped Dolphin	100,475	4,621	0	206,688	17,593	0
White-Beaked Dolphin	1,112	31	0	1,547	44	0
Odontocetes – Sperm Whales						
Sperm Whale*	6,623	92	0	14,311	435	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	13,627	46	0	27,991	187	0
Cuvier's Beaked Whale	17,256	51	0	34,698	196	0
Gervais' Beaked Whale	14,063	65	0	28,020	233	0
Northern Bottlenose Whale	10,806	12	0	18,320	36	0
Sowerby's Beaked Whale	4,710	15	0	9,907	56	0
True's Beaked Whale	7,444	15	0	16,637	73	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	104	1,995	5	169	4,914	13
Harbor Porpoise	117,605	18,955	57	120,895	20,161	62
Phocid Seals						
Bearded Seal	0	0	0	0	0	0
Gray Seal	29	0	0	35	0	0
Harbor Seal	30	0	0	37	0	0
Harp Seal	0	0	0	0	0	0
Hooded Seal	4	0	0	5	0	0
Ringed Seal*	0	0	0	0	0	0
Manatees						
West Indian Manatee*	9	0	0	9	0	0

PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-16: Predicted Impacts per Year from Annually Recurring Sonar and Other Active Acoustic Testing Activities

	No Action Alternative			Alternative 1			Alternative 2		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Mysticetes									
Blue Whale*	1	1	0	5	9	0	6	10	0
Bryde's Whale	2	1	0	19	37	0	21	39	0
Minke Whale	400	337	0	2,733	3,323	1	3,100	3,571	1
Fin Whale*	38	21	0	253	250	0	282	263	0
Humpback Whale*	12	10	0	87	89	0	100	94	0
North Atlantic Right Whale*	2	2	0	54	9	0	66	11	0
Sei Whale*	37	21	0	288	419	0	316	439	0
Odontocetes – Delphinids									
Atlantic Spotted Dolphin	2,036	513	0	11,242	6,674	0	12,562	7,447	0
Atlantic White-Sided Dolphin	1,006	60	0	6,925	2,114	0	7,776	2,164	0
Bottlenose Dolphin	2,829	831	0	14,619	10,549	0	16,488	11,760	0
Clymene Dolphin	242	48	0	1,149	649	0	1,302	695	0
Common Dolphin	3,960	769	0	25,568	15,549	0	28,764	16,913	0
False Killer Whale	13	3	0	52	35	0	60	37	0
Fraser's Dolphin	7	2	0	90	53	0	98	57	0
Killer Whale	118	22	0	823	452	0	921	486	0
Melon-Headed Whale	76	12	0	700	558	0	767	590	0
Pantropical Spotted Dolphin	780	83	0	3,474	3,569	0	3,916	3,679	0
Pilot Whale	1,280	160	0	9,221	4,126	0	10,343	4,370	0
Pygmy Killer Whale	6	1	0	62	47	0	67	50	0
Risso's Dolphin	2,063	359	0	13,135	7,034	0	14,693	7,614	0
Rough-Toothed Dolphin	10	2	0	64	46	0	70	50	0

PTS: permanent threshold shift; TTS: temporary threshold shift

* ESA-listed species

Table 3.4-16: Predicted Impacts per Year from Annually Recurring Sonar and Other Active Acoustic Testing Activities (Continued)

	No Action Alternative			Alternative 1			Alternative 2		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Spinner Dolphin	488	57	0	1,575	723	0	1,799	786	0
Striped Dolphin	1,358	163	0	11,112	6,430	0	12,208	6,784	0
White-Beaked Dolphin	144	32	0	1,164	292	0	1,335	302	0
Odontocetes – Sperm Whale									
Sperm Whale*	110	10	0	1,010	564	0	1,101	584	0
Odontocetes – Beaked Whales									
Blainville's Beaked Whale	792	2	0	4,167	102	0	4,595	107	0
Cuvier's Beaked Whale	1,045	3	0	5,362	133	0	5,943	139	0
Gervais' Beaked Whale	773	6	0	4,096	120	0	4,526	130	0
Northern Bottlenose Whale	2,762	2	0	10,184	130	0	11,946	132	0
Sowerby's Beaked Whale	513	2	0	2,266	41	0	2,617	43	0
True's Beaked Whale	523	1	0	2,762	40	0	3,068	41	0
Odontocetes – *Kogia* Species and Porpoises									
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	7	66	0	25	954	5	29	1061	5
Harbor Porpoise	692,605	23,948	5	1,130,312	70,605	98	1,964,774	78,250	99
Phocid Seals									
Bearded Seal	1	1	0	25	1	0	31	1	0
Gray Seal	71	469	5	1,529	737	6	1,874	828	7
Harbor Seal	197	3,317	38	1,461	5,315	55	1,703	5,833	62
Harp Seal	157	240	0	1,902	739	4	2,275	791	4
Hooded Seal	20	4	0	214	34	0	251	35	0
Ringed Seal*	9	1	0	288	3	0	355	4	0
Manatees									
West Indian Manatee*	0	0	0	0	0	0	0	0	0

PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-17: Predicted Impacts per Event for Sonar and Other Active Acoustic Sources Used in the Biennial Training Activity, Civilian Port Defense – Proposed under Alternatives 1 and 2 Only

	Alternatives 1 & 2[1]		
	Behavioral Reaction	**TTS**	**PTS**
Mysticetes			
Bryde's Whale	0	0	0
Minke Whale	0	0	0
Fin Whale*	0	0	0
Humpback Whale*	0	0	0
North Atlantic Right Whale*	0	0	0
Sei Whale*	0	0	0
Bryde's Whale*	0	0	0
Odontocetes – Delphinids			
Atlantic Spotted Dolphin	149	1	0
Atlantic White-Sided Dolphin	20	0	0
Bottlenose Dolphin	345	6	0
Clymene Dolphin	1	0	0
Common Dolphin	24	0	0
False Killer Whale	0	0	0
Fraser's Dolphin	0	0	0
Killer Whale	1	0	0
Melon-Headed Whale	0	0	0
Pantropical Spotted Dolphin	3	0	0
Pilot Whale	10	0	0
Pygmy Killer Whale	0	0	0
Risso's Dolphin	11	0	0
Rough-Toothed Dolphin	1	0	0
Spinner Dolphin	1	0	0
Striped Dolphin	7	0	0
White-Beaked Dolphin	19	0	0
Odontocetes – Sperm Whale			
Sperm Whale*	1	0	0
Odontocetes – Beaked Whales			
Blainville's Beaked Whale	1	0	0
Cuvier's Beaked Whale	1	0	0
Gervais' Beaked Whale	2	0	0
Northern Bottlenose Whale	2	0	0
Sowerby's Beaked Whale	1	0	0
True's Beaked Whale	1	0	0
Odontocetes – *Kogia* Species and Porpoises			
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	0	1	0
Harbor Porpoise	725	432	0
Phocid Seals			
Gray Seal	47	0	0
Harbor Seal	43	0	0
Harp Seal	4	0	0
Hooded Seal	0	0	0
Manatees			
West Indian Manatee*	0	0	0

PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species
[1] Civilian port defense does not occur under the No Action Alternative.

Table 3.4-18: Predicted Impacts for Nonannual Sonar and Other Active Acoustic Source Testing Activities Involving Unmanned Underwater Vehicle Demonstrations Occurring Once per Five-Year Period at Each Location: Naval Surface Warfare Center, Panama City Division; South Florida Ocean Measurement Facility near Fort Lauderdale, Florida; and Naval Undersea Warfare Center Division, Newport near Newport, Rhode Island

	NSWC PCD (All Alternatives)			SFOMF (Alternatives 1 and 2 Only)			NUWCDIVNPT (All Alternatives)		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Mysticetes									
Blue Whale*	0	1	0	0	1	0	0	0	0
Bryde's Whale	0	1	0	0	3	0	0	0	0
Minke Whale	23	469	1	3	342	0	6	191	1
Fin Whale*	2	30	0	0	2	0	0	14	0
Humpback Whale*	0	2	0	0	2	0	0	1	0
North Atlantic Right Whale*	0	0	0	0	0	0	0	10	0
Sei Whale*	1	14	0	0	18	0	0	1	0
Odontocetes – Delphinids									
Atlantic Spotted Dolphin	52	1,753	0	7	1,168	0	5	190	0
Atlantic White-Sided Dolphin	2	38	0	0	0	0	7	190	0
Bottlenose Dolphin	87	2,731	0	14	1,926	0	13	419	0
Clymene Dolphin	7	157	0	0	10	0	0	0	0
Common Dolphin	74	2,362	0	13	2,622	0	6	145	0
False Killer Whale	0	9	0	0	3	0	0	0	0
Fraser's Dolphin	0	6	0	0	9	0	0	0	0
Killer Whale	2	61	0	1	59	0	0	5	0
Melon-Headed Whale	2	51	0	0	73	0	0	0	0
Pantropical Spotted Dolphin	21	261	0	1	55	0	0	0	0
Pilot Whale	12	351	0	3	385	0	6	120	0
Pygmy Killer Whale	0	4	0	0	11	0	0	0	0
Risso's Dolphin	36	1,111	0	6	723	0	2	77	0
Rough-Toothed Dolphin	0	6	0	0	11	0	0	0	0

NSWC PCD: Naval Undersea Warfare Center, Panama City Division Testing Range; NUWCDIV NPT: Naval Undersea Warfare Center Division, Newport Testing Range; PTS: permanent threshold shift; SFOMF: South Florida Ocean Measurement Facility Testing Range; TTS: temporary threshold shift

Table 3.4-18: Model-Predicted Impacts for Nonannual Sonar and other Active Acoustic Source Testing Activities Involving Unmanned Underwater Vehicle Demonstrations Occurring Once per Five-Year Period at Each Location: Naval Surface Warfare Center, Panama City Division; South Florida Ocean Measurement Facility near Fort Lauderdale, Florida; and Naval Undersea Warfare Center Division, Newport near Newport, Rhode Island (Continued)

	NSWC PCD (All Alternatives)			SFOMF (Alternatives 1 and 2 Only)[1]			NUWCDIVNPT (All Alternatives)		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Spinner Dolphin	17	169	0	1	70	0	0	0	0
Striped Dolphin	20	443	0	4	604	0	1	22	0
White-Beaked Dolphin	0	0	0	0	0	0	9	171	0
Odontocetes – Sperm Whale									
Sperm Whale*	1	27	0	0	52	0	0	3	0
Odontocetes – Beaked Whales									
Blainville's Beaked Whale	10	7	0	16	12	0	3	2	0
Cuvier's Beaked Whale	13	8	0	27	11	0	1	2	0
Gervais' Beaked Whale	29	18	0	36	22	0	1	1	0
Northern Bottlenose Whale	1	1	0	0	0	0	6	6	0
Sowerby's Beaked Whale	21	10	0	0	0	0	4	3	0
True's Beaked Whale	13	5	0	0	0	0	4	2	0
Odontocetes – *Kogia* Species and Porpoises									
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	0	48	1	0	17	1	0	0	0
Harbor Porpoise	0	0	0	0	0	0	121,689	17,326	0
Phocid Seals									
Bearded Seal	0	0	0	0	0	0	0	1	0
Gray Seal	0	0	0	0	0	0	22	557	6
Harbor Seal	0	0	0	0	0	0	37	1,083	15
Harp Seal	0	0	0	0	0	0	36	891	10
Hooded Seal	0	0	0	0	0	0	0	7	0
Ringed Seal*	0	0	0	0	0	0	0	0	0

NSWC PCD: Naval Undersea Warfare Center, Panama City Division Testing Range; NUWCDIV NPT: Naval Undersea Warfare Center Division, Newport Testing Range; PTS: permanent threshold shift; SFOMF: South Florida Ocean Measurement Facility Testing Range; TTS: temporary threshold shift

Note: NA: Species not analyzed for specific area because they do not occur there.

* ESA-listed species

[1] Unmanned Underwater Vehicle Demonstrations would not occur at South Florida Ocean Measurement Facility Testing Range under the No Action Alternative.

3.4.3.1.8.4 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), training activities under the No Action Alternative include activities that produce in-water noise from the use of sonar and other active acoustic sources. Activities could occur throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, and Jacksonville (JAX) Range Complexes, with fewer events in the Gulf of Mexico (GOMEX) and Northeast Range Complexes. These Navy range complexes are within the Northeast and Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area.

Predicted acoustic impacts on marine mammals from exposure to sonar and other active acoustic sources for annually recurring training activities under the No Action Alternative are shown in Table 3.4-15. Civilian Port Defense would not occur under the No Action Alternative; therefore, all sonar and other active acoustic source training activities under the No Action Alternative potentially reoccur each year.

Mysticetes

Predicted impacts on mysticetes from training activities under the No Action Alterative from sonar and other active acoustic sources are primarily (approximately 88 percent) from anti-submarine warfare activities. Remaining predicted effects to mysticetes from this stressor are from surface ship and submarine sonar maintenance and navigation. As discussed in Section 3.4.3.1.8.1 (Range to Effects), ranges to TTS for hull-mounted sonar (e.g., sonar bin MF1: SQS-53 anti-submarine warfare hull-mounted sonar) can be on the order of several kilometers, whereas some behavioral effects could take place at distances exceeding 100 km. Significant behavioral effects, however, are much more likely at higher received levels within a few kilometers of the sound source.

Approximately 68 percent of the predicted acoustic impacts on mysticetes from training activities using sonar and other active acoustic sources under the No Action Alternative are predicted within the JAX Range Complex, followed by the Navy Cherry Point, VACAPES, Northeast, and GOMEX Range Complexes.

Under the No Action Alternative, about 23 percent of predicted acoustic impacts on mysticetes from sonar and other active acoustic sources are due to the major training exercises (composite training unit exercise and joint task force/sustainment exercise). These major training exercises are multi-day events that transition across large areas and involve multiple anti-submarine warfare assets. These events take place in the VACAPES, Navy Cherry Point, and JAX Range Complexes, and one composite training unit exercise per year could take place within the GOMEX Range Complex. Within the JAX Range Complex, sonar activities could be concentrated on the Undersea Warfare Training Range after it is constructed. Potential acoustic impacts from major training exercises, especially behavioral impacts, could be more pronounced given the duration and scale of the events. Some animals may be exposed multiple times over the course of a few days. Many mysticetes may stop vocalizing, break off feeding dives, or ignore the acoustic stimulus, especially if it is more than a few kilometers away. Section 3.4.3.1.2.5 (Behavioral Reactions) discusses research and observations on the behavioral reactions of mysticetes to sonar and other active acoustic sources. Migrating mysticetes may divert around sound sources that are within their path. More sensitive mysticetes may avoid a major training exercise as it moves through an area, although these activities do not use the same training locations day-after-day during multi-day activities. Therefore, displaced animals could return quickly after the major training exercise moves away, allowing the animal to recover from any energy expenditure or missed resources. It is unlikely that most mysticetes would encounter a major training exercise more than once per year.

Training activities involving the coordination of multiple assets, including Group Sail, anti-submarine warfare tactical development exercise, and integrated anti-submarine warfare course, are responsible for approximately 25 percent of the predicted impacts on mysticetes. Although smaller in scale and shorter in duration than major training exercises discussed above, these events can still last for a matter of days and transit across large areas of a range complex. The majority of these events take place within the JAX Range Complex, followed by the Navy Cherry Point and VACAPES Range Complexes; however, the integrated anti-submarine warfare course could also take place in the GOMEX Range Complex once per year. Repeated exposures to some individual whales are likely in these events; however, due to the shorter duration and smaller footprint as compared to major training exercises, impacts from these activities are likely to be less pronounced.

Unit level training activities, including anti-submarine warfare, navigation, and object detection activities, are responsible for approximately 42 percent of the total impacts on mysticetes. These events could take place anywhere within the Study Area, but are concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes, with fewer events taking place within the Northeast and GOMEX Range Complexes. These events often involve the use of a single vessel, perhaps participating with an aircraft, but overall activity is limited and lasts for only a few hours over a small area of ocean. Given the short duration of these activities, they often occur close to homeports and in the same general locations each time. These conditions could result in resident animals more frequently being exposed to these types of activities. Submarine and surface ship sonar maintenance is responsible for about 10 percent of the total predicted acoustic impacts on mysticetes from sonar and other active acoustic sources; however, maintenance activities always involve the use of a single system in a limited manner either pierside or in the open ocean. These training and maintenance activities are limited in scope and duration, so significant behavioral reactions are not expected in most cases.

All other activities, including submarine under ice certification and mine hunting (mine countermeasures–ship sonar and airborne mine countermeasure–mine detection) use high-frequency systems that are not within mysticetes' ideal hearing range; therefore, there were no predicted effects. Section 3.4.2.3 (Vocalization and Hearing of Marine Mammals) discusses low-frequency cetacean (i.e., mysticetes) hearing abilities. It is unlikely that any of the acoustic stressors within these activities would cause a significant behavioral reaction by a mysticete.

North Atlantic Right Whales (ESA-Listed)

North Atlantic right whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. Exposures could occur in feeding grounds off the New England coast, on migration routes along the east coast, and on calving grounds in the southeast off the coast of Florida and Georgia. The acoustic analysis predicts that North Atlantic right whales could be exposed to sound that may result in 22 TTS and 33 behavioral reactions per year. The majority of these impacts are predicted in the JAX Range Complex, where animals spend winter months calving. All predicted impacts would be to the Gulf of Maine stock because this is the only North Atlantic right whale stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways, depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting; breaking off feeding dives and surfacing; diving or swimming away; or no response at all. Additionally, migrating animals may ignore a sound source or may divert around the source if it is in their path. In the ocean, the use of sonar and other active

acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even by a single individual, are unlikely to produce long-term consequences for that individual or the population.

Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. Considering these factors and the low number of overall predicted impacts, long-term consequences for individuals or populations would not be expected.

In the southeast North Atlantic right whale mitigation area (as discussed in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), no training activities using sonar or other active acoustic sources would occur under any alternative with the exception of object detection/navigational sonar training and maintenance activities for surface ships and submarines while entering or exiting ports located in Kings Bay, Georgia, and Mayport, Florida. In addition, training activities involving helicopter dipping sonar would occur off of Mayport, Florida, within the right whale critical habitat. As stated in Section 3.4.2.5 (North Atlantic Right Whale [*Eubalaena glacialis*]), the most concentrated densities of North Atlantic right whales are within the migratory corridor, which includes the southeastern North Atlantic right whale critical habitat at its southern extent. However, the majority of active sonar activities would occur outside the southeast critical habitat. North Atlantic right whales can be found outside designated critical habitat, and sound from nearby activities may be detectable within the critical habitat. Acoustic modeling predictions consider these potential circumstances.

As discussed in detail in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), before transiting through or conducting any training or testing activities within the southeast North Atlantic right whale mitigation area during calving season (15 November to 15 April), the Navy will initiate communication with the Fleet Area Control and Surveillance Facility, Jacksonville to obtain Early Warning System North Atlantic right whale sightings data. When transiting within the mitigation area, all Navy vessels will exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. This high level of awareness will further enhance the Navy's mitigation effectiveness for reducing potential acoustic impacts to North Atlantic right whales.

In the northeast North Atlantic right whale mitigation area (see Chapter 5 [Standard Operating Procedures, Mitigation, and Monitoring] for a description of the area), hull-mounted sonar would not be used during training or testing. However, a limited number of torpedo exercises would be conducted in August and September, when many North Atlantic right whales have migrated south out of the area. These torpedo exercise areas were established during previous ESA consultations with NMFS. Under all alternatives, torpedo exercise activities would not occur within 2.7 nm of the Stellwagen Bank National Marine Sanctuary.

The sound from sonar and other active acoustic sources associated with training activities under the No Action Alternative would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitat (i.e., water temperature and depth in the southeast and copepods in the northeast).

Humpback Whales (ESA-Listed)

Humpback whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that humpback whales could be exposed to sound that may result in 402 TTS and 320 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes. All predicted impacts would be to the Gulf of Maine stock since this is the only humpback whale stock present within the Study Area. The costs and potential long-term consequences to the individuals resulting from predicted TTS and behavioral reactions would be similar to those described above for the North Atlantic right whale. Long-term consequences for populations are not expected.

Sei Whales (ESA-Listed)

Sei whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that sei whales could be exposed to sound that may result in 2,112 TTS and 1,954 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent predicted in the GOMEX and Northeast Range Complexes. All predicted impacts would be to the Nova Scotia stock since this is the only sei whale stock present within the Study Area. The costs and potential long-term consequences to the individuals resulting from predicted TTS and behavioral reactions would be similar to those described above for the North Atlantic right whale. Long-term consequences for populations are not expected.

Fin Whales (ESA-Listed)

Fin whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that fin whales could be exposed to sound that may result in 972 TTS and 879 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of impacts predicted in the GOMEX and Northeast Range Complexes. All predicted impacts would be to the Western North Atlantic stock since this is the only fin whale stock present within the Study Area. The costs and potential long-term consequences to the individuals resulting from predicted TTS and behavioral reactions would be similar to those described above for the North Atlantic right whale. Long-term consequences for populations are not expected.

Blue Whales (ESA-Listed)

Blue whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that blue whales could be exposed to sound that may result in 31 TTS and 26 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of impacts predicted in the GOMEX and Northeast Range Complexes. All predicted impacts would be to the Western North Atlantic stock since this is the only blue whale stock present within the Study Area. The costs and potential long-term consequences to the individuals resulting from predicted TTS and behavioral reactions would be similar to those described above for the North Atlantic right whale. Long-term consequences for populations are not expected.

Minke and Bryde's Whales

Minke and Bryde's whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that Bryde's whales could be exposed to sound that may result in 217 TTS and 181 behavioral reactions. The acoustic analysis predicts that minke whales could be exposed to sound that may result in 2 PTS; 16,175 TTS; and

11,770 behavioral reactions per year. For both species, the majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of impacts predicted in the Northeast Range Complexes. Minke whales also have a relatively small number of impacts predicted in the GOMEX Range Complex. All predicted impacts on minke whales would be to the Canadian East Coast stock and all predicted impacts on Bryde's whales would be to the Gulf of Mexico Oceanic stock since these are the only stocks for these species present within the Study Area.

The costs and potential long-term consequences to the individuals resulting from predicted TTS and behavioral reactions would be similar to those described above for the North Atlantic right whale. Long-term consequences for populations are not expected. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Long-term consequences for minke whale populations, which number in the thousands, are not expected.

Odontocetes

Predicted impacts on odontocetes from training activities under the No Action Alterative from sonar and other active acoustic sources are about 75 percent from anti-submarine warfare activities; about 15 percent from surface ship object detection and submarine navigational exercises; about 9 percent for submarine and surface ship sonar maintenance; and about one percent from mine neutralization and countermeasure exercises. As discussed in Section 3.4.3.1.8.1 (Range to Effects), ranges to TTS for hull-mounted sonar (e.g., sonar bin MF1; SQS-53 anti-submarine warfare hull-mounted sonar) can be on the order of a few hundred meters for mid-frequency odontocetes (cetaceans) but can stretch to distances of over 10 km for high-frequency cetaceans (i.e., harbor porpoises and dwarf and pygmy sperm whales). Some behavioral impacts could take place at distances exceeding 100 km, especially for more sensitive species such as harbor porpoises and beaked whales, although significant behavioral effects are much more likely at higher received levels within a few kilometers of the sound source.

The majority of acoustic impacts on odontocetes from training activities using sonar and other active acoustic sources under the No Action Alternative are predicted within the JAX Range Complex (approximately 57 percent), followed by the VACAPES (approximately 25 percent) and Navy Cherry Point (approximately 10 percent) Range Complexes. The approximately 8 percent of impacts remaining were predicted within the GOMEX and the Northeast Range Complexes.

About 20 percent of predicted acoustic impacts on odontocetes from sonar and other active acoustic sources are due to composite training unit exercise and joint task force/sustainment exercise. These major training exercises are multiday events that transition large areas and involve multiple anti-submarine warfare assets as described above under Mysticetes. More sensitive species of odontocetes such as beaked whales, harbor porpoises, and dwarf and pygmy sperm whales may avoid the area for the duration of the event. Section 3.4.3.1.2.5 (Behavioral Reactions) discusses these species observed reactions to sonar and other active acoustic sources. Displaced animals would likely return after the major training exercise subsides within an area, as seen in the Bahamas study with Blainville's beaked whales (Tyack et al. 2011). This would allow the animal to recover from any energy expenditure or missed resources, reducing the likelihood of long-term consequences for the individual or population.

Training activities involving the coordination of multiple assets include Group Sail, anti-submarine warfare tactical development exercise, and integrated anti-submarine warfare course, which are

responsible for about 21 percent of the predicted impacts on odontocetes. Although smaller in scale and shorter in duration than major training exercises discussed above, these events can still last for days and cover large parts of a range complex. Repeated exposures to some individual animals are likely in these events; however, due to the shorter duration and smaller footprint as compared to major training exercises, impacts from these activities are likely to be less severe. Long-term consequences for individuals or populations would not be expected.

Unit level training activities, including anti-submarine warfare, mine warfare, and navigation and object detection activities, are responsible for about 49 percent of the total impacts on odontocetes. These activities often involve the use of a single vessel, perhaps participating with an aircraft, but overall activity is limited and lasts for only a few hours over a small area of ocean. Given the short duration of these activities, they often occur close to homeports and in the same general locations each time. These conditions could result in resident animals more frequently being exposed to these types of activities. These training activities are very limited in scope and duration, so significant behavioral reactions are not expected in most cases. Long-term consequences for individuals or populations would not be expected.

Submarine and surface ship sonar maintenance is responsible for about 9 percent of the total predicted acoustic impacts on odontocetes from sonar and other active acoustic sources; however, maintenance events always involve the use of a single system being used in a limited manner either pierside or in the open ocean. Because of the very low activity level and short duration of these events and because many of these events are proposed in high-use ports, significant behavioral reactions are not expected in most cases. Long-term consequences for individuals or populations would not be expected.

Sperm Whales (ESA-Listed)

Sperm whales (classified as mid-frequency cetaceans [Section 3.4.2.3.2, Mid-Frequency Cetaceans]) may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that sperm whales could be exposed to sound that may result in 92 TTS and 6,623 behavioral reactions. Sperm whales within the Study Area belong to one of three stocks: North Atlantic; Gulf of Mexico Oceanic; or Puerto Rico and U.S. Virgin Islands. Predicted effects on sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico Oceanic stock, whereas the majority of impacts predicted offshore of the east coast would impact the North Atlantic stock.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if sperm whales are exposed to sonar or other active acoustic sources, they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Sperm whales have shown resilience to acoustic and human disturbance, although they may react to sound sources and activities within a few kilometers. Sperm whales that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, avoid the area by swimming away or diving, or display aggressive behavior. Long-term consequences for individuals or populations would not be expected.

Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days depending on the severity of the initial shift. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. Considering these factors, and the low

number of overall predicted impacts, long-term consequences for individuals or populations would not be expected.

Dolphins and Small Whales (Delphinids)

Dolphins (classified as mid-frequency cetaceans [Section 3.4.2.3.2, Mid-Frequency Cetaceans]) may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that delphinids (17 species total) could be exposed to sound that may result in 37,616 TTS and 744,301 behavioral reactions. Most delphinid species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted impacts on delphinids within the Gulf of Mexico are presumed to be primarily to the Gulf of Mexico stocks, whereas the majority of impacts predicted offshore of the east coast would be to the Western North Atlantic stocks. Bottlenose dolphins are divided into one oceanic and many coastal stocks along the east coast. The majority of exposures to bottlenose dolphins are likely to the oceanic stock with the exception of nearshore and in-port events, which could expose animals in coastal stocks.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if delphinids are exposed to sonar or other active acoustic sources, they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Delphinids may not react at all until the sound source is approaching within a few hundred meters to within a few kilometers, depending on the species. Delphinids that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, change their behaviors or vocalizations, avoid the sound source by swimming away or diving, or be attracted to the sound source. Long-term consequences to individual delphinids or populations are not likely due to exposure to sonar or other active acoustic sources.

Costs and long-term consequences to the individual and population resulting from a marine mammal receiving a TTS are discussed in the sections above (see Sperm Whales). Population level consequences are not expected.

Beaked Whales

Beaked whales may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that beaked whales (six species total) could be exposed to sound that may result in 204 TTS and 67,906 behavioral reactions. Most beaked whale species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted impacts on beaked whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if beaked whales are exposed to sonar or other active acoustic sources they may startle, break off feeding dives, and avoid the area of the sound source to levels of 157 dB re 1 μPa, or below (McCarthy et al. 2011). Furthermore, in research done at the Navy's fixed tracking range in the Bahamas, animals leave the immediate area of the anti-submarine warfare training exercise but return within a few days after the event ends. Populations of beaked whales and other odontocetes on the Bahamas, and other Navy fixed ranges that have been operating for tens of years, appear to be stable (Section 3.4.3.1.6, Marine Mammal Monitoring during Navy Training). Significant behavioral reactions seem likely in most cases if beaked whales are exposed to anti-submarine sonar within a few tens of kilometers (Section 3.4.3.1.8.1, Range

to Effects), especially for prolonged periods (a few hours or more) since this is one of the most sensitive marine mammal groups to anthropogenic sound of any species or group studied to date.

Costs and long-term consequences to the individual and population resulting from a marine mammal receiving a TTS are discussed in the sections above (see Sperm Whales). Population level consequences are not expected.

Based on the best available science, the Navy believes that beaked whales that exhibit a significant behavioral reaction due to sonar and other active acoustic training activities would generally not have long-term consequences for individuals or populations. However, because of a lack of scientific consensus regarding the causal link between sonar and stranding events, NMFS has stated in a letter to the Navy dated October 2006 that it "cannot conclude with certainty the degree to which mitigation measures would eliminate or reduce the potential for serious injury or mortality."

Therefore, the Navy is requesting up to 10 serious injury or mortality takes for beaked whale species per year, and no more than 10 serious injury or mortality takes for beaked whale species over a five-year period. This approach overestimates the potential effects on marine mammals associated with Navy sonar training in the Study Area, as no mortality or serious injury of any species is anticipated. This request will be made even though almost 40 years of conducting similar exercises without observed incident in the operating environments represented in the Study Area indicate that injury, strandings, and mortality are not expected to occur resulting from Navy activities.

Neither NMFS nor the Navy anticipates that marine mammal strandings or mortality will result from the operation of sonar during Navy exercises within the Study Area. Additionally, through the MMPA process (which allows for adaptive management), NMFS and the Navy will determine the appropriate way to proceed in the event that a causal relationship were to be found between Navy activities and a future stranding.

Pygmy and Dwarf Sperm Whales (*Kogia* spp.)

Pygmy and dwarf sperm whales (genus: *Kogia*) may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that pygmy and dwarf sperm whales could be exposed to sound that may result in 5 PTS; 1,995 TTS; and 104 behavioral reactions. The majority of predicted impacts on these species are within the JAX and GOMEX Range Complexes. *Kogia* species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico Oceanic. Predicted impacts on pygmy and dwarf sperm whales within the Gulf of Mexico are presumed to be primarily to the Gulf of Mexico stocks, whereas the majority of impacts predicted offshore of the east coast would be to the Western North Atlantic stocks.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) on *Kogia* species are limited. However, these species tend to avoid human activity and presumably anthropogenic sounds. Pygmy and dwarf sperm whales may startle and leave the immediate area of the anti-submarine warfare training exercise. Significant behavioral reactions seem more likely than with most other odontocetes; however, it is unlikely that animals would receive multiple exposures over a short period, allowing animals time to recover lost resources (e.g., food) or opportunities (e.g., mating). Therefore, long-term consequences for individual *Kogia* or their respective populations are not expected.

Costs and long-term consequences to the individual and population resulting from a marine mammal receiving a TTS are discussed above. Population-level consequences are not expected.

Harbor Porpoises

Harbor porpoises may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 57 PTS; 18,955 TTS; and 117,605 behavioral reactions. Predicted impacts on this species are within the VACAPES and Northeast Range Complexes, primarily within inland waters and in the Northeast U.S. Continental Shelf Large Marine Ecosystem. All harbor porpoises within the Study Area belong to the Gulf of Maine/Bay of Fundy Stock, and therefore all predicted impacts would be on this stock.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) of harbor porpoises show that this small species is very wary of human activity and will avoid anthropogenic sound sources in many situations at levels down to 120 dB re 1 μPa. This level was determined by observing harbor porpoise reactions to acoustic deterrent and harassment devices used to drive away animals from around fishing nets and aquaculture facilities. Avoidance distances typically were about 1 km or more, but it is unknown if animals would react similarly if the sound source were at a distance of tens or hundreds of kilometers. The behavioral response function is not used to estimate behavioral responses by harbor porpoises; rather, a single threshold is used. Because of this very low behavioral threshold (120 dB re 1 μPa) for harbor porpoises, animals at distances exceeding 200 km in some cases are predicted to have a behavioral reaction in this acoustic analysis. It is not known whether animals would actually react to sound sources at these ranges, regardless of the received sound level. Harbor porpoises may startle and leave the immediate area of the anti-submarine warfare training exercise but return within a few days after the cessation of the event. Significant behavioral reactions seem more likely than with most other odontocetes. Since these species are typically found in nearshore and inshore habitats, animals that are resident during all or part of the year near Navy ports or fixed ranges could receive multiple exposures over a short period and throughout the year. Animals that do exhibit a significant behavioral reaction would likely recover from any incurred costs, reducing the likelihood of long-term consequences for the individual or population.

PTS and TTS are predicted for harbor porpoises. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Consequences for the population would not be expected even if a few individuals suffered long-term consequences because harbor porpoise populations number in the tens of thousands.

Phocid Seals

Predicted effects on pinnipeds from annual training activities under the No Action Alterative from sonar and other active acoustic sources indicate that three species of phocid seals (i.e., gray, harbor, and hooded seals) could be exposed to sound that may result in 63 behavioral reactions; these impacts happen almost entirely within the Northeast Range Complexes. Predicted impacts on phocid seals are from submarine sonar maintenance (about 57 percent), submarine tracking exercise/torpedo exercise events (about 40 percent), and submarine navigational activities within the VACAPES and Northeast Range Complexes and adjacent Navy ports (e.g., Norfolk) (approximately 3 percent). These activities use

anti-submarine warfare hull-mounted sonar. As discussed in Section 3.4.3.1.8.1 (Range to Effects) ranges to TTS for hull-mounted sonar (e.g., sonar bin MF1; SQS-53) can be several kilometers for phocid seals. Some behavioral impacts could hypothetically take place at distances exceeding 100 km, although significant behavioral impacts are much more likely at higher received levels within a few kilometers of the sound source. Bearded and ringed seals are rare in the Study Area and would generally not occur in areas proposed for training activities that use sonar and other active acoustic sources. The acoustic model predicted no exposures to these two species.

Impacts are predicted to occur mostly within the Northeastern U.S. Continental Shelf Large Marine Ecosystem, with some effects predicted for the Gulf Stream Open Ocean Area. The hooded, gray, and harbor seals are all part of their species' respective Western North Atlantic stocks. Therefore, all predicted exposures to pinnipeds are associated with the species' single stock represented within the Study Area.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that pinnipeds in the water are tolerant of anthropogenic noise and activity. If seals are exposed to sonar or other active acoustic sources, they may react in various ways, depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Seals may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Significant behavioral reactions would not be expected in most cases, and long-term consequences for individual seals or populations are unlikely.

Recovery from a hearing threshold shift (i.e., partial hearing loss- TTS) can take a few minutes to a few days depending on the severity of the initial shift. More severe shifts may not fully recover and thus would be considered PTS. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Manatees (ESA-Listed)

The manatee is considered an inshore species, with most sightings occurring in warm fresh and brackish water, estuaries, and extremely nearshore coastal waters. During winter, manatees are largely restricted to Florida. Distribution expands northward into southeastern Georgia and beyond and westward in the Gulf of Mexico during warmer months.

Predicted impacts on manatees from training activities that use sonar and other active acoustic sources under the No Action Alterative are due to surface ship object detection at Mayport, Florida. All impacts on manatees are predicted within the JAX Range Complex at Mayport, Florida. This activity uses hull-mounted mid-frequency active sonar to locate underwater objects that may impede transit in and out of port. As discussed in Section 3.4.3.1.8.1 (Range to Effects), ranges to some behavioral impacts could take place at distances exceeding 100 km; however, only a very small percentage of marine mammals would be expected to react to the low received levels at these long distances. Significant behavioral impacts are much more likely at higher received levels within a few kilometers of the sound source.

West Indian manatees may be exposed to sonar or other active acoustic stressors associated with training activities throughout the year. The acoustic analysis predicts that manatees at Mayport, Florida

could be exposed to sound that may result in 9 behavioral reactions. However, a single density estimate was applied across all seasons during the acoustic modeling process; therefore, differences in seasonal occurrence were not accounted for within the predicted impacts. In reality, manatee occurrence in the Mayport area where the acoustic impacts are predicted varies throughout the year with significantly lower densities during the colder winter months when the majority of the manatee population migrates to central and southern Florida. In addition, the predicted impacts do not factor in implementation of mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), that are intended to reduce potential impacts from activities involving sonar and other active acoustic sources.

Manatees within the Port Canaveral and Mayport portions of the designated West Indian manatee critical habitat areas may be exposed to sound from sonar and other active acoustic sources. The primary constituent elements of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presence of seagrasses and warm water refuges. These elements would not be impacted by the sound or energy from sonar or other active acoustic sources.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that manatees are generally tolerant, or perhaps habituated, to high levels of anthropogenic noise and activity. Manatees that did react have been observed alerting and swimming to deeper water in response to active acoustic sources. Manatees may not react at all until the sound source is approaching within a few hundred meters. Significant behavioral reactions would not be expected, and long-term consequences for individuals or populations are unlikely.

Conclusion

Training activities under the No Action Alternative include the use of sonar and other active acoustic sources as described in Table 2.8-1 and Section 3.0.5.3.1 (Acoustic and Explosive Stressors). These activities do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be exposed to noise associated with these stressors.

It is important to note, as discussed in Section 3.4.3.1.5.6, that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during training activities as described under the No Action Alternative:

- *may expose marine mammals up to 1,030,567 times annually to sound levels that would be considered Level B harassment;*
- *may expose marine mammals up to 64 times annually to sound levels that would be considered Level A harassment; and*
- *may expose up to 10 beaked whales annually and no more than 10 beaked whales in a five-year period to sound levels that may elicit stranding and subsequent serious injury or mortality.*

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whaled;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.8.5 No Action Alternative – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-2 and 2.8-3 in Section 3.0.5.3.1 (Acoustic and Explosive Stressors), testing activities under the No Action Alternative include activities that use sonar and other active acoustic sources that produce underwater sound. These activities would be concentrated in the Northeast Range Complexes and the Rhode Island inland waters, with lesser amounts of activity in the GOMEX Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. VACAPES, JAX, and Key West Range Complexes also host a significant number of testing activities. Within these range complexes, activities involving the use of sonar and other active acoustic sources are concentrated on the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems and Gulf Stream Open Ocean Area.

Predicted acoustic impacts on marine mammals from exposure to sonar and other active acoustic sources for annually recurring testing activities under the No Action Alternative are shown in Table 3.4-16. Unmanned underwater vehicle demonstrations would be conducted under the No Action Alternative no more than once per five-year period at each of the following locations: Naval Surface Warfare Center, Panama City Division Testing Range and Naval Undersea Warfare Center Division, Newport Testing Range. Model predicted impacts for these nonrecurring activities (i.e., do not happen annually, but once over the five-year period) are shown in Table 3.4-18.

Mysticetes

About 50 percent of predicted impacts on mysticetes from annual testing activities under the No Action Alternative from sonar and other active acoustic sources would occur in the Northeast Range Complexes and testing ranges due primarily to submarine sonar testing and maintenance, torpedo testing, and unmanned underwater vehicle testing. About 30 percent of predicted impacts on mysticetes would occur at Naval Surface Warfare Center, Panama City Division Testing Range; the GOMEX Range Complex; and the Key West Range Complex due primarily to anti-submarine warfare sonar testing, unmanned underwater vehicle testing, and mine detection classification testing. Testing activities in the VACAPES and JAX Range Complexes are responsible for about 18 percent of the predicted impacts on mysticetes primarily due to unmanned underwater vehicle testing, torpedo testing, and submarine sonar testing.

North Atlantic Right Whales (ESA-Listed)

North Atlantic right whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year, especially in feeding grounds off the New England coast. The acoustic analysis predicts that North Atlantic right whales could be exposed to sound that may result in 2 TTS and 2 behavioral reactions. These impacts are predicted in Rhode Island inland waters and within the Northeast Range Complexes. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 10 TTS over the five-year period. All predicted impacts would be to the Western North Atlantic stock because this is the only North Atlantic right whale stock present within the Study Area.

The sound from sonar and other active acoustic sources associated with training activities under the No Action Alternative would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitat (i.e., water temperature and depth in the southeast and copepods in the northeast).

Predicted impacts are low overall. Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Humpback Whales (ESA-Listed)

Humpback whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that humpback whales could be exposed to sound that may result in 10 TTS and 12 behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 3 TTS over the five-year period. All predicted impacts would be to the Gulf of Maine stock since this is the only humpback whale stock present within the Study Area.

Predicted impacts are low overall. Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Sei Whales (ESA-Listed)

Sei whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that sei whales could be exposed to sound that may result in 21 TTS and 37 behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 15 TTS and 1 behavioral reaction over the five-year period, primarily at Naval Surface Warfare Center, Panama City Division Testing Range. All predicted impacts would be to the Nova Scotia stock because this is the only sei whale stock present within the Study Area.

Predicted impacts are low overall. Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Fin Whales (ESA-Listed)

Fin whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that fin whales could be exposed to sound that may result in 21 TTS and 38 behavioral reactions. The majority of these impacts are predicted within the Northeast Range Complexes with lesser impacts in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 44 TTS and 2 behavioral reactions over the five-year period, primarily at Naval Surface Warfare Center, Panama City Division Testing Range. All predicted impacts would be to the Western North Atlantic stock since this is the only fin whale stock present within the Study Area.

Predicted impacts are low overall. Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Blue Whales (ESA-Listed)

Blue whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that one TTS and one behavioral reaction may result from annual testing activities that use sonar and other active acoustic sources. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in one TTS over the five-year period. All predicted impacts would be to the Western North Atlantic stock because this is the only blue whale stock present within the Study Area.

Predicted impacts are low overall. Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Minke and Bryde's Whales

Minke and Bryde's whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that minke whales could be exposed to sound that may result in 337 TTS and 400 behavioral reactions, and Bryde's whale could be exposed to sound that may result in one TTS and two behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose minke whales to sound that may result in 2 PTS, 660 TTS, and 29 behavioral reactions and Bryde’s whales to sound that may result in one TTS over the five-year period. All predicted effects on minke whales would be to the Canadian East Coast stock because this is the only stock present within the Study Area.

Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Odontocetes

Predicted effects on odontocetes from annual testing activities under the No Action Alterative from sonar and other active acoustic sources are primarily (approximately 96 percent) to harbor porpoises in the Northeast Range Complexes within the Northeastern U.S. Continental Shelf Large Marine Ecosystem primarily due to anti-submarine warfare tracking testing and torpedo testing. The remaining testing impacts under the No Action Alternative include anti-submarine warfare testing, stationary and semi-stationary source testing, and unmanned underwater vehicle testing. These activities would primarily occur within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

Many testing events involve the use of a single sound source and have low levels of activity overall. More sensitive odontocetes (e.g., harbor porpoises, beaked whales, and pygmy and dwarf sperm whales) may avoid the area for the duration of the testing event. Because of the limited scope and duration of most testing events, significant behavioral reactions are not expected in most cases and model predicted results are likely an overestimate.

Sperm Whales (ESA-Listed)

Sperm whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that sperm whales could be exposed to sound that may result in 10 TTS and 110 behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 30 TTS and one behavioral reaction over the five-year period. Sperm whales within the Study Area belong to one of three stocks: North Atlantic; Gulf of Mexico Oceanic; or Puerto Rico and U.S. Virgin Islands. Predicted impacts on sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico Oceanic stock, whereas the majority of impacts predicted offshore of the east coast would impact the North Atlantic stock.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if sperm whales are exposed to sonar or other active acoustic sources, they may react in a variety of ways, depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Sperm whales have shown resilience to acoustic and human disturbance, although they may react to sound sources and activities within a few kilometers. Sperm whales that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, avoid the area by swimming away or diving, or display aggressive behavior. Long-term consequences to the individual or population are not expected.

Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause TTS or behavioral reactions are discussed in Section 3.4.3.1.8.4 (No Action Alternative – Training Activities). Long-term consequences to the individual or population are not expected.

Dolphins and Small Whales (Delphinids)

Dolphins and small whales (delphinids) may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that delphinids (17 species total) could be exposed to sound that may result in 3,117 TTS and 16,416 behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 10,852 TTS and 381 behavioral reactions over the five-year period. Most delphinid species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted effects on delphinids within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks. Bottlenose dolphins are divided into multiple coastal and one oceanic stock along the east coast. The majority of exposures to bottlenose dolphins are likely to the oceanic stock with the exception of nearshore and in-port events that could expose coastal animals.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if dolphins are exposed to sonar or other active acoustic sources, they may react in a variety of ways, depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Delphinids may not react at all until the sound source is approaching within a few hundred meters to within a few kilometers depending on the species. Delphinids that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, change their behaviors or vocalizations, avoid the area by swimming away or diving, or be attracted to the sound source. Long-term consequences to individual dolphins or populations are not likely from exposure to sonar or other active acoustic sources.

Recovery from a hearing threshold shift (i.e., partial hearing loss- TTS) can take a few minutes to a few days, depending on the severity of the initial shift. More severe shifts may not fully recover and thus would be considered PTS. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Beaked Whales

Beaked whales may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that beaked whales (six species total) could be exposed to sound that may result in 16 TTS and 6,408 behavioral reactions. The majority of these impacts happen within the Northeast Range Complexes, with lesser effects in the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 65 TTS and 106 behavioral reactions over the five-year period. Most beaked whale species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted effects on beaked whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if beaked whales are exposed to sonar or other active acoustic sources they may startle, break off feeding dives, and avoid the area of the sound source to levels below 157 dB re 1 μPa (McCarthy et al. 2011). Significant behavioral reactions seem likely in most cases if beaked whales are exposed to sonar within a few tens of kilometers (Section 3.4.3.1.8.1, Range to Effects), especially for prolonged periods (a few hours or more) since this is one of the most sensitive marine mammal groups to anthropogenic sound of any species or group studied to date.

Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause PTS or TTS are discussed above for delphinids and would be similar for beaked whales. Long-term consequences to the individual or population are not expected.

Pygmy and Dwarf Sperm Whales (*Kogia* spp.)

Pygmy and dwarf sperm whales (genus: *Kogia*) may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year. The acoustic analysis predicts that pygmy and dwarf sperm whales could be exposed to sound that may result in 66 TTS and 7 behavioral reactions. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 1 PTS and 48 TTS over the five-year period. *Kogia* species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico Oceanic. Predicted effects on pygmy and dwarf sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) on *Kogia* species are limited, however these species tends to avoid human activity and presumably anthropogenic sounds. Pygmy and dwarf sperm whales may startle and leave the immediate area of the testing exercise but return within a few days after the end of the event. Significant behavioral reactions seem more likely than with most other odontocetes; however, it is unlikely that animals would receive multiple exposures over a short

time period. Those that do exhibit a significant behavioral reaction may recover from any incurred costs, reducing the likelihood of long-term consequences for the individual or population.

Costs and long-term consequences for individuals and populations due to exposure to sound levels that may cause PTS or TTS are discussed above for delphinids and are assumed to be similar for dwarf and pygmy sperm whales. Long-term consequences for the individual or population are not expected.

Harbor Porpoises

Harbor porpoises may be exposed to sonar or other active acoustic stressors associated with testing activities throughout the year under the No Action Alternative. The acoustic analysis indicates that harbor porpoises could be exposed in annual testing activities to levels of sonar and other active acoustic sources resulting in 5 PTS; 23,948 TTS; and 692,605 behavioral responses. Almost all effects on harbor porpoises due to sonar and other active acoustic stressors proposed for use in testing activities would occur within the Northeast Range Complexes, with a few exposures within the VACAPES Range Complex. Nonrecurring, unmanned underwater vehicle demonstrations could expose animals to sound that may result in 17,326 TTS and 121,689 behavioral reactions over the five-year period at Naval Undersea Warfare Center Division, Newport Testing Range. All harbor porpoises within the Study Area belong to the Gulf of Maine/Bay of Fundy stock, and therefore all predicted impacts would be incurred to this stock.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) of harbor porpoises show that this small species is very wary of human activity and will avoid anthropogenic sound sources in many situations at levels down to 120 dB re 1 µPa. This level was determined by observing harbor porpoise reactions to acoustic deterrent and harassment devices used to drive away animals from around fishing nets and aquaculture facilities. Avoidance distances typically were 1 km or more, but it is unknown if an animals would react similarly if the sound source was located at a distance of tens or hundreds of kilometers. The behavioral response function is not used to estimate behavioral responses by harbor porpoises; rather, a single threshold is used. Because of this very low behavioral threshold (120 dB re 1 µPa) for harbor porpoises, in some cases animals at distances exceeding 200 km are predicted to have a behavioral reaction in this acoustic analysis. Since a large proportion of testing activities happen within harbor porpoise habitat in the northeast, predicted effects on this species are relatively greater than predicted effects for other marine mammals. Nevertheless, it is not known whether animals would actually react to sound sources at these ranges, regardless of the received sound level. Harbor porpoises may startle and leave the immediate area of the testing event but may return after the end of the event. Significant behavioral reactions seem more likely than with most other odontocetes, especially at closer ranges (within a few kilometers). Since these species are typically found in nearshore and inshore habitats, animals that are resident during all or part of the year near Navy ports or fixed ranges in the northeast could receive multiple exposures over a short period and throughout the year. Animals that do exhibit a significant behavioral reaction would likely recover from any incurred costs, reducing the likelihood of long-term consequences for the individual or population.

Animals that do experience hearing loss (PTS or TTS) may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term

consequences for that individual, although many mammals lose hearing ability as they age. Long-term consequences for the population would not be expected.

Phocid Seals

The acoustic analysis indicates that phocid seals could be exposed to sound that may result in 43 PTS, 4,032 TTS, and 455 behavioral reactions during annual testing activities using sonar and other active acoustic sources under the No Action Alterative; these impacts would happen almost entirely within the Northeast Range Complexes. Nonrecurring unmanned underwater vehicle demonstrations could expose animals to sound that may result in 31 PTS; 2,539 TTS; and 95 behavioral reactions over the five-year period at Naval Undersea Warfare Center Division, Newport Testing Range.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that pinnipeds in the water are tolerant of anthropogenic noise and activity. If seals are exposed to sonar or other active acoustic sources, they may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Significant behavioral reactions would not be expected in most cases, and long-term consequences for individual seals or populations are unlikely.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Manatees (ESA-Listed)

The manatee is considered an inshore species, with most sightings occurring in warm fresh and brackish water, estuaries, and extremely nearshore coastal waters. During winter, manatees are largely restricted to Florida. Distribution expands northward into southeastern Georgia and beyond, and westward in the Gulf of Mexico during warmer months.

Manatees may be exposed to sonar and other active acoustic sources during proposed testing activities in inland waters along the southeastern United States and Gulf of Mexico; however the Navy's acoustic model indicates no predicted effects from annual testing activities under the No Action Alterative using sonar and other active acoustic sources. The AFTT Draft EIS/OEIS previously stated that manatees could be exposed to sound that may result in TTS at Submarine Base Kings Bay, Georgia, from mid-frequency pierside sonar testing. Source level reductions in pierside testing are standard protocol, and a reduction of a minimum of 36 dB from full power for mid-frequency transmissions at Kings Bay will be implemented. Navy's acoustic model indicated no predicted effects for manatees, once this source level reduction was accounted for.

Manatees within the Port Canaveral and Mayport portions of the designated West Indian manatee critical habitat areas may be exposed to sound from sonar and other active acoustic sources. The primary constituent element of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presence of seagrasses and warm water refuges. These elements would not be impacted by the sound or energy from sonar or other active acoustic sources.

Conclusion

Testing activities under the No Action Alternative include the use of sonar and other active acoustic sources as described in Table 2.8-2 to 2.8-3 and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources). These activities do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be exposed to sound associated with these stressors.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during testing activities as described under the No Action Alternative:

- *may expose marine mammals up to 748,075 times annually to sound levels that would be considered Level B harassment;*
- *may expose marine mammals up to 48 times annually to sound levels that would be considered Level A harassment;*
- *may expose marine mammals up to 153,898 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level B harassment; and*
- *may expose marine mammals up to 34 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level A harassment.*

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.8.6 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1 and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), the number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would increase. These activities would happen in the same general locations under Alternative 1 as under the No Action Alternative, with the following exceptions:

- Training activities under Alternative 1 were analyzed in areas both within and outside of Navy range complexes and OPAREAs, as well as in areas normally used by vessels crossing the Atlantic Ocean. Predicted impacts on mysticetes and odontocetes in these areas include 70,079 behavioral reactions and 2,115 TTS; however, many activities analyzed in these areas under

Alternative 1 were analyzed within range complexes under the No Action Alternative so that overall predicted impacts are similar for these activities.

- Airborne mine countermeasure training activities would increase in the GOMEX Range Complex to about 288 events per year from zero events under the No Action Alternative. Airborne mine countermeasure training activities have relatively low numbers of predicted acoustic impacts on marine mammals overall, so this change in activities does not present a notable change in predicted impacts.
- Ship mine countermeasure exercises that use ship mine detecting sonar would decrease in the GOMEX Range Complex from 274 events per year under the No Action Alternative to 20 events per year under Alternative 1 due to the introduction of the Littoral Combat Ship and the relocation of the mine countermeasure ships to the west coast. In turn, some of these events would move to the JAX and VACAPES Range Complexes, increasing to 48 events per year per area from no events under the No Action Alternative.

New training activities proposed under Alternative 1 and notable increases in numbers of activities from the No Action Alternative are as follows:

- Alternative 1 would include the mine warfare training activity civilian port defense, which is not included under the No Action Alternative. Table 3.4-16 lists predicted marine mammal impacts. Acoustic analysis predicts that a maximum of 1,420 behavioral reaction and 440 TTS on marine mammals could occur during each event. This could take place biennially in any of the following locations: Earle, New Jersey; Groton, Connecticut; Hampton Roads, Virginia; Morehead City, North Carolina; Wilmington, North Carolina; Kings Bay, Georgia; Mayport, Florida; Beaumont, Texas; or Corpus Christi, Texas. Predicted impacts associated with sonar and other active acoustic sources used in these events are very low due to the higher frequencies and lower power of mine detecting sonar (e.g., AN/AQS-20) used in these events. Predicted impacts on ESA-listed species include only one behavioral reaction from a sperm whale; however, all ESA-listed marine mammals within the Study Area could be exposed to sound from these events. Significant behavioral reactions would be unlikely for most species during these events.
- Two additional joint task force/sustainment exercises per year (four total) are proposed under Alternative 1, doubling the number of proposed events and therefore doubling the predicted impacts from these events to all species.
- Submarine under ice certification is a new activity proposed under Alternative 1, although acoustic analysis predictions show low impacts on marine mammals overall from sonar and other active acoustic sources used in this activity in the VACAPES and Northeast Range Complexes.
- Submarine sonar maintenance events would roughly double under Alternative 1 over the No Action Alternative. This would in turn double the predicted marine mammal impacts associated with this activity in the Northeast and VACAPES Range Complexes and in inland waters near Norfolk, Virginia.

The increase in proposed activities under Alternative 1 over the No Action Alternative would in turn lead to an approximately 99 percent increase in predicted acoustic impacts to marine mammal species. This could mean an increase in the number of individual animals exposed per year, or an increase in the number of times per year some individuals are exposed, although the types and severity of individual responses to sonar and other active acoustic sources are unlikely to change. Predicted acoustic impacts on marine mammals from exposure to sonar and other active acoustic sources for annually recurring

training activities under Alternative 1 are shown in Table 3.4-14. Notable results for Alternative 1 are as follows:

- Predicted acoustic impacts on mysticetes overall would increase by about 122 percent. The most substantial differences in predicted impacts are within the VACAPES Range Complex. Under Alternative 1, one fin, one humpback, and one sei whale are predicted to suffer PTS that were not predicted under the No Action Alternative.
- Predicted acoustic impacts on ESA-listed sperm whales increase by about 120 percent for Alternative 1 as compared to the No Action Alternative. This is primarily due to increased proposed activity, and therefore predicted impacts, within the VACAPES Range Complex.
- Predicted acoustic impacts on dolphins and small-toothed whales increase by about 114 percent.
- Predicted acoustic impacts on beaked whales increase by about 100 percent. This is primarily due to increased joint task force/sustainment exercise and tracking exercise/torpedo exercise anti-submarine warfare activities in the JAX Range Complex leading to higher predicted behavioral reactions.
- Predicted acoustic impacts on harbor porpoises increase by about 3 percent, and predicted impacts on pygmy and dwarf sperm whales increase by about 141 percent.
- Predicted acoustic impacts on phocid seals increase by about 26 percent. No PTS are predicted.

Costs and long-term consequences for individuals and the population resulting from exposure to sonar and other active acoustic source sound and energy are discussed in Section 3.4.3.1.9.4 (No Action Alternative – Training Activities). Although the numbers and locations of the predicted reactions differ some between Alternative 1 and the No Action Alternative, the types and severity of reactions and the related consequences would be similar (Section 3.4.3.1.8.4, No Action Alternative – Training Activities).

Training activities involving sonar and other active acoustic sources proposed under Alternative 1 do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be impacted by noise associated with proposed Navy training activities.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during training activities as described under Alternative 1:

- *may expose marine mammals 2,049,956 times per year to sound levels that would be considered Level B harassment;*
- *may expose marine mammals 88 times per year to sound levels that would be considered Level A harassment;*
- *may expose marine mammals up to 1,860 times during each biennial civilian port defense activity to sound levels that would be considered Level B harassment;*
- *would not expose marine mammal to sound levels that would be considered Level A harassment during the biennial civilian port defense activities; and*
- *may expose up to 10 beaked whales annually and no more than 10 beaked whales over a five-year period to sound levels that may elicit stranding and subsequent serious injury or mortality.*

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.8.7 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Sonar and Other Active Acoustic Sources), the number of annual testing activities that produce in-water noise from the use of sonar and other active acoustic sources analyzed under Alternative 1 would increase over what was analyzed for the No Action Alternative (Section 3.4.3.1.9.5 describes predicted impacts on marine mammals under the No Action Alternative from testing activities). These activities would happen in the same general locations under Alternative 1 as under the No Action Alternative.

In addition to unmanned underwater vehicle demonstrations described under the No Action Alternative conducted once per five-year period at both Naval Surface Warfare Center, Panama City Division Testing Range and Naval Undersea Warfare Center Division, Newport Testing Range, one unmanned underwater vehicle demonstration per five-year period could be conducted at the South Florida Ocean Measurement Facility Testing Range near Fort Lauderdale under Alternative 1. See Table 3.4-17 for predicted marine mammal impacts. Predicted impacts associated with sonar and other active acoustic sources used in this event are relatively low. The ESA-listed species blue whale, humpback whale, sei whale, fin whale, and sperm whale all have predicted TTS. No PTS is predicted to ESA-listed species for this testing event.

The increase in proposed annual testing activities under Alternative 1 over the No Action Alternative would in turn lead to an approximately 89 percent increase in predicted impacts (behavioral reactions, TTS and PTS) to marine mammals due to an increase in proposed testing activities. This could increase the number of individual animals exposed per year or increase the number of times per year some animals are exposed, although the types and severity of individual responses to sonar and other active

acoustic sources are unlikely to change. Predicted acoustic impacts on marine mammals from exposure to sonar and other active acoustic sources for annually recurring testing activities under Alternative 1 are shown in Table 3.4-15. Notable results for Alternative 1 are as follows:

- Predicted impacts on mysticetes increased by a factor of about nine times, and predicted impacts on ESA-listed mysticetes increased by a factor of about 10 times over the No Action Alternative. There is one predicted PTS to a minke whale per year for annual testing. All other predicted impacts on mysticetes are TTS and behavioral reactions.
- Predicted acoustic impacts on the ESA-listed sperm whale would increase by a factor of about 13 times over the No Action Alternative. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on delphinids from sonar and other active acoustic sources would increase by a factor of about eight times as compared to the No Action Alternative. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on beaked whales from sonar and other active acoustic sources would increase by a factor of about five times over the No Action Alternative. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on harbor porpoises would increase by approximately 68 percent compared to the No Action Alternative. Behavioral reactions, TTS, and PTS are predicted.
- Predicted acoustic impacts on pygmy and dwarf sperm whales from sonar and other active acoustic sources would increase by a factor of about 14 times compared to the No Action Alternative. This includes 5 PTS predictions not included under the No Action Alternative.
- Predicted acoustic impacts on phocid seals from sonar and other active acoustic sources would increase by a factor of about three times for Alternative 1 as compared to the No Action Alternative. Behavioral reactions, TTS, and PTS are predicted.

Costs and long-term consequences for individuals and the population resulting from exposure to sonar and other active acoustic source sound and energy are discussed above under the No Action Alternative. Although the numbers and locations of the predicted reactions differ some between Alternative 1 and the No Action Alternative, the types and severity of reactions and the related consequences would be similar (Section 3.4.3.1.9.5, No Action Alternative – Testing Activities).

Testing activities involving sonar and other active acoustic sources proposed under Alternative 1 do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be impacted by noise associated with proposed Navy testing activities.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 1:

- *may expose marine mammals up to 1,412,571 times annually to sound levels that would be considered Level B harassment;*
- *may expose marine mammals up to 169 times to sound levels that would be considered Level A harassment;*
- *may expose marine mammals up to 162,241 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level B harassment; and*
- *may expose marine mammals up to 35 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level A harassment.*

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.8.8 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Section 3.4.3.1.9.6 (Alternative 1 – Training Activities).

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during training activities as described under Alternative 2:

- *may expose marine mammals 2,049,956 times per year to sound levels that would be considered Level B harassment;*
- *may expose marine mammals 88 times per year to sound levels that would be considered Level A harassment;*
- *may expose marine mammals up to 1,860 times during each biennial civilian port defense activity to sound levels that would be considered Level B harassment;*
- *would not expose marine mammal to sound levels that would be considered Level A harassment during the biennial civilian port defense activities; and*
- *may expose up to 10 beaked whales annually and no more than 10 beaked whales over a five-year period to sound levels that may elicit stranding and subsequent serious injury or mortality.*

Appropriate authorization is being sought from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. Table 3.4-14 and Table 3.4-16 present the Navy's marine mammal predicted exposures for training activities under Alternative 2.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale ;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.8.9 Alternative 2 (Preferred Alternative) – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Acoustic Stressors), the number of annual testing activities that produce in-water noise from the use of sonar and other active acoustic sources analyzed under Alternative 2 would increase over the No Action Alternative. Section 3.4.3.1.8.3 (Predicted Impacts from Sonar and Other Active Acoustic Sources) describes predicted impacts on marine mammals. These activities would happen in the same general locations under Alternative 2 as under the No Action Alternative.

Unmanned underwater vehicle demonstrations would be conducted once in the five-year period at each of the three proposed location under Alternative 2 as described under Alternative 1 above (Section 3.4.3.1.8.7, Alternative 1 – Testing Activities). Predicted impacts on marine mammals would be identical as shown in Table 3.4-17.

The increase in proposed annual testing activities under Alternative 2 over the No Action Alternative would in turn lead to approximately a 205 percent increase in predicted impacts (behavioral reactions, TTS, and PTS) to marine mammals due to annual testing activities. This could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, although the types and severity of individual responses to sonar and other active acoustic sources are unlikely to change. Predicted acoustic impacts on marine mammals from exposure

to sonar and other active acoustic sources for annually recurring testing activities under Alternative 2 are shown in Table 3.4-15. Notable results for Alternative 2 are as follows:

- Predicted impacts on mysticetes increase by a factor of about nine times, and predicted impacts on ESA-listed mysticetes increase by a factor of about 11 times. As with Alternative 1, there is one predicted PTS to a minke whale per year for annual testing. All other predicted impacts on mysticetes are TTS and behavioral reactions.
- Predicted acoustic impacts on ESA-listed sperm whales increase by a factor of about 14 times. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on delphinids increase by a factor of approximately nine times. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on beaked whales increase by a factor of approximately five times. Behavioral reactions and TTS are predicted; however, no PTS is predicted.
- Predicted acoustic impacts on harbor porpoises increase by a factor of approximately three times.
- Predicted acoustic impacts on pygmy and dwarf sperm whales increase by a factor of about 15 times.
- Predicted acoustic impacts on phocid seals increase by a factor of about three times.

Costs and long-term consequences for individuals and the population resulting from exposure to sonar and other active acoustic source sound and energy are discussed above under the No Action Alternative. Although the numbers and locations of the predicted reactions differ some between Alternative 2 and the No Action Alternative, the types and severity of reactions and the related consequences would be similar (Section 3.4.3.1.8.5, No Action Alternative – Testing Activities).

Testing activities involving sonar and other active acoustic sources proposed under Alternative 2 do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be impacted by noise associated with proposed Navy testing activities.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 2:

- *may expose marine mammals up to 2,278,338 times annually to sound levels that would be considered Level B harassment;*
- *may expose marine mammals up to 178 times to sound levels that would be considered Level A harassment;*
- *may expose marine mammals up to 162,241 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level B harassment; and*
- *may expose marine mammals up to 35 times over a five-year period associated with unmanned underwater vehicle demonstrations to sound levels that would be considered Level A harassment.*

Appropriate authorization is being sought from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. Table 3.4-15 and Table 3.4-17 present the Navy's marine mammal predicted exposures for testing activities under Alternative 2.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.9 Impacts from Explosives

Marine mammals could be exposed to energy and sound from underwater explosions associated with proposed activities.

Section 3.4.3.1.2.1 (Direct Injury) presents a review of observations and experiments involving marine mammals and reactions to impulsive sounds and underwater detonations. Energy from explosions is capable of causing mortality, direct injury, hearing loss, or a behavioral response depending on the level of exposure. The death of an animal would, of course, eliminate future reproductive potential and cause a long-term consequence for the individual that must then be considered for potential long-term consequences for the population. Exposures that result in long-term injuries such as PTS may limit an animal's ability to find food, communicate with other animals, or interpret the surrounding environment. Impairment of these abilities can decrease an individual's chance of survival or impact its ability to successfully reproduce. TTS can also impair an animal's abilities, but the individual may recover quickly with little significant effect. Behavioral responses can include shorter surfacings, shorter dives, fewer blows (breaths) per surfacing, longer intervals between blows, ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (National Research Council 2005). However, it is not clear how these responses relate to long-term consequences for the individual or population (National Research Council 2005).

Explosions in the ocean or near the water surface can introduce loud, impulsive, broadband sounds into the marine environment. These sounds are likely within the audible range of most cetaceans, but the

duration of individual sounds is very short. The direct sound from explosions used during Navy training and testing activities last less than a second, and most events involve the use of only one or a few explosions. Furthermore, events are dispersed in time and throughout the Study Area. These factors reduce the likelihood of these sources causing substantial auditory masking in marine mammals.

3.4.3.1.9.1 Range to Effects

The following section provides the range to effects from an explosion to specific criteria using the Navy's explosive propagation model. Marine mammals within these ranges would be predicted to receive the associated effect. The range to effects is important information in estimating the accuracy of model results against real-world situations and determining adequate mitigation ranges to avoid higher-level effects, especially physiological effects such as injury and mortality.

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the explosive criteria (Section 3.4.3.1.4, Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on Marine Mammals) and the explosive propagation calculations from the Navy Acoustic Effects Model (Section 3.4.3.1.5.3, Navy Acoustic Effects Model). The range to effects are shown for a range of explosive bins (Section 3.4.3.1.9.1, Range to Effects), from E2 (up to 0.5 lb. net explosive weight) to E17 (up to 58,000 lb. net explosive weight).

Figure 3.4-9 through Figure 3.4-14 show the range to slight lung injury and mortality for five representative animals of different masses for 0.5–58,000 lb. net explosive weight detonations. Modeled ranges for onset slight lung injury and onset mortality are based on the smallest calf weight in each category and therefore represents a conservative estimate (i.e., longer ranges) since populations contain many animals larger than calves that are less susceptible to injurious impacts. Animals within these water volumes would be expected to receive minor injuries at the outer ranges, increasing to more substantial injuries, and finally mortality as an animal approaches the detonation point.

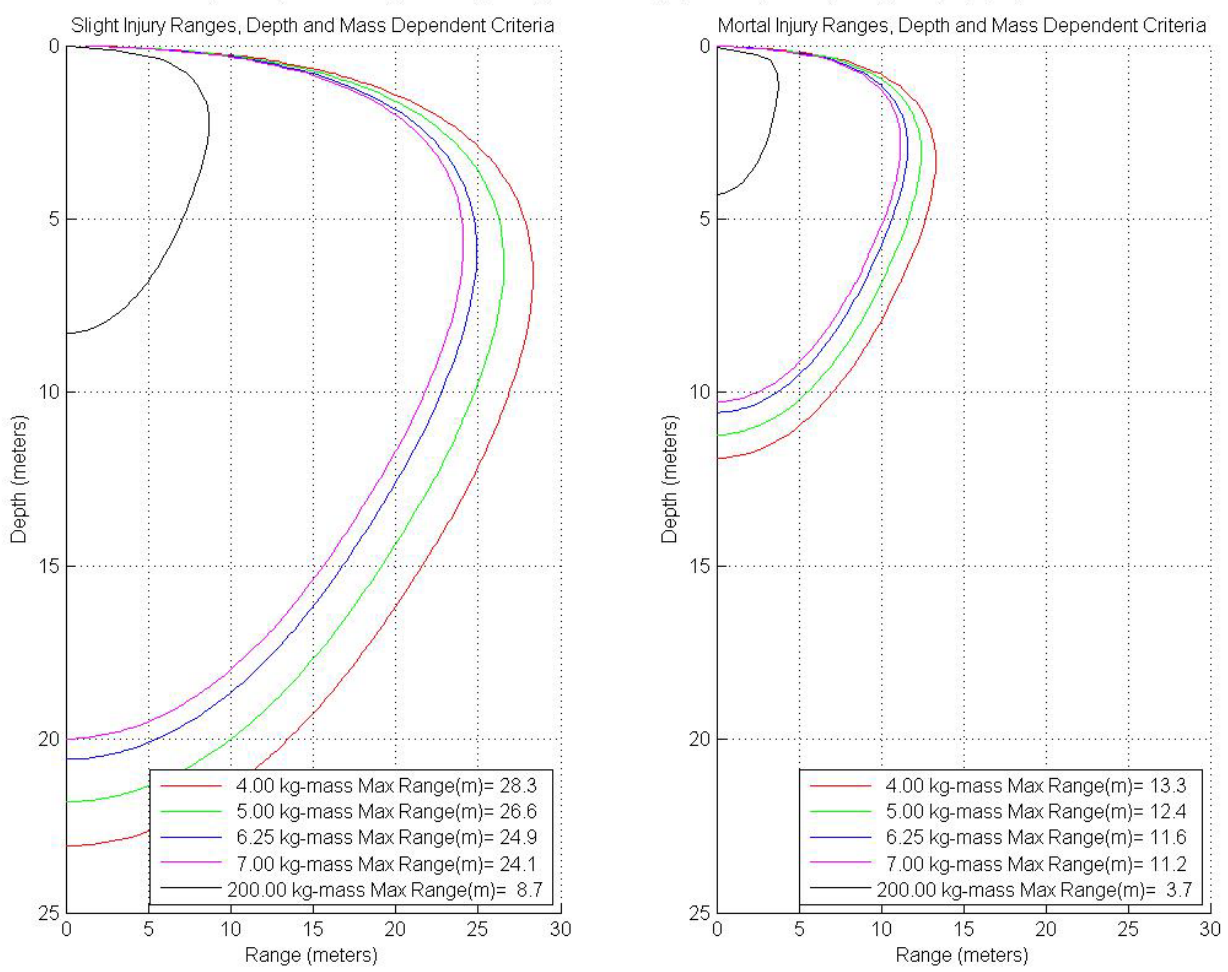


Figure 3.4-9: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 0.5-Pound Net Explosive Weight Charge (Bin E2) Detonated at 1-m Depth
m: meters; kg: kilogram

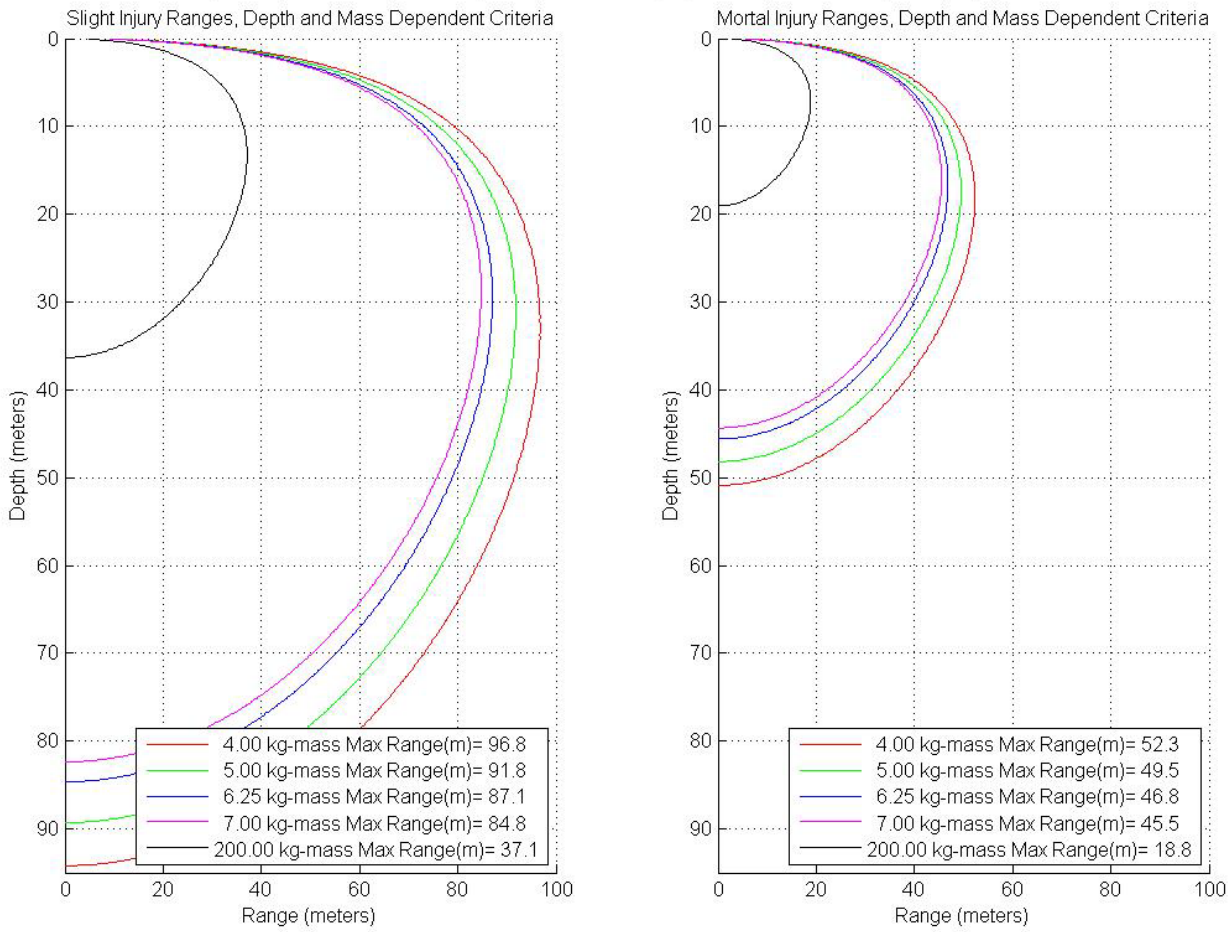


Figure 3.4-10: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 10-Pound Net Explosive Weight Charge (Bin E5) Detonated at 1-m Depth

m: meters; kg: kilogram

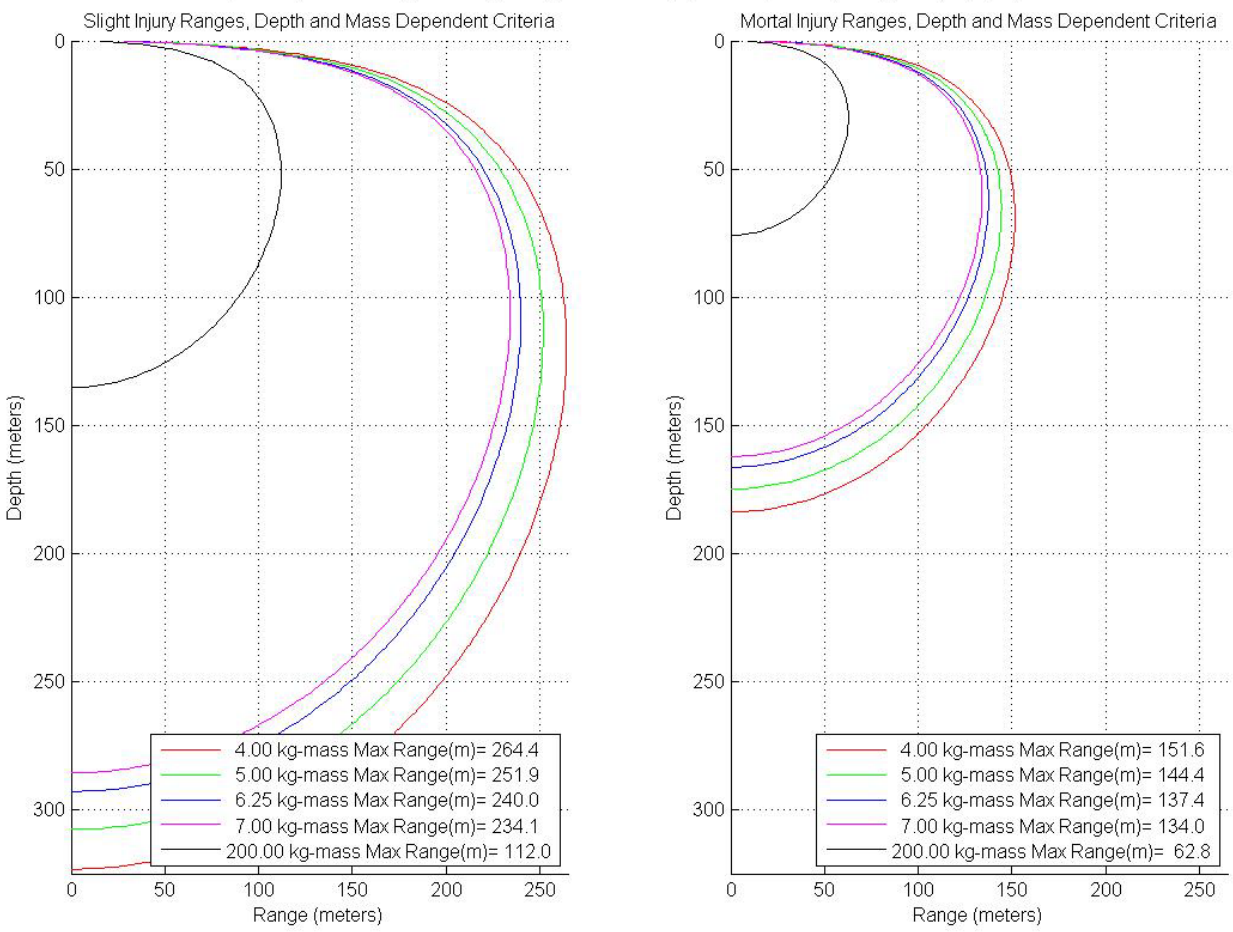


Figure 3.4-11: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 250-Pound Net Explosive Weight Charge (Bin E9) Detonated at 1-m Depth

m: meters; kg: kilogram

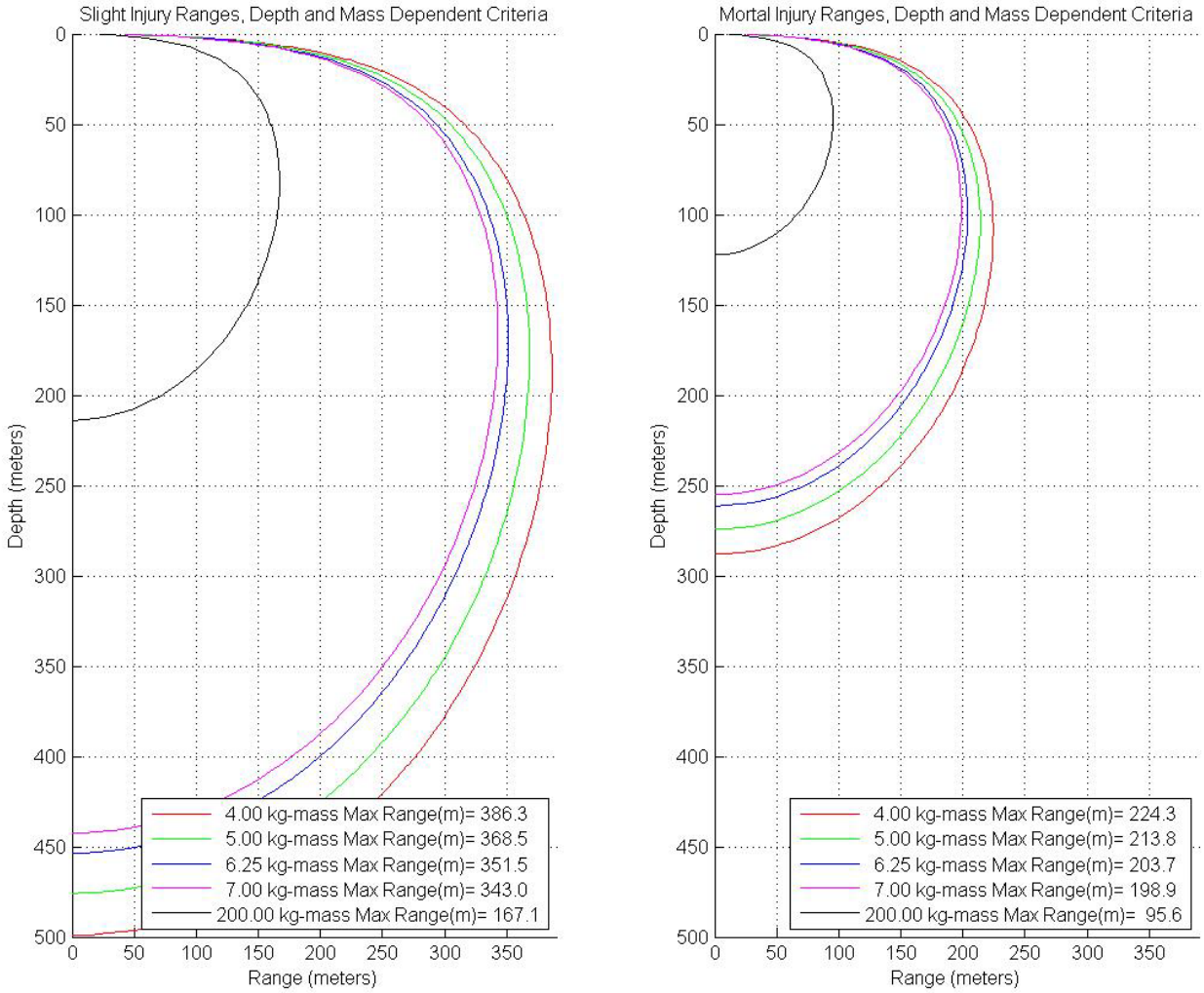


Figure 3.4-12: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 1,000-Pound Net Explosive Weight Charge (Bin E12) Detonated at 1-m Depth
m: meters; kg: kilogram

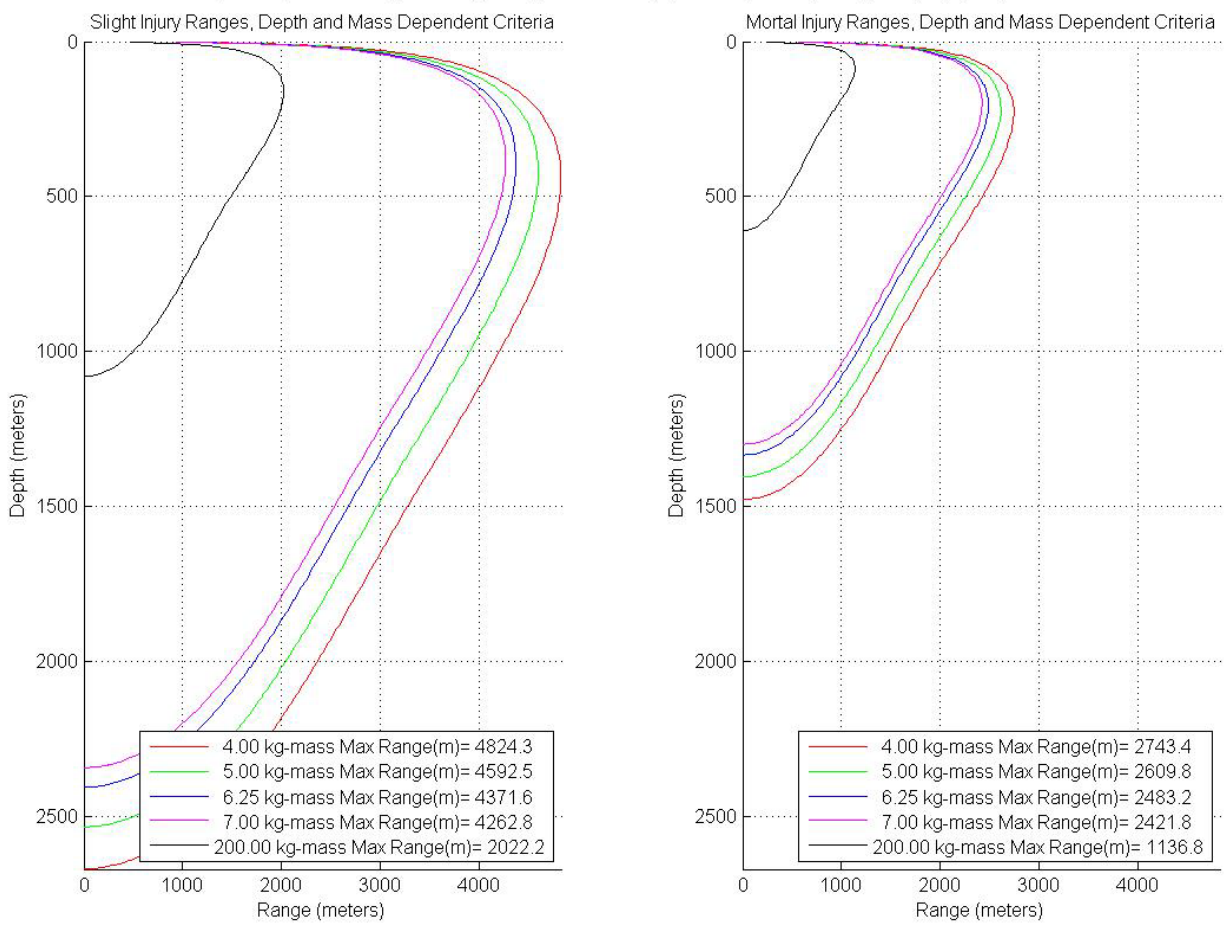


Figure 3.4-13: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 14,500-Pound Net Explosive Weight Charge (Bin E16) Detonated at 61-m Depth
m: meters; kg: kilogram

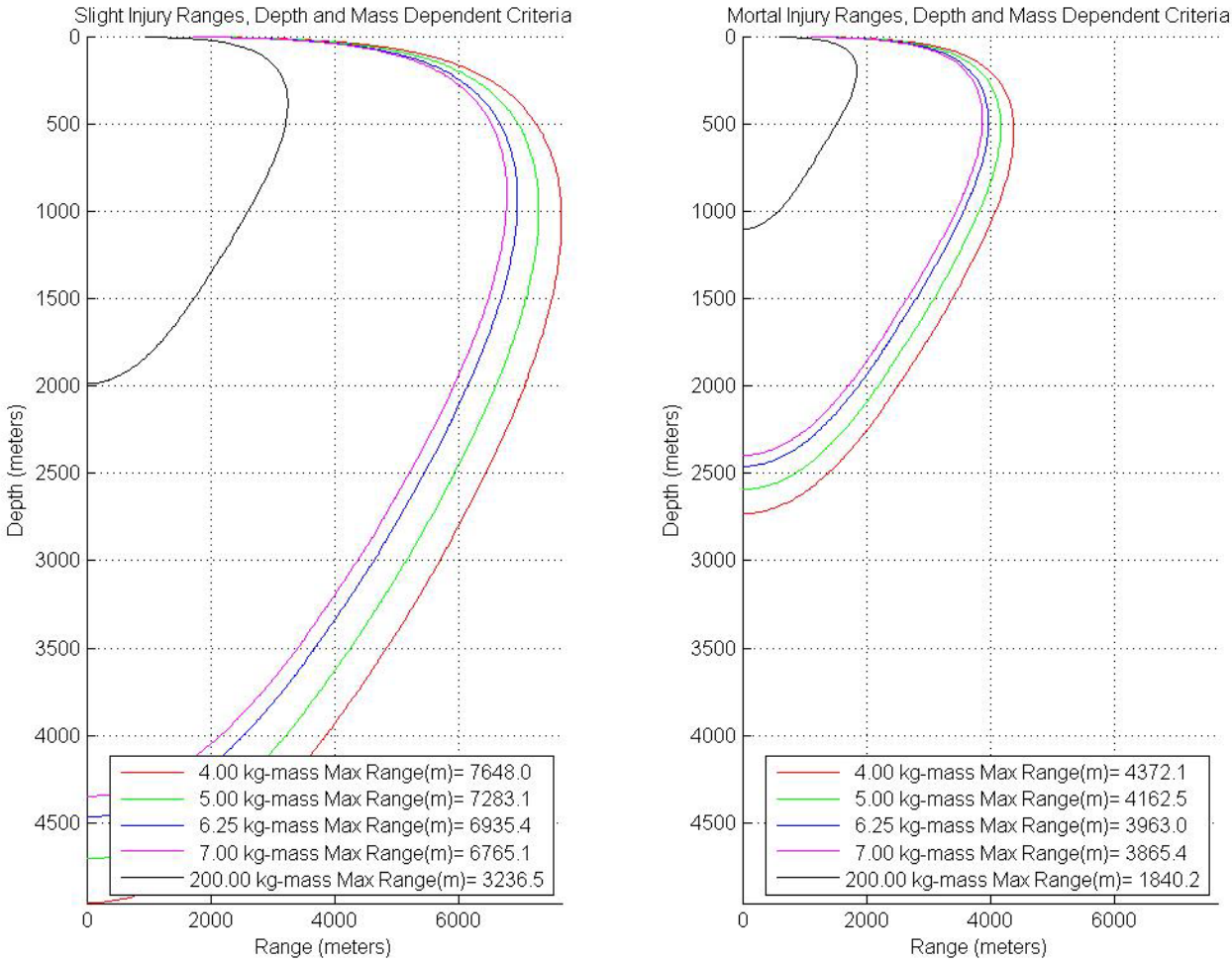


Figure 3.4-14: Threshold Profiles for Slight Lung Injury (left) and Mortality (right) Based on Five Representative Animal Masses (4.0, 5.0, 6.25, 7.0, and 200 kg) for a 58,000-Pound Net Explosive Weight Charge (Bin E17) Detonated at 61-m Depth
m: meters; kg: kilogram

The following tables (Table 3.4-19 through Table 3.4-22) show the average ranges to the potential effect based on the thresholds described in Section 3.4.3.1.4 (Thresholds and Criteria for Predicting Acoustic and Explosive Impacts to Marine Mammals). Similar to slight lung injury and mortality ranges discussed above, behavioral, TTS, and PTS ranges also represent conservative estimates (i.e., longer ranges) based on assuming all impulses are 1 second in duration. In fact, most impulses are much less than 1 second and therefore contain less energy than what is being used to produce the estimated ranges below.

Table 3.4-19: Average Range to Effects from Explosions for Low-Frequency Cetaceans across Representative Acoustic Environments within the Study Area

Criteria/Predicted Impact	Range to Effects (meters)					
	Bin E2 (0.5 lb. NEW)	Bin E5 (10 lb. NEW)	Bin E9 (250 lb. NEW)	Bin E12 (1,000 lb. NEW)	Bin E16 (14,500 lb. NEW)	Bin E17 (58,000 lb. NEW)
Onset Mortality	4	19	63	96	1,137	1,840
Onset Slight Lung Injury	9	37	112	167	2,022	3,237
Onset Slight GI Tract Injury	25	71	147	274	765	1,249
PTS	71	164	247	611	2,991	4,953
TTS	169	367	550	1,595	12,750	12,444
Behavioral Response	210	461	773	2,117	NA	NA

GI: Gastrointestinal; lb.: pound; NA: Behavioral Response Not Analyzed for bins E16 and E17 because these are single explosive events; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift

Table 3.4-20: Average Range to Effects from Explosions for Mid-Frequency Cetaceans across Representative Acoustic Environments within the Study Area

Criteria/Predicted Impact	Range to Effects (meters)					
	Bin E2 (0.5 lb. NEW)	Bin E5 (10 lb. NEW)	Bin E9 (250 lb. NEW)	Bin E12 (1,000 lb. NEW)	Bin E16 (14,500 lb. NEW)	Bin E17 (58,000 lb. NEW)
Onset Mortality	11	46	134	199	2,422	3,865
Onset Slight Lung Injury	24	85	234	343	4,263	6,765
Onset Slight GI Tract Injury	25	71	147	274	765	1,249
PTS	26	76	153	297	766	1,201
TTS	83	202	364	832	2,878	4,282
Behavioral Response	111	266	455	1,119	NA	NA

GI: Gastrointestinal; lb.: pound; NA: Behavioral Response Not Analyzed for bins E16 and E17 because these are single explosive events; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift

Table 3.4-21: Average Range to Effects from Explosions for High-Frequency Cetaceans across Representative Acoustic Environments within the Study Area

Criteria/Predicted Impact	Range to Effects (meters)					
	Bin E2 (0.5 lb. NEW)	Bin E5 (10 lb. NEW)	Bin E9 (250 lb. NEW)	Bin E12 (1,000 lb. NEW)	Bin E16 (14,500 lb. NEW)	Bin E17 (58,000 lb. NEW)
Onset Mortality	12	50	144	214	2,610	4,163
Onset Slight Lung Injury	27	92	252	369	4,593	7,283
Onset Slight GI Tract Injury	25	71	147	274	765	1,249
PTS	132	313	473	1,198	5,973	10,322
TTS	290	799	928	3,575	21,297	35,129
Behavioral Response	458	1,021	1,151	4,371	NA	NA

GI: Gastrointestinal; lb.: pound; NA: Behavioral Response Not Analyzed for bins E16 and E17 because these are single explosive events; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift

Table 3.4-22: Average Range to Effects from Explosions for Phocid Seals across Representative Acoustic Environments within the Study Area

Criteria/Predicted Impact	Range to Effects (meters)					
	Bin E2 (0.5 lb. NEW)	Bin E5 (10 lb. NEW)	Bin E9 (250 lb. NEW)	Bin E12 (1,000 lb. NEW)	Bin E16 (14,500 lb. NEW)	Bin E17 (58,000 lb. NEW)
Onset Mortality	13	52	152	224	2,743	4,372
Onset Slight Lung Injury	28	97	264	386	4,824	7,648
Onset Slight GI Tract Injury	25	71	147	274	765	1,249
PTS	70	158	359	824	2,914	4,733
TTS	150	433	787	1,870	12,655	11,663
Behavioral Response	194	561	967	2,305	NA	NA

GI: Gastrointestinal; lb.: pound; NA: Behavioral Response Not Analyzed for bins E16 and E17 because these are single explosive events; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift

3.4.3.1.9.2 Avoidance Behavior and Mitigation Measures as Applied to Explosives

As discussed above (Section 3.4.3.1.5.4, Model Assumptions and Limitations), within the Navy Acoustic Effects Model, animats (virtual animals) do not move horizontally or react in any way to avoid sound at any level. In reality, various researchers have demonstrated that cetaceans can perceive the location and movement of a sound source (e.g., vessel, seismic source, etc.) relative to their own location and react with responsive movement away from the source, often at distances of a kilometer or more (Au and Perryman 1982; Jansen et al. 2010; Richardson et al. 1995; Tyack et al. 2011; Watkins 1986; Wursig et al. 1998). Section 3.4.3.1.2.5 (Behavioral Reactions) reviews research and observations of marine mammals' reactions to sound sources including seismic surveys and explosives. The Navy Acoustic Effects Model also does not account for the implementation of mitigation, which would prevent many of the model-predicted injurious and mortal exposures to explosives. Therefore, the model-estimated mortality and injurious impacts are further analyzed considering avoidance and implementation of mitigation measures [see Section 3.4.3.1.5 (Quantitative Analysis) and the technical report *Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for Atlantic Fleet Training and Testing* (U.S. Department of the Navy 2013b)].

If explosive activities are preceded by multiple vessel traffic or hovering aircraft, harbor porpoises and beaked whales are assumed to move beyond the range to onset mortality before detonations occur, as discussed in Section 3.4.3.1.5.5 (Marine Mammal Avoidance of Sound Exposures). Table 3.4-20 and Table 3.4-21 show the ranges to onset mortality for mid-frequency and high frequency cetaceans for a representative range of charge sizes. The range to onset mortality for all net explosive weights (excluding ship shock charges) is generally less than 214 m, which is conservatively based on range to onset mortality for a calf (the maximum range to effects, excluding ship shock trials, is 300 m for source class E14). Because the Navy Acoustic Effects Model does not include avoidance behavior, the model-estimated mortalities are based on unlikely behavior for these species- that they would tolerate staying in an area of high human activity. Therefore, harbor porpoises and beaked whales that were model-estimated to experience mortality are assumed to move into the range of potential injury prior to the start of the explosive activity for the activities listed in Table 3.4-23.

Table 3.4-23: Activities Using Explosives Preceded by Multiple Vessel Movements or Hovering Helicopters

ACTIVITIES
Training
Civilian Port Defense
COMPTUEX
FIREX
Group Sail
GUNEX [S-S] – Boat – Medium-Caliber
GUNEX [S-S] – Ship – Medium-Caliber
JTFEX/SUSTAINEX
Maritime Security Operations – Anti-Swimmer Grenade
Mine Neutralization – EOD
Mine Neutralization – ROV
MISSILEX [A-S]
MISSILEX [S-S]
SINKEX
UNDET
Testing
[A-S] MISSILEX
Airborne Mine Neutralization Systems
Airborne Projectile-Based Mine Clearance System
Airborne Towed Mine Sweeping Test
ASW Tracking Test – Helo
At-Sea Explosives Testing
MCM Mission Package Testing
Mine Countermeasure/Neutralization Testing
NSWC: Mine Countermeasure/Neutralization Testing
NSWC: Stationary Source Testing
NUWC: Pierside Integrated Swimmer Defense
Pierside Integrated Swimmer Defense
Ship Shock Trials
Sonobuoy Lot Acceptance Testing
Torpedo (Explosive) Testing

Note: A-S: air to surface; ASW: anti-submarine warfare; COMPTUEX: composite training unit exercise; EOD: explosive ordnance disposal; FIREX: firing exercise; GUNEX: gunnery exercise; JTFEX: joint forces exercise; MCM: mine countermeasure; NSWC: Naval Surface Warfare Center, Panama City Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; ROV: remotely operated vehicle; SINKEX: sinking exercise; S-S: surface to surface; SUSTAINEX: sustainment exercise; UNDET: underwater detonation

The Navy Acoustic Effects Model does not consider mitigation, discussed in detail in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). As explained in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), to account for the implementation of mitigation measures, the acoustic analysis assumes a model-predicted mortality or injury would not occur if an animal at the water surface would likely be observed during those activities with dedicated Lookouts up to and during the use of explosives, considering the mitigation effectiveness (Table 3.4-24) and sightability of a species based on g(0) (see Table 5.3-1). The mitigation effectiveness is considered over two regions of an activity's mitigation zone: (1) the range to onset mortality closer to the explosion and (2) range to onset PTS. The model-estimated mortalities and injuries are reduced by the portion of animals that are likely to be seen [Mitigation Effectiveness x Sightability, g(0)]; these animals are instead assumed to be present within the range to injury and range to TTS, respectively.

Table 3.4-24: Consideration of Mitigation in Acoustic Effects Analysis for Explosives

Activity[1,2]	Mitigation Effectiveness Factor for Acoustic Analysis		Mitigation Platform
	Injury Zone	Mortality Zone	
Training			
BOMBEX [A-S] (HF/Phocids/LF)	–	1	Aircraft
BOMBEX [A-S] (MF)	0.5	1	Aircraft
Civilian Port Defense	1	1	Vessel
COMPTUEX (IEER/Mine Neutralization Exercise)	0.5	0.5	Both[3]
Group Sail (IEER)	0.5	0.5	Aircraft
GUNEX [A-S] – Medium-Caliber (HF/Phocids)	0.5	0.5	Aircraft
GUNEX [A-S] – Medium-Caliber (MF/LF)	1	1	Aircraft
GUNEX [S-S] – Boat – Medium-Caliber (HF/Phocids)	0.5	0.5	Vessel
GUNEX [S-S] – Boat – Medium-Caliber (MF/LF)	1	1	Vessel
GUNEX [S-S] – Ship – Medium-Caliber (HF/Phocids)	0.5	0.5	Vessel
GUNEX [S-S] – Ship – Medium-Caliber (MF/LF)	1	1	Vessel
JTFEX-SUSTAINEX/SUSTAINEX (IEER)	0.5	0.5	Aircraft
Maritime Security Operations – Anti-Swimmer Grenade	1	1	
Mine Neutralization – EOD	0.5	1	Vessel
Mine Neutralization – ROV	1	1	Vessel
SINKEX (HF/Phocids/LF)	–	1	Aircraft
SINKEX (MF)	0.5	1	Aircraft
TRACKEX/TORPEX – MPA Sonobuoy	0.5	0.5	Aircraft
UNDET	1	1	Vessel
Testing			
[A-S] GUNEX (HF/Phocids)	0.5	0.5	Aircraft
[A-S] GUNEX (MF/LF)	1	1	Aircraft
Airborne Mine Neutralization Systems (HF/Phocids)	–	1	Both[3]
Airborne Mine Neutralization Systems (MF/LF)	1	1	Both[3]
Airborne Projectile-Based Mine Clearance System (HF/Phocids)	–	1	Both[3]
Airborne Projectile-Based Mine Clearance System (MF/LF)	1	1	Both[3]
Airborne Towed Mine Sweeping Test (HF/Phocids)	–	1	Both[3]
Airborne Towed Mine Sweeping Test (MF/LF)	1	1	Both[3]
Aircraft Carrier Sea Trial	1	1	Vessel
ASW Tracking Test – Helo	0.5	0.5	Aircraft
At-Sea Explosives Testing	1	1	Vessel
MCM Mission Package Testing	1	1	Vessel
Mine Countermeasure/Neutralization Testing	1	1	Vessel
NSWC: Mine Countermeasure/Neutralization Testing	1	1	Vessel
Ship Shock Trials	0.5	1	Both[4]
Sonobuoy Lot Acceptance Testing	1	1	Vessel
Torpedo (Explosive) Testing	–	1	Aircraft

[1] Ranges to effect differ for functional hearing groups based on weighted threshold values. HF: high frequency cetaceans; MF: mid-frequency cetaceans; LF: low frequency cetaceans

[2] If less than half of the mitigation zone can be continuously visually observed or if the mitigation zone cannot be visually observed during most of the scenarios within the activity due to the type of surveillance platform(s), number of Lookouts, and size of the mitigation zone, mitigation is not considered in the acoustic effects analysis of that activity and the activity is not listed in this table. For activities in which only mitigation in the mortality zone is considered in the analysis, no value is provided for the injury zone.

[3] Activity employs both vessel and aircraft based Lookouts. The larger g(0) value (aerial or vessel) is used.

[4] Activity employs vessel or aircraft based Lookouts. If vessels are the only platform, a sufficient number of vessel-based Lookouts will be used to effectively mitigate the area in a manner comparable to aerial mitigation.

Note: A-S: air-to-surface; ASW: anti-submarine warfare; BOMBEX: bombing exercise; COMPTUEX: composite unit training exercise; EOD: explosive ordnance disposal; GUNEX: gunnery exercise; HF: high-frequency; IEER: Improved Extended Echo Ranging; JTFEX: joint forces exercise; LF: low-frequency; MCM: mine countermeasure; MF: mid-frequency; MPA: maritime patrol aircraft; NSWC: Naval Surface Warfare Center; ROV: remotely operated vehicle; SINKEX: sinking exercise; S-S: surface-to-surface; SUSTAINEX: sustainment exercise; TORPEX: torpedo exercise; TRACKEX: tracking exercise; UNDET: underwater detonation

During an activity with a series of explosions (not concurrent multiple explosions)(see Table 3.4-25), an animal is expected to exhibit an initial startle reaction to the first detonation followed by a behavioral response after multiple detonations. At close ranges and high sound levels approaching those that could cause PTS, avoidance of the area around the explosions is the assumed behavioral response for most cases. The ranges to PTS for each functional hearing group for a range of explosive sizes (single detonation) are shown in Table 3.4-19 through Table 3.4-26. Animals not observed by Lookouts within the ranges to PTS at the time of the initial couple of explosions are assumed to experience PTS; however, animals that exhibit avoidance reactions beyond the initial range to PTS are assumed to move away from the expanding range to PTS effects with each additional explosion. Research has demonstrated that odontocetes have directional hearing, with best hearing sensitivity facing a sound source (Kastelein et al. 2005a; Mooney et al. 2008; Popov and Supin 2009). Therefore, an odontocete avoiding a source would receive sounds along a less sensitive hearing axis, potentially reducing impacts. Because the Navy Acoustic Effects Model does not account for avoidance behavior, the model-estimated effects are based on unlikely behavior – that animals would remain in the vicinity of potentially injurious sound sources. Therefore, only the initial exposures resulting in model-estimated PTS are expected to actually occur. The remaining model-estimated PTS are considered to actually be TTS due to avoidance.

Table 3.4-25: Activities with Multiple Non-Concurrent Explosions

ACTIVITIES
Training
BOMBEX [A-S]
Civilian Port Defense
FIREX
Maritime Security Operations – Antii-Swimmer Grenades
Mine Neutralization – EOD
Mine Neutralization – ROV
SINKEX
Testing
Airborne Mine Neutralization Systems
Airborne Projectile-Based Mine Clearance System
MCM Mission Package Testing
Mine Countermeasure/Neutralization Testing
NSWC: Mine Countermeasure/Neutralization Testing
NSWC: Ordnance Testing
NSWC: Stationary Source Testing
NUWC: Pierside Integrated Swimmer Defense
Pierside Integrated Swimmer Defense
Sonobuoy Lot Acceptance Testing

Note: A-S: air-to-surface; BOMBEX: bombing exercise; EOD: explosive ordnance disposal; FIREX: fire support exercise; GUNEX: gunnery exercise; MCM: mine countermeasure; NUWC: Naval Undersea Warfare Center Division, Newport; ROV: remotely operated vehicle; SINKEX: sinking exercise; S-S: surface-to-surface; UNDET: underwater detonation

3.4.3.1.9.3 Predicted Impacts from Explosives

Table 3.4-22 through Table 3.4-29 present the predicted impacts on marine mammals separated between training and testing activities, and between annual and nonannual events. Nonannual events, those events that may only take place a few times over the five-year period and do not reoccur every

year, are considered separately since these impacts would not be assessed each year. This acoustic impact analysis uses the Navy Acoustic Effects Model (Section 3.4.3.1.5.3 [Navy Acoustic Effects Model]) followed by post-model consideration of avoidance and implementation of mitigation to predict effects using the explosive criteria and thresholds described in Section 3.4.3.1.4 (Thresholds and Criteria for Predicting Acoustic and Explosive Impacts to Marine Mammals).

The Navy Acoustic Effects Model does not account for several factors (Section 3.4.3.1.5.4 [Model Assumptions and Limitations]) that must be considered in the overall explosive analysis. When there is uncertainty in model input values, a conservative approach is often chosen to assure that potential effects are not under-estimated. As a result, the Navy Acoustic Effects Model provides estimates that are conservative (over-estimate the likely impacts). The following is a list of several such factors that cause the model to overestimate potential effects:

- The onset mortality criterion is based on the impulse at which one percent of the animals receiving an injury would not recover, leading to mortality. Therefore, many animals that are predicted to suffer mortality in this analysis may actually recover from their injuries.
- Slight lung injury criteria is based on the impulse at which one percent of the animals exposed would incur a slight lung injury from which full recovery would be expected. Therefore, many animals that are predicted to suffer slight lung injury in this analysis may actually not incur injuries.
- The metrics used for the threshold for slight lung injury and mortality (i.e., acoustic impulse) are based on the animal's mass. The smaller an animal, the more susceptible that individual is to these effects. In this analysis, all individuals of a given species are assigned the weight of that species newborn calf or pup weight. Since many individuals in a population are obviously larger than a newborn calf or pup of that species, this assumption causes the acoustic model to overestimate the number of animals that may suffer slight lung injury or mortality. As discussed in the explanation of onset mortality and onset slight lung injury criteria in Section 3.4.3.1.4.1 (Mortality and Injury from Explosions), the volumes of water in which the threshold for onset mortality may be exceeded are generally less than a fifth for an adult animal versus a calf.
- Many explosions from munitions such as bombs and missiles actually occur upon impact with above-water targets. However, for this analysis, sources such as these were modeled as exploding at 1 m depth. This overestimates the amount of explosive and acoustic energy entering the water and therefore overestimates effects on marine mammals.

Impacts on manatees from explosive energy or sound are not predicted under any alternative for training or testing. Furthermore, explosive detonations do not occur within or near West Indian manatee critical habitat. These events would not take place in bearded and ringed seal habitat, and impacts from explosive energy or sound are not predicted under any alternative (training or testing) for these species. There are no predicted impacts on marine mammals from explosions associated with the testing activity aircraft carrier sea trial that could occur once per five-year period under Alternatives 1 and 2.

These predicted impacts shown below are the result of the acoustic analysis, including acoustic effect modeling followed by consideration of animal avoidance of multiple exposures, avoidance of areas with high level of activity by sensitive species, and mitigation. It is important to note that acoustic impacts presented in Table 3.4-22 through Table 3.4-29 are the total number of impacts and not necessarily the number of individuals impacted. As discussed in Section 3.4.3.1.4.5 (Behavioral Responses), an animal

Table 3.4-26: Predicted Impacts per Year from Explosions for Annually Recurring Training Activities under the No Action Alternative

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	3	9	1	0	0	0
Fin Whale*	0	0	0	0	0	0
Humpback Whale*	0	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0	0
Sei Whale*	0	1	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	5	10	1	0	4	2
Atlantic White-Sided Dolphin	2	2	0	0	1	0
Bottlenose Dolphin	8	10	1	0	2	1
Clymene Dolphin	1	1	0	0	1	0
Common Dolphin	11	15	1	0	9	4
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	1	0	0	0	0
Melon-Headed Whale	1	0	0	0	0	0
Pantropical Spotted Dolphin	13	9	0	0	11	3
Pilot Whale	3	4	0	0	1	0
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	6	6	0	0	1	0
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	2	1	0	0	1	0
Striped Dolphin	6	6	0	0	5	2
White-Beaked Dolphin	0	0	0	0	0	0
Odontocetes – Sperm Whale						
Sperm Whale*	0	0	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	0	3	1	0	0	0
Harbor Porpoise	9	120	53	0	3	1
Phocid Seals						
Gray Seal	0	0	0	0	0	0
Harbor Seal	0	0	0	0	0	0
Harp Seal	0	0	0	0	0	0
Hooded Seal	0	0	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-27: Predicted Impacts per Year from Explosions for Annually Recurring Training Activities under Alternatives 1 and 2

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	9	30	4	1	1	0
Fin Whale*	1	1	0	0	0	0
Humpback Whale*	0	1	0	0	0	0
North Atlantic Right Whale*	0	1	0	0	0	0
Sei Whale*	1	1	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	15	34	3	0	9	3
Atlantic White-Sided Dolphin	4	7	1	0	2	1
Bottlenose Dolphin	27	45	3	1	4	2
Clymene Dolphin	1	2	0	0	1	0
Common Dolphin	19	41	3	0	14	5
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	1	0	0	0	0
Melon-Headed Whale	1	0	0	0	0	0
Pantropical Spotted Dolphin	2	4	0	0	1	0
Pilot Whale	6	12	1	0	2	1
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	8	14	1	0	2	1
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	1	1	0	0	0	0
Striped Dolphin	6	11	1	0	6	2
White-Beaked Dolphin	1	2	0	0	0	0
Odontocetes – Sperm Whale						
Sperm Whale*	1	1	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	1	5	2	0	0	0
Harbor Porpoise	94	497	177	1	21	2
Phocid Seals						
Gray Seal	0	0	0	0	0	0
Harbor Seal	1	2	0	0	0	0
Harp Seal	0	0	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-28: Predicted Impacts per Year from Explosions for Annually Recurring Testing Activities under the No Action Alternative

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	2	5	1	0	0	0
Fin Whale*	0	0	0	0	0	0
Humpback Whale*	0	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0	0
Sei Whale*	0	0	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	1	8	0	0	3	1
Atlantic White-Sided Dolphin	1	2	0	0	1	0
Bottlenose Dolphin	3	9	0	0	2	1
Clymene Dolphin	0	0	0	0	0	0
Common Dolphin	3	6	0	0	5	2
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	0	0	0	0	0
Melon-Headed Whale	0	0	0	0	0	0
Pantropical Spotted Dolphin	1	1	0	0	2	0
Pilot Whale	1	3	0	0	1	0
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	2	4	0	0	1	0
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	0	0	0	0	0	0
Striped Dolphin	2	2	0	0	3	1
White-Beaked Dolphin	0	0	0	0	0	0
Odontocetes –Sperm Whale						
Sperm Whale*	0	0	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	0	1	0	0	0	0
Harbor Porpoise	301	180	53	0	4	1
Phocid Seals						
Gray Seal	4	4	0	0	0	0
Harbor Seal	3	3	0	0	0	0
Harp Seal	1	1	0	0	0	0
Hooded Seal	0	0	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-29: Model-Predicted Impacts per Year from Explosions for Annually Recurring Testing Activities under Alternative 1

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	3	9	1	0	0	0
Fin Whale*	0	0	0	0	0	0
Humpback Whale*	0	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0	0
Sei Whale*	0	1	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	6	21	0	0	6	2
Atlantic White-Sided Dolphin	2	5	0	0	1	0
Bottlenose Dolphin	8	19	1	0	2	1
Clymene Dolphin	1	1	0	0	1	0
Common Dolphin	10	23	0	0	9	4
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	1	0	0	0	0
Melon-Headed Whale	0	1	0	0	0	0
Pantropical Spotted Dolphin	1	2	0	0	2	1
Pilot Whale	2	9	0	0	1	0
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	7	12	0	0	1	0
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	0	1	0	0	1	0
Striped Dolphin	6	10	0	0	5	1
White-Beaked Dolphin	0	1	0	0	0	0
Odontocetes – Sperm Whale						
Sperm Whale*	0	0	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	1	2	1	0	0	0
Harbor Porpoise	302	245	79	0	5	1
Phocid Seals						
Gray Seal	4	4	0	0	0	0
Harbor Seal	3	3	0	0	0	0
Harp Seal	1	1	0	0	0	0
Hooded Seal	0	0	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-30: Model-Predicted Impacts Per Year from Explosions for Annually Recurring Testing Activities under Alternative 2

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	4	11	2	0	0	0
Fin Whale*	0	1	0	0	0	0
Humpback Whale*	0	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0	0
Sei Whale*	0	1	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	7	24	0	0	7	2
Atlantic White-Sided Dolphin	2	6	0	0	1	1
Bottlenose Dolphin	10	23	1	0	3	1
Clymene Dolphin	1	1	0	0	1	0
Common Dolphin	12	28	0	0	12	4
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	1	0	0	0	0
Melon-Headed Whale	1	1	0	0	0	0
Pantropical Spotted Dolphin	2	2	0	0	4	1
Pilot Whale	3	11	0	0	1	0
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	8	14	0	0	2	0
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	0	1	0	0	1	0
Striped Dolphin	7	11	0	0	7	1
White-Beaked Dolphin	0	1	0	0	0	0
Odontocetes – Sperm Whales						
Sperm Whale*	1	0	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	1	2	1	0	0	0
Harbor Porpoise	485	348	110	0	7	1
Phocid Seals						
Gray Seal	6	6	1	0	0	0
Harbor Seal	6	6	1	0	0	0
Harp Seal	2	2	0	0	0	0
Hooded Seal	1	1	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-31: Predicted Impacts per Event from Explosions for Civilian Port Defense Occurring Biennially under Alternatives 1 and 2

Species	Behavioral Response	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes						
Blue Whale*	0	0	0	0	0	0
Bryde's Whale	0	0	0	0	0	0
Minke Whale	0	0	0	0	0	0
Fin Whale*	0	0	0	0	0	0
Humpback Whale*	0	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0	0
Sei Whale*	0	0	0	0	0	0
Odontocetes – Delphinids						
Atlantic Spotted Dolphin	0	0	0	0	0	0
Atlantic White-Sided Dolphin	0	0	0	0	0	0
Bottlenose Dolphin	0	0	0	0	0	0
Clymene Dolphin	0	0	0	0	0	0
Common Dolphin	0	0	0	0	0	0
False Killer Whale	0	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0	0
Killer Whale	0	0	0	0	0	0
Melon-Headed Whale	0	0	0	0	0	0
Pantropical Spotted Dolphin	0	0	0	0	0	0
Pilot Whale	0	0	0	0	0	0
Pygmy Killer Whale	0	0	0	0	0	0
Risso's Dolphin	0	0	0	0	0	0
Rough-Toothed Dolphin	0	0	0	0	0	0
Spinner Dolphin	0	0	0	0	0	0
Striped Dolphin	0	0	0	0	0	0
White-Beaked Dolphin	0	0	0	0	0	0
Odontocetes – Sperm Whale						
Sperm Whale*	0	0	0	0	0	0
Odontocetes – Beaked Whales						
Blainville's Beaked Whale	0	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0	0
Northern Bottlenose Whale	0	0	0	0	0	0
Sowerby's Beaked Whale	0	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	0	0	0	0	0	0
Harbor Porpoise	0	7	1	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-32: Predicted Impacts for Aircraft Carrier Ship Shock Trials Occurring Once per Five-Year Period under Alternatives 1 and 2
(up to four 58,000-pound Net Explosive Weight Detonations)

Species	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes					
Blue Whale*	0	0	0	0	0
Bryde's Whale	0	0	0	0	0
Minke Whale	26	0	0	8	3
Fin Whale*	3	0	0	0	0
Humpback Whale*	1	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0
Sei Whale*	4	0	0	0	0
Odontocetes – Delphinids					
Atlantic Spotted Dolphin	1,098	0	0	1,683	109
Atlantic White-Sided Dolphin	123	0	0	116	30
Bottlenose Dolphin	175	0	0	95	26
Clymene Dolphin	0	0	0	73	11
Common Dolphin	1,449	0	0	1,955	106
False Killer Whale	0	0	0	0	0
Fraser's Dolphin	1	0	0	0	0
Killer Whale	2	0	0	2	0
Melon-Headed Whale	23	0	0	24	1
Pantropical Spotted Dolphin	40	0	0	57	5
Pilot Whale	87	0	0	140	22
Pygmy Killer Whale	3	0	0	3	0
Risso's Dolphin	52	0	0	46	14
Rough-Toothed Dolphin	1	0	0	0	0
Spinner Dolphin	15	0	0	23	2
Striped Dolphin	1,486	0	0	2,344	113
White-Beaked Dolphin	0	0	0	3	1
Odontocetes – Sperm Whale					
Sperm Whale*	11	0	0	3	2
Odontocetes – Beaked Whales					
Blainville's Beaked Whale	1	0	0	3	0
Cuvier's Beaked Whale	0	0	0	1	0
Gervais' Beaked Whale	1	0	0	4	0
Northern Bottlenose Whale	2	0	0	3	0
Sowerby's Beaked Whale	0	0	0	0	0
True's Beaked Whale	0	0	0	1	0
Odontocetes – *Kogia* Species and Porpoises					
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	3	1	0	3	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species

Table 3.4-33: Predicted Impacts per Event for the Guided Missile Destroyer and Littoral Combat Ship Shock Trials Occurring Three Times per Five-Year Period Under Alternatives 1 and 2
(up to four 14,500-pound Net Explosive Weight Detonations)

Species	TTS	PTS	GI Tract Injury	Onset Slight Lung Injury	Onset Mortality
Mysticetes					
Blue Whale*	0	0	0	0	0
Bryde's Whale	0	0	0	0	0
Minke Whale	5	0	0	1	0
Fin Whale*	1	0	0	0	0
Humpback Whale*	0	0	0	0	0
North Atlantic Right Whale*	0	0	0	0	0
Sei Whale*	1	0	0	0	0
Odontocetes – Delphinids					
Atlantic Spotted Dolphin	58	0	0	82	7
Atlantic White-Sided Dolphin	11	0	0	15	2
Bottlenose Dolphin	31	0	0	25	3
Clymene Dolphin	0	0	0	3	1
Common Dolphin	79	0	0	118	8
False Killer Whale	0	0	0	0	0
Fraser's Dolphin	0	0	0	0	0
Killer Whale	1	0	0	0	0
Melon-Headed Whale	2	0	0	2	0
Pantropical Spotted Dolphin	4	0	0	5	1
Pilot Whale	5	0	0	6	1
Pygmy Killer Whale	0	0	0	0	0
Risso's Dolphin	10	0	0	11	2
Rough-Toothed Dolphin	0	0	0	0	0
Spinner Dolphin	2	0	0	2	0
Striped Dolphin	74	0	0	124	4
White-Beaked Dolphin	0	0	0	0	0
Odontocetes – Sperm Whale					
Sperm Whale*	3	0	0	1	0
Odontocetes – Beaked Whales					
Blainville's Beaked Whale	0	0	0	0	0
Cuvier's Beaked Whale	0	0	0	0	0
Gervais' Beaked Whale	0	0	0	0	0
Northern Bottlenose Whale	1	0	0	1	0
Sowerby's Beaked Whale	0	0	0	0	0
True's Beaked Whale	0	0	0	0	0
Odontocetes – *Kogia* Species and Porpoises					
Dwarf and Pygmy Sperm Whales (*Kogia* spp.)	1	0	0	0	0

GI: gastrointestinal; PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA

could be predicted to receive more than one acoustic impact over the course of a year. Species presented in tables had species density values (i.e., theoretically present to some degree) within the areas modeled for the given alternative and activities, although all predicted effects may still indicate "0" (zero) after summing all impacts and applying standard arithmetic rounding rules (i.e., numbers less than 0.5 round down to 0.0).

3.4.3.1.9.4 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosives), training activities under the No Action Alternative would use underwater detonations and explosive munitions. Training activities involving explosions would be conducted throughout the Study Area but would be concentrated in the VACAPES Range Complex, followed in descending order of numbers of activities by JAX, Navy Cherry Point, GOMEX, and the Northeast Range Complexes. These events would be concentrated in the Northeast U.S. Continental Shelf and Southeast U.S. Continental Shelf Large Marine Ecosystems or the Gulf Stream Open Ocean Area, with fewer activities in the Gulf of Mexico Large Marine Ecosystem and the North Atlantic Gyre Open Ocean Area. Activities that involve underwater detonations and explosive munitions typically occur more than 3 nm from shore.

Predicted effects on marine mammals from exposures to explosions during annually recurring training activities under the No Action Alternative are shown in Table 3.4-22. Civilian port defense training activities would not take place under the No Action Alternative. About 15 percent of modeled activities involve multiple detonations (multiple detonations, as defined for this analysis, are described in Section 3.4.3.1.4.5, Behavioral Responses) and are therefore evaluated for potential behavioral responses from marine mammals.

Mysticetes

Predicted impacts on mysticetes from training activities under the No Action Alternative from explosions are relatively low over a year of training activities, with 1 PTS, 10 TTS, and 3 behavioral responses predicted. The acoustic analysis predicts that two species, the minke and sei whale, could potentially be impacted, although all mysticetes within the Study Area could be exposed to sound and energy from explosions. Table 3.4-18 presents predicted ranges to specified effects for low-frequency cetaceans (mysticetes). Impacts are predicted primarily within VACAPES, JAX, and Navy Cherry Point Range Complexes, in the Northeast U.S. Continental Shelf and Southeast U.S. Continental Shelf Large Marine Ecosystems, and the Gulf Stream Open Ocean Area.

North Atlantic Right Whales (ESA-Listed)

North Atlantic right whales may be exposed to sound or energy from explosions associated with training activities throughout the year, although acoustic modeling predicts no impacts on North Atlantic right whales. Although ESA-listed North Atlantic right whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Training activities that use explosives, with the exception of training with explosive sonobuoys, are not conducted in the southeast North Atlantic right whale mitigation area. Training activities that use explosives would not occur in the northeast North Atlantic right whale mitigation area. The sound and energy from explosions associated with training activities under the No Action Alternative would not impact the assumed primary constituent elements of the southeast North Atlantic right whale critical habitat (i.e., water temperature and depth).

Humpback Whales (ESA-Listed)

Humpback whales may be exposed to sound or energy from explosions associated with training activities throughout the year, although the acoustic analysis predicts that no humpback whales would be impacted. Although ESA-listed humpback whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Sei Whales (ESA-Listed)

Sei whales may be exposed to sound and energy from explosions associated with training activities throughout the year. The acoustic analysis predicts that one sei whale could be exposed annually to sound from explosions that may cause TTS. This could happen anywhere within the Study Area. Predicted impacts would be to the Nova Scotia stock since this is the only sei whale stock present within the Study Area.

Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. Considering these factors and the low number of overall predicted impacts, long-term consequences for individuals or populations would not be expected.

Fin Whales (ESA-Listed)

Fin whales may be exposed to sound or energy from explosions associated with training activities throughout the year, although the acoustic analysis predicts that no fin whales would be impacted. Although ESA-listed fin whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Blue Whales (ESA-Listed)

Blue whales may be exposed to sound or energy from explosions associated with training activities throughout the year, although the acoustic analysis predicts that no blue whales would be impacted. Although ESA-listed blue whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Minke and Bryde's Whales

Minke and Bryde's whales may be exposed to sound or energy from explosions associated with training activities throughout the year. The acoustic analysis predicted no impacts on Bryde's whales from training activities involving explosions. The acoustic analysis predicts that minke whales could be exposed to sound annually that may result in 3 behavioral reactions, 9 TTS, and 1 PTS (Table 3.4-22 describes the predicted numbers of exposures). As with mysticetes overall, impacts are primarily predicted within the VACAPES Range Complex, followed by JAX, Navy Cherry Point, and GOMEX Range Complexes. All predicted impacts on minke whales would be to the Canadian East Coast stock since this is the only stock present within the Study Area.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if mysticetes are exposed to the sound from explosions, they may react in a variety of ways, which may include alerting, startling, breaking off feeding dives and surfacing, diving or swimming away, or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations.

Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Considering these factors and the low number of overall predicted impacts, consequences for individuals or populations would not be expected.

Odontocetes

Sperm Whales (ESA-Listed)

Sperm whales may be exposed to sound and energy from explosions associated with training activities throughout the year; however, the acoustic analysis predicts that no sperm whales would be impacted. Although ESA-listed sperm whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and

Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Dolphins and Small Whales (Delphinids)

Dolphins and small whales (delphinids) may be exposed to sound and energy from explosions associated with training activities throughout the year. The acoustic analysis predicts that delphinids could be exposed to sound that may result in mortality, injury, temporary hearing loss, and behavioral reactions (Table 3.4-22 describes predicted numbers of exposures). The majority of these exposures occur within the VACAPES and GOMEX Range Complexes. Most delphinid species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted impacts on delphinids within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of impacts predicted offshore of the east coast would impact the Western North Atlantic stocks. Bottlenose dolphins are divided into multiple coastal and one oceanic stock along the east coast. The majority of exposures to bottlenose dolphins from training activities involving explosives would be to the oceanic stock.

A total of 12 onset mortalities and 36 onset slight lung injuries are predicted for the following delphinids: Atlantic spotted dolphins, Atlantic white-sided dolphins, bottlenose dolphins, clymene dolphins, common dolphins, pantropical spotted dolphins, pilot whales, Risso's dolphins, spinner dolphins, and striped dolphins. These explosive impact criteria are based upon newborn calf weights, and therefore these effects are overpredicted by the model, assuming most animals within the population are larger than a newborn calf. Furthermore, as explained above, the criteria for mortality and slight lung injury are very conservative (e.g., overestimate the effect). Nevertheless, it is possible for delphinids to be injured or killed by an explosion in isolated instances. While the Navy does not anticipate delphinid mortalities from underwater detonations during mine neutralization activities involving time-delay diver placed charges, there is a possibility of a marine mammal approaching too close to an underwater detonation when there is insufficient time to delay or stop without jeopardizing human safety. Considering that delphinid species for which these impacts are predicted have stocks with tens of thousands of animals, removing several animals from the population would be unlikely to have measurable long-term consequences.

A total of 3 PTS and 65 TTS are predicted for 11 species of delphinids. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

The acoustic analysis indicates that 58 delphinids from 11 species could be exposed to sound or energy from underwater explosions that would result in a behavioral response. Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if delphinids are exposed to explosions, they may react by alerting, ignoring the stimulus, changing their behaviors or vocalizations, or avoiding the area by swimming away or diving. Overall, predicted impacts are low. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual animals or populations.

Beaked Whales

Beaked whales may be exposed to sound and energy from explosions associated with training activities throughout the year, although the acoustic analysis predicts that no beaked whales would be impacted. Long-term consequences for individuals or populations would not be expected.

Pygmy and Dwarf Sperm Whales (*Kogia* spp.)

Pygmy and dwarf sperm whales (genus: *Kogia*) may be exposed to sound and energy from explosions associated with training activities throughout the year. The acoustic analysis predicts that pygmy and dwarf sperm whales could be exposed to sound annually that may result in three TTS and one PTS (Table 3.4-22 describes predicted numbers of exposures). The majority of these exposures occur within the VACAPES and GOMEX Range Complexes. *Kogia* species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico Oceanic. Predicted impacts on pygmy and dwarf sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of impacts predicted offshore of the east coast would impact the Western North Atlantic stocks.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Long-term consequences for the population would not be expected.

Harbor Porpoises

Harbor porpoises may be exposed to sound and energy from explosions associated with training activities throughout the year. The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 9 behavioral reactions, 120 TTS, 53 PTS, 3 slight lung injuries, and 1 mortality (Table 3.4-22 describes predicted numbers of exposures). Predicted impacts on this species are in the VACAPES Range Complex, generally within the Northeast U.S. Continental Shelf Large Marine Ecosystem. All harbor porpoises within the Study Area belong to the Gulf of Maine/Bay of Fundy Stock, and therefore all predicted impacts would be incurred to this stock.

Onset mortality and onset slight lung injury criteria use conservative thresholds to predict the onset of effect as discussed in Section 3.4.3.1.4 (Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on Marine Mammals). The thresholds are based upon newborn calf masses, and therefore these impacts are overpredicted by the acoustic model, assuming most animals within the population are larger than a newborn calf. As explained above, the criteria for onset mortality and onset slight lung injury are very conservative (e.g., overestimate the effect). Furthermore, harbor porpoises are wary of human activity and may avoid the area around the detonation point before the explosion occurs due to activity associated with setting up underwater detonations or targets. Nevertheless, it is possible for harbor porpoises to be injured or killed by an explosion. Considering that harbor porpoises are numerous, measurable population level effects are unlikely even upon removing a few animals from the population.

Animals that do experience hearing loss (PTS or TTS) may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully

recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Long-term consequences for the population would not be expected.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) of harbor porpoises show that this small species is wary of human activity and will avoid anthropogenic sound sources in many situations at levels down to 120 dB re 1 μPa. Harbor porpoises may startle and leave the immediate area of the training exercise but return within a few days after the event ends. As discussed above, harbor porpoises may leave the area before a detonation, allowing the animal to avoid more significant impacts such as hearing loss, injury, or mortality. Significant behavioral reactions seem more likely than with most other odontocetes. Animals that do exhibit a significant behavioral reaction would likely recover from any incurred costs, reducing the likelihood of long-term consequences for the individual or population.

Phocid Seals

Phocid seals may be exposed to sound and energy from explosions associated with training activities throughout the year, although the acoustic analysis predicts that no phocid seals would be impacted. Long-term consequences for individuals or populations would not be expected.

Manatees (ESA-Listed)

The manatee is primarily an inshore species, with most sightings occurring in warm fresh water, estuaries, and occasionally extremely nearshore coastal waters. Training activities that include explosions do not typically occur within or near West Indian manatee habitat, and therefore, impacts on manatees are unlikely. For this reason, manatees were not considered within the acoustic model when predicting impacts from explosions associated with the Proposed Action. Proposed activities involving explosions would not take place within or near ESA-designated critical habitat and therefore would not affect it.

Conclusion

Training activities under the No Action Alternative include the use of explosions as described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-1, and in Section 3.0.5.3.1.2 (Explosives). These activities do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be exposed to noise or energy from explosions.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects.

Pursuant to the MMPA, the use of explosive sources during training activities as described under the No Action Alternative:

- *may expose marine mammals up to 268 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 97 times annually to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 13 marine mammals annually to explosive energy that may cause mortality.*

Table 3.4-22 presents the Navy's marine mammal predicted exposures for Training Activities under the No Action Alternative.

Pursuant to the ESA, the use of explosive sources during training activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect the sei whale;*
- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, polar bear, and West Indian manatee; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.9.5 No Action Alternative – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-2 and Table 2.8-3, and Section 3.0.5.3.1.2 (Explosives), testing activities under the No Action Alternative would use underwater detonations and explosive munitions. Testing activities involving explosions could be conducted throughout the Study Area but would be concentrated in the VACAPES Range Complex, followed by the JAX and Key West Range Complexes. These events would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Caribbean Sea Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Testing activities using explosions do not normally occur within 3 nm of shore; the exception is the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is nearshore, partially within the surf zone.

Predicted acoustic impacts on marine mammals from exposure to explosions during annually recurring testing activities under the No Action Alternative are shown in Table 3.4-24. Aircraft carrier sea trials and ship shock trials would not occur under the No Action Alternative. Approximately 15 percent of modeled activities involve multiple detonations (multiple detonations, as defined for this analysis, are described in Section 3.4.3.1.4.5, Behavioral Responses) and are therefore evaluated for potential behavioral responses from marine mammals.

Mysticetes

Overall predicted impacts on mysticetes from explosions used during testing activities under the No Action Alternative are relatively low. The acoustic analysis predicts that only the minke whale would potentially be impacted, although all mysticetes within the Study Area could be exposed to sound and energy from explosions. Section 3.4.3.1.9.1 (Range to Effects) discusses predicted ranges to specific impacts for low-frequency cetaceans (mysticetes). Impacts are predicted primarily within the Naval

Surface Warfare Center, Panama City Division Testing Range in the Gulf of Mexico Large Marine Ecosystem and in the VACAPES Range Complex within the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area.

North Atlantic Right Whales (ESA-Listed)

North Atlantic right whales may be exposed to sound or energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts no impacts on North Atlantic right whales. Although ESA-listed North Atlantic right whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Testing activities that use explosives would not occur in the North Atlantic right whale mitigation areas. The sound and energy from explosions associated with testing activities under the No Action Alternative would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitats (i.e., water temperature and depth in the southeast and copepods in the northeast).

Humpback Whales (ESA-Listed)

Humpback whales may be exposed to sound or energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no humpback whales would be impacted. Although ESA-listed humpback whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Sei Whales (ESA-Listed)

Sei whales may be exposed to sound or energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no sei whales would be impacted. Although ESA-listed sei whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Fin Whales (ESA-Listed)

Fin whales may be exposed to sound or energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no fin whales would be impacted.

Although ESA-listed fin whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Blue Whales (ESA-Listed)

Blue whales may be exposed to sound or energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no blue whales would be impacted. Although ESA-listed blue whales are present in the Study Area, it is unlikely that explosive stressors and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Minke and Bryde's Whales

Minke and Bryde's whales may be exposed to sound or energy from explosions associated with testing activities throughout the year. The acoustic analysis predicted no impacts to Bryde's whale from testing activities involving explosions. The acoustic analysis predicts that minke whales could be exposed to sound and energy from explosives annually that may result in two behavioral responses, five TTS, and one PTS. All predicted effects on minke whales would be to the Canadian East Coast stock since this is the only stock present within the Study Area.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if mysticetes are exposed to explosions, they may react in a variety of ways, which may include alerting, startling, breaking off feeding dives and surfacing, diving or swimming away, or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations.

Odontocetes

Sperm Whales (ESA-Listed)

Sperm whales may be exposed to sound and energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no sperm whales would be impacted. Although ESA-listed sperm whales are present in the Study Area, it is unlikely that explosive stressors

and this species would co-occur based on the expected locations of testing, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. Even with use of conservative assumptions in the acoustic impacts modeling, criteria, and thresholds (see Section 3.4.3.1.5.4, Model Assumptions and Limitations, and Section 3.4.3.1.10.3, Predicted Impacts), the quantitative analysis of acoustic impacts predicts that this species is unlikely to be affected by the use of explosives. Long-term consequences for individuals or populations would not be expected.

Dolphins and Small Whales (Delphinids)

Dolphins and small whales (delphinids) may be exposed to sound and energy from explosions associated with testing activities throughout the year. The acoustic analysis predicts that delphinids could be exposed to sound that may result in 5 mortalities, 18 slight lung injuries, 35 TTS, and 14 behavioral reactions (Table 3.4-24 describes predicted numbers of exposures). Predicted explosive impacts on dolphins occur primarily in the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range, but a few impacts could occur throughout the Study Area. Impacts would be concentrated within the Northeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and the Gulf Stream Open Ocean Area. Most dolphin species are separated into two stocks within the Study Area: the Western North Atlantic and Gulf of Mexico. Predicted impacts on delphinids within the Gulf of Mexico are presumed to be on the Gulf of Mexico stocks, whereas the majority of impacts predicted offshore of the east coast would be on the Western North Atlantic stocks. Bottlenose dolphins are divided into multiple coastal and one oceanic stock along the east coast. The majority of exposures to bottlenose dolphins are likely to the oceanic stock.

Mortality and slight lung injury are predicted for eight species of dolphins, including Atlantic spotted dolphins, Atlantic white-sided dolphins, bottlenose dolphins, common dolphins, pantropical spotted dolphins, pilot whales, Risso's dolphins, and striped dolphins. These explosive criteria are based upon newborn calf weights, and therefore these effects are overpredicted by the model, assuming most animals within the population are larger than a newborn calf. Furthermore, as explained above, the criteria for mortality and slight lung injury are very conservative (e.g., overestimate the effect). Nevertheless, it is possible for delphinids to be injured or killed by an explosion in isolated instances. Considering that delphinid species for which these effects are predicted have stocks with tens of thousands of animals, removing several animals from the population would be unlikely to have measurable long-term consequences.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that if delphinids are exposed to explosions, they may react by alerting, ignoring the stimulus, changing their behaviors or vocalizations, or avoiding the area by swimming away or diving. Overall, predicted effects are low. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual animals or populations.

Beaked Whales

Beaked whales may be exposed to sound and energy from explosions associated with testing activities throughout the year, although the acoustic analysis predicts that no beaked whales would be impacted. Long-term consequences for individuals or populations would not be expected.

Pygmy and Dwarf Sperm Whales (*Kogia* spp.)

Pygmy and dwarf sperm whales may be exposed to sound and energy from explosions associated with testing activities throughout the year. The acoustic analysis predicts that a pygmy or dwarf sperm whale could be exposed to energy or sound from underwater explosions that may result in one TTS. This impact could happen anywhere throughout the Study Area where testing activities involving explosives occur.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Harbor Porpoises

Harbor porpoises may be exposed to sound and energy from explosions associated with testing activities throughout the year. The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 301 behavioral reactions, 180 TTS, 53 PTS, 4 slight lung injuries, and 1 mortality. Predicted impacts on this species are primarily within the VACAPES and Northeast Range Complexes. Impacts would primarily occur within the Northeast U.S. Continental Shelf Large Marine Ecosystem. All harbor porpoises within the Study Area belong to the Gulf of Maine/Bay of Fundy stock, and therefore, all predicted impacts would be on this stock.

Onset mortality and onset slight lung injury criteria are based upon newborn calf masses, and therefore these effects are overpredicted by the acoustic model, assuming most animals within the population are larger than a newborn calf. As explained above, the criteria for onset mortality and onset slight lung injury are very conservative (e.g., overestimate the effect). Furthermore, harbor porpoises are wary of human activity and may avoid the area around the detonation point before the explosion occurs due to activity associated with setting up underwater detonations or targets. Nevertheless, it is possible for harbor porpoises to be injured or killed by an explosion. Considering that harbor porpoises are numerous, measureable population level effects are unlikely even upon removing a few animals from the population.

PTS and TTS are predicted for harbor porpoises. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) of harbor porpoises show that this species is wary of human activity and will avoid anthropogenic sound sources, in many situations at levels down to 120 dB re 1 μPa. Harbor porpoises may startle and leave the immediate area of the

testing exercise but return within a few days after the event ends. Animals may also leave the area before an event begins, based on activity related to underwater detonation placement or target area setup. Therefore, these animals could avoid more significant impacts such as hearing loss, injury, or mortality. Significant behavioral reactions are more likely than with most other marine mammals. Animals that do exhibit a significant behavioral reaction would likely recover from any incurred cost, reducing the likelihood of long-term consequences for the individual. Any long-term consequences, such as reduced fitness to a few individuals, are unlikely to cause long-term consequences for harbor porpoise populations.

Phocid Seals

Phocid seals may be exposed to sound and energy from explosions associated with testing activities throughout the year. The acoustic analysis predicts that phocid seals could be exposed to sound that may result in eight behavioral reactions and eight TTS. The predicted effects are in the Northeast Range Complexes within the Northeast U.S. Continental Shelf Large Marine Ecosystem.

Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. Considering these factors and the low number of overall predicted impacts, long-term consequences for individuals or populations would not be expected.

Research and observations (Section 3.4.3.1.2.5, Behavioral Reactions) show that pinnipeds in the water are tolerant of anthropogenic noise and activity. Significant behavioral reactions would not be expected in most cases. Overall, predicted effects are low. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual animals or populations.

Manatees (ESA-Listed)

The manatee is primarily an inshore species, with most sightings occurring in warm fresh water, estuaries, and occasionally extremely nearshore coastal waters. Testing activities that include explosions do not typically occur in West Indian manatee habitat, and therefore, impacts on manatees are unlikely. Proposed activities involving explosions would not take place within ESA-designated critical habitat. There were no model-predicted effects to manatees from explosions associated with the Proposed Action, however, within the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is nearshore and partially within the surf zone, manatees could be exposed to sound and energy from underwater explosions. Mitigation measures outlined in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would reduce or eliminate the potential for manatees to be exposed to high levels of explosive sound and energy that could cause injury or strong behavioral reactions.

Conclusion

Testing activities under the No Action Alternative include the use of explosions as described in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives) and in Section 3.0.5.3.1.2 (Explosives). These activities do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be exposed to noise or energy from explosions.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects. Pursuant to the MMPA, the use of explosive sources during testing activities as described under the No Action Alternative:

- *may expose marine mammals up to 554 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 76 times annually to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 6 marine mammals annually to explosive energy that may cause mortality.*

Table 3.4-24 presents the Navy's marine mammal predicted exposures for Testing Activities under the No Action Alternative.

Pursuant to the ESA, the use of explosive sources during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, fin whale, sei whale, blue whale, sperm whale and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.9.6 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosives), the number of annual training activities that use explosives under Alternative 1 would approximately double (Section 3.4.3.1.9.4, No Action Alternative – Training Activities, describes predicted impacts on marine mammals under the No Action Alternative). For Alternative 1, predicted effects are shown in Table 3.4-23 for annually recurring training activities and in Table 3.4-27 for civilian port defense. These activities would happen in the same general locations and in similar numbers as described by the No Action Alternative, with the following notable exceptions:

- Training activities using explosive source sonobuoys (Bin E4) would be relocated from the GOMEX Range Complex under Alternative 1 to the VACAPES and JAX Range Complexes. This would decrease impacts in the GOMEX Range Complex and increase impacts for the VACAPES and JAX Range Complexes.
- Alternative 1 would include the training activity civilian port defense, which is not included under the No Action Alternative. Table 3.4-27 indicates that predicted effects on marine mammals are very low. This event would take place once every two years in one of the following locations: Earle, New Jersey; Groton, Connecticut; Hampton Roads, Virginia; Morehead City, North Carolina; Wilmington, North Carolina; Kings Bay, Georgia; Mayport, Florida; Beaumont, Texas; or Corpus Christi, Texas. However, any phases of the event that involve underwater detonation training would occur in designated areas in the VACAPES, JAX, and GOMEX Range Complexes. Predicted impacts represent the highest estimate of impacts on each species across all areas. Throughout all of the areas and seasons, only harbor porpoises in the winter in the VACAPES Range Complex were predicted to receive seven TTS and one PTS.

- Two additional joint task force/sustainment exercises per year (four total) are proposed under Alternative 1. There are no predicted impacts on marine mammals from these events.
- Mine neutralization events would increase in the VACAPES Range Complex under Alternative 1 to 524 events per year from 24 events per year, as described under the No Action Alternative. These activities use up to a 60 lb. net explosive weight charge (but typically use a 20 lb. net explosive weight charge or less) to destroy an underwater mine (explosive mines are not used for this activity, only mine-like shapes). Predicted impacts would increase substantially due to the increase in this activity. Model predicted impacts indicate behavioral reactions, TTS, slight lung injuries, and mortalities for several dolphin species; and 2 behavioral reactions, 6 TTS, and one PTS of minke whales not predicted under the No Action Alternative. Total predicted impacts on harbor porpoises from mine neutralization activities increased from 14 to 278.

The increase in proposed activities under Alternative 1 over the No Action Alternative would in turn lead to an overall increase in predicted impacts on marine mammals by a factor of about three (behavioral reactions, TTS, PTS, gastrointestinal tract injuries, slight lung injuries, and mortalities). This could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, although the types and severity of individual responses to explosions are unlikely to change. Notable results from Alternative 1 are as follows:

- Predicted impacts on mysticetes would increase by a factor of approximately three times. Predicted impacts on minke whales would include 9 behavioral reactions, 30 TTS, 4 PTS, 1 gastrointestinal tract injury, and 1 slight lung injury. For ESA-listed mysticetes, Alternative 1 also includes one behavioral reaction and one TTS prediction each for fin and sei whales, one TTS for a humpback whale, and one TTS for a North Atlantic right whale.
- Predicted impacts on ESA-listed sperm whales would increase under Alternative 1, to include one behavioral reaction and one TTS.
- Predicted impacts on delphinids would increase by about 90 percent.
- As with the No Action Alternative, there are no predicted impacts on beaked whales.
- Predicted impacts on harbor porpoises would increase by a factor of approximately four times due primarily to an increase in mine neutralization, bombing, and naval gunnery training exercises in the VACAPES Range Complex. Predicted behavioral reactions, TTS, and PTS would increase, as would the predicted numbers of mortalities and lung injuries.
- Predicted impacts on pygmy and dwarf sperm whales would be minor overall and would not substantially change from the No Action Alternative.
- Predicted impacts on phocids would increase slightly, including two TTS and one behavioral reaction for harbor seals.
- As with the No Action Alternative, training activities that include explosions would not typically occur in West Indian manatee habitat, so impacts on manatees from explosive sources were not quantitatively analyzed. Activities would not affect West Indian manatee critical habitat.

Although impacts on marine mammals due to explosive energy and sound would increase under Alternative 1 compared to the No Action Alternative, the types and severity of individual responses to explosions are unlikely to change. Increases in the number of times individual animals are exposed throughout the year could occur, which would increase the likelihood of that individual suffering long-term consequences due to repeated exposures. The number of animals exposed throughout the year could also increase, although it is uncertain how the increase in the number of individual animals predicted to receive direct impacts, and therefore the number of individuals that may suffer long-term consequences, would affect populations.

As described under the No Action Alternative, mortalities and lung injuries are overpredicted; hearing loss may affect an animal's ability to detect relevant sounds for a short period or permanently depending on the level of exposure; and behavioral reactions could occur, although occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences. If long-term consequences for a few animals in populations that number in the tens of thousands do occur, they are unlikely to have measurable long-term consequences for marine mammal populations.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects. Pursuant to the MMPA, the use of explosive sources during training activities as described under Alternative 1:

- *may expose marine mammals up to 912 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 262 times annually to sound or energy levels that would be considered Level A harassment;*
- *may expose marine mammals up to 7 times during each biennial civilian port defense activity to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to one time during each biennial civilian port defense activity to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 17 marine mammals annually to explosive energy that may cause mortality.*

Table 3.4-23 and Table 3.4-27 present the Navy's marine mammal predicted exposures for training activities under Alternative 1.

Pursuant to the ESA, the use of explosive sources during training activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed sperm whale, sei whale, fin whale, humpback whale, and North Atlantic right whale;*
- *may affect but is not likely to adversely affect the ESA-listed blue whale;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, polar bear, and West Indian manatee; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.9.7 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-2 and Table 2.8-3, and in Section 3.0.5.3.1.2 (Explosives), the number of annual testing activities that use explosions under Alternative 1 would increase over the No Action Alternative. These activities would happen in the same general locations under Alternative 1 as under the No Action Alternative. New testing activities proposed under Alternative 1 and notable increases in numbers of activities from the No Action Alternative are as follows:

- Alternative 1 would include one aircraft carrier sea trial, which would take place once within a five-year period. This event could take place during any season; however, there are no predicted impacts to marine mammals from energy or sound associated with underwater explosions.

- Alternative 1 would include one aircraft carrier ship shock trial during the five-year period. This event could take place in one of two locations (VACAPES or JAX Range Complex) during fall, winter, or summer. Predicted impacts represent the highest estimate for each species across all areas and seasons. The aircraft carrier ship shock trial would use up to four 58,000 lb. net explosive weight charges, one at a time, over a several-week period. Predicted impacts from the aircraft carrier shock trial are substantial (see Table 3.4-28). They include 4,607 TTS, 1 PTS, 6,590 slight lung injuries, and 445 mortalities of marine mammals. Impacts are predicted mostly for dolphin species, although 4 TTS are predicted for the ESA-listed sei whale, 1 TTS for the ESA-listed humpback whale, and 3 TTS for the ESA-listed fin whale. Additionally, the acoustic analysis predicts 11 TTS, 3 slight lung injuries, and 2 mortalities for the ESA-listed sperm whale. For non-ESA listed species, all mortalities are predicted to be delphinids, with the exception that three minke whale mortalities. Based on conservativeness of the onset mortality criteria and impulse modeling, and past ship shock trials during which no marine mammal mortalities were observed, the mortalities predicted for the aircraft carrier ship shock trial are considered overestimates and highly unlikely to occur. Therefore, the Navy conservatively estimates that 10 small odontocete mortalities could occur during the aircraft carrier ship shock trial. Although shipboard and aerial pre-exercise monitoring to avoid exposing marine mammals to high levels of explosive energy were applied to the model-predicted mortalities for aircraft carrier shock trials, it is important to note that there are additional protections offered by mitigation measures, which are known to be effective and will reduce exposures to marine mammals, but are not considered in the quantitative adjustment of the tabulated impacts.
- Alternative 1 would include one guided missile destroyer ship shock trial and two Littoral Combat Ship shock trials during the five-year period. These ship shock trials would use up to four 14,500 lb. net explosive weight charges, one at a time, over a several week period. These events could take place in the JAX Range Complex during fall, spring, or summer, or year-round within the VACAPES Range Complex. Predicted impacts represent the highest estimate for each species across all areas and seasons. Predicted impacts are substantial (Table 3.4-29) and include 289 TTS, 396 slight lung injuries, and 29 mortalities per event, mostly to delphinid species. The acoustic analysis predicts one TTS for the ESA-listed sei whale and one TTS for the ESA-listed fin whale. Predicted impacts include three TTS and one slight lung injury for the ESA-listed sperm whale per event. Based on conservativeness of the onset mortality criteria and impulse modeling, and past ship shock trials during which no marine mammal mortalities were observed, the mortalities predicted for the these ship shock trials are considered overestimates and highly unlikely to occur. Therefore, the Navy conservatively estimates that 15 small odontocete mortalities could occur during these three ship shock trials. Although pre-exercise monitoring to avoid exposing marine mammals to high levels of explosive energy was applied to the model-predicted mortalities for these shock trials, it is important to note that there are additional protections offered by mitigation measures, which are known to be effective and will reduce exposures to marine mammals, but are not considered in the quantitative adjustment of the tabulated impacts.

The increase in proposed annual testing activities under Alternative 1 over the No Action Alternative would increase overall predicted impacts on marine mammals (behavioral reactions, hearing loss, injuries, and mortalities) by 44 percent, in addition to the predicted impacts due to the proposed ship shock trials. This could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, although the types and severity of individual responses to explosions are unlikely to change. Predicted acoustic impacts on marine mammals from exposure to explosions from annually recurring testing activities under Alternative 1 are

shown in Table 3.4-25, for aircraft carrier shock trials in Table 3.4-28, and for guided missile destroyer and Littoral Combat Ship shock trials in Table 3.4-29. Notable results for Alternative 1 are as follows:

- Predicted impacts on mysticetes would increase. Predicted impacts on minke whales could increase during annually recurring activities as well as due to the addition of ship shock trials. In addition to the predicted impacts on ESA-listed mysticetes due to ship shock trials (discussed above), one TTS for a sei whale is predicted per year due to annual testing activities.
- Predicted impacts on ESA-listed sperm whales would increase primarily due to the inclusion of ship shock trials. See above discussions on shock trials for details.
- Predicted impacts on delphinids would increase by 151 percent due to increases in annually recurring testing activities. Shock trials could also impact up to 13,656 delphinids per five-year period. See above discussions on shock trials for details.
- As with testing activities under the No Action Alternative, there are no predicted explosive impacts on beaked whales due to annually recurring testing activities under Alternative 1. Ship shock trials are predicted to impact 22 beaked whales (7 behavioral harassments and 15 injuries) over five years.
- Predicted impacts from annual testing activities to harbor porpoises would increase by 17 percent. No impacts to harbor porpoises are predicted due to shock trials.
- Predicted impacts on pygmy and dwarf sperm whales would slightly increase. Additionally, ship shock trials could expose these species to explosive sound and energy that may result in 6 TTS, 1 PTS, and 3 slight lung injuries over a five-year period.
- Predicted impacts on phocid seals would be identical to impacts predicted under the No Action Alternative.
- As with the No Action Alternative, testing activities may expose manatees to sound and energy from underwater explosives within the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is nearshore and partially within the surf zone.

These activities do not overlap bowhead whale, beluga whale, narwhal, walrus, or polar bear habitat. Therefore, it is very unlikely that these marine mammal species would be exposed to noise or energy from explosions.

Impacts on marine mammals due to explosive energy and sound increase under Alternative 1 compared to the No Action Alternative, especially due to the inclusion of ship shock trials. As described under the No Action Alternative, mortalities and lung injuries are overpredicted; hearing loss may affect an animal's ability to detect relevant sounds for a short period or permanently, depending on the level of exposure; and behavioral reactions could occur, although occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences. Generally, if long-term consequences for a few animals in populations that number in the tens of thousands do occur, they are unlikely to have measureable long-term consequences for populations. However, ranges to mortality and lung injury for ship shock trials can be up to a few kilometers from the point of detonation, thereby potentially encompassing tens of square kilometers. If a large group of marine mammals (e.g., a large pod of dolphins) were within this area during the detonation, impacts on localized stocks or populations could be substantial; however, it is important to note that there are additional protections offered by mitigation measures (discussed in Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures), which are known to be effective and will reduce exposures to marine mammals, but are not considered in the quantitative adjustment of the tabulated impacts.

Pursuant to the MMPA, the use of explosive sources during annually recurring testing activities as described under Alternative 1:

- *may expose marine mammals up to 728 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 116 times annually to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 10 marine mammals annually to explosive energy that may cause mortality.*

Pursuant to the MMPA, the use of explosive sources during the testing activity aircraft carrier sea trials conducted once per five-year period as described under Alternative 1 would not expose marine mammals to sound or energy levels that would be considered Level A or Level B harassment, or result in a mortality.

Pursuant to the MMPA, the use of explosive sources during the testing activity aircraft carrier ship shock trial conducted once per five-year period as described under Alternative 1:

- *may expose marine mammals up to 4,607 times to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 6,591 times to sound or energy levels that would be considered Level A harassment; and*
- *Though the acoustic analysis predicts that up to 445 marine mammal mortalities may occur, based on conservativeness of the model, conservativeness of the impact criteria and thresholds, and past monitoring results, this event may expose up to 10 marine mammals over a five-year period to explosive energy that may cause mortality.*

Pursuant to the MMPA, the use of explosive sources during the testing activity guided missile destroyer and Littoral Combat Ship shock trials conducted three times per five-year period as described under Alternative 1:

- *may expose marine mammals up to 289 times per event to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 396 times per event to sound or energy levels that would be considered Level A harassment; and*
- *though the acoustic analysis predicts that up to 29 marine mammal mortalities may occur, based on conservativeness of the model, conservativeness of the impact criteria and thresholds, and past monitoring results, these events may expose up to 15 marine mammals per event and no more than 15 marine mammals total over a five-year period to explosive energy that may cause mortality.*

Table 3.4-25, Table 3.4-28, and Table 3.4-29 present the Navy's marine mammal predicted exposures for testing activities under Alternative 1.

Pursuant to the ESA, the use of explosive sources during testing activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed sei whale, fin whale, humpback whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, blue whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.9.8 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Section 3.4.3.1.9.6 (Alternative 1 – Training Activities).

Pursuant to the MMPA, the use of explosive sources during training activities as described under Alternative 2:

- *may expose marine mammals up to 912 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 262 times annually to sound or energy levels that would be considered Level A harassment;*
- *may expose marine mammals up to 7 times during each biennial civilian port defense activity to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to one time during each biennial civilian port defense activity to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 17 marine mammals annually to explosive energy that may cause mortality.*

Table 3.4-23 and Table 3.4-27 present the Navy's marine mammal predicted exposures for training activities under Alternative 2.

Pursuant to the ESA, the use of explosive sources during training activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed sperm whale, sei whale, fin whale, humpback whale, and North Atlantic right whale;*
- *may affect but is not likely to adversely affect the ESA-listed blue whale;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, polar bear, and West Indian manatee; and*
- *will have no effect on North Atlantic right and West Indian manatee critical habitats.*

3.4.3.1.9.9 Alternative 2 (Preferred Alternative) – Testing Activities

The number of annual testing activities that use explosives under Alternative 2 would increase by a factor of three over the No Action Alternative; however, the amount of explosive munitions would only increase by approximately 10 percent over the No Action Alternative. Section 3.4.3.1.9.3 (Predicted Impacts from Explosives) describes predicted impacts on marine mammals. This includes overall

increases to amphibious warfare, anti-surface warfare, anti-submarine warfare, and mine warfare. A more detailed description of these testing activities and their proposed locations is in Table 2.8-2 and Table 2.8-3 and in Section 3.0.5.3.1 (Acoustic Stressors). These activities would happen in the same general locations under Alternative 2 as under the No Action Alternative.

New testing activities proposed under Alternative 2 are identical in location and number as those proposed under Alternative 1. Section 3.4.3.1.9.7 (Alternative 1 – Testing Activities) discusses these additional activities (one aircraft carrier sea trial and four ship shock trials) and the resulting predicted impacts.

The increase in proposed annually recurring testing activities under Alternative 2 over the No Action Alternative would increase overall predicted impacts on marine mammals (behavioral reactions, hearing loss, injuries, and mortalities) by 103 percent, in addition to the predicted effects due to ship shock trials. This could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, although the types and severity of individual responses to explosions are unlikely to change. Predicted acoustic impacts on marine mammals from exposure to explosions from annually recurring testing activities under Alternative 2 are shown in Table 3.4-25, for aircraft carrier shock trials in Table 3.4-28, for guided missile destroyer and Littoral Combat Ship shock trials in Table 3.4-29. Notable differences in the number of predicted impacts on marine mammals from explosions between Alternative 2 and the No Action Alternative are similar to the differences between Alternative 1 and the No Action Alternative, as discussed above in Section 3.4.3.1.9.7 (Alternative 1 – Testing Activities), with three notable exceptions:

- Predicted impacts on ESA-listed species would increase slightly with one additional predicted TTS to a fin whale, one additional predicted TTS to a sei whale, and one additional predicted behavioral reaction of a sperm whale compared to the No Action Alternative for annual testing. Impacts on ESA-listed species due to ship shock trials are identical to those discussed under Alternative 1.
- Predicted impacts on harbor porpoises would increase by about 76 percent over the No Action Alternative due the increase in annual testing activities. Impacts on harbor porpoises from ship shock trials would be identical to those discussed above under Alternative 1. Predicted impacts on phocid seals under Alternative 2 would increase by 68 percent over the No Action Alternative to 15 predicted behavioral responses, 15 TTS, and 2 potential PTS. As with the No Action Alternative, testing activities may expose manatees to sound and energy from underwater explosives within the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is nearshore and partially within the surf zone.

Impacts on marine mammals due to explosive energy and sound increase under Alternative 2 compared to the No Action Alternative, especially due to the inclusion of ship shock trials, although the types and severity of individual responses to explosions are unlikely to change. As described under the No Action Alternative, mortalities and lung injuries are overpredicted, hearing loss may affect an animal's ability to detect relevant sounds for a short period or permanently depending on the level of exposure, and behavioral reactions could occur, although occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences. Generally, if long-term consequences for a few animals in populations that number in the tens of thousands do occur, they are unlikely to have measureable long-term consequences for populations. However, ranges to mortality and lung injury for shock trials can be up to a few kilometers from the point of detonation, thereby potentially encompassing tens of square

kilometers. If a large group of marine mammals (e.g., a large pod of dolphins) were within this area during the detonation, impacts on localized populations could be substantial, making long-term consequences for the stock or overall population more likely.

It is important to note, as discussed in Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures), that there are additional protections offered by mitigation measures (as described in detail in Chapter 5; Standard Operating Procedures, Mitigation, and Monitoring) which will further reduce potential impacts to marine mammals, but are not considered in the quantitative adjustment of the model predicted effects. Pursuant to the MMPA, the use of explosive sources during testing activities as described under Alternative 2:

- *may expose marine mammals up to 1,061 times annually to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 162 times annually to sound or energy levels that would be considered Level A harassment; and*
- *may expose up to 11 marine mammals annually to explosive energy that may cause mortality.*

Pursuant to the MMPA, the use of explosive sources for the testing activity aircraft carrier sea trials conducted once per five-year period as described in Alternative 2 would not expose marine mammals to levels of sound or energy that would be considered Level A or Level B harassment, or result in a mortality.

Pursuant to the MMPA, the use of explosive sources during the testing activity aircraft carrier ship shock trial conducted once per five-year period as described under Alternative 2:

- *may expose marine mammals up to 4,607 times to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 6,591 times to sound or energy levels that would be considered Level A harassment; and*
- *though the acoustic analysis predicts that up to 445 marine mammal mortalities may occur, based on conservativeness of the model, conservativeness of the impact criteria and thresholds, and past monitoring results, this event may expose up to 10 marine mammals over a 5-year period to explosive energy that may cause mortality.*

Pursuant to the MMPA, the use of explosive sources during the testing activity guided missile destroyer and Littoral Combat Ship shock trials conducted three times per five-year period as described under Alternative 2:

- *may expose marine mammals up to 289 times per event to sound or energy levels that would be considered Level B harassment;*
- *may expose marine mammals up to 396 times per event to sound or energy levels that would be considered Level A harassment; and*
- *though the acoustic analysis predicts that up to 29 marine mammal mortalities may occur, based on conservativeness of the model, conservativeness of the impact criteria and thresholds, and past monitoring results, these events may expose up to 15 marine mammals over a five-year period to explosive energy that may cause mortality.*

Table 3.4-25, Table 3.4-28, and Table 3.4-29 present the Navy's marine mammal predicted exposures for testing activities under Alternative 2.

Pursuant to the ESA, the use of explosive sources during testing activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed fin whale, sei whale, humpback whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, blue whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.10 Impacts from Pile Driving

Construction of the elevated causeway system, a temporary pier allowing offloading of supply ships, would require pile driving and pile removal during Joint Logistics Over-the-Shore training. A separate environmental assessment has been prepared to address impacts due to all activities that occur during Joint Logistics Over-the-Shore training, with the exception of impacts due to in-water noise generated during construction of the elevated causeway. This EIS/OEIS includes analysis of the impact of underwater noise generated by pile driving during elevated causeway construction to facilitate holistic analysis of impacts due to all underwater noise generated during training and testing in the Study Area.

Marine mammals could be exposed to sounds from impact and vibratory pile driving during the construction and removal phases of the elevated causeway. Sounds produced during pile driving are described in Section 3.0.5.3.1.3 (Pile Driving). This activity would involve intermittent impact pile driving of 24-inch, uncapped, steel pipe piles over about two weeks at a rate of about eight piles per day, one pile at a time, for a total of approximately 100 piles. Each pile takes about 10 minutes to drive. When training events that use the elevated causeway system are complete, the structure would be removed. The piles would be removed using vibratory methods over seven to ten days. Crews can remove about 14 piles per day, each taking about six minutes to remove. The duration of pile driving during installation and removal of piles is as follows:

Impact pile driving (approximately 100 piles):

100 piles/8 piles per day = 12.5 days

8 piles x 10 minutes impact driving per pile = 80 minutes per day

Portion of day impact pile driving noise produced = 6 percent

Vibratory pile removal (approximately 100 piles):

100 piles/14 piles per day = 7.1 days

14 piles x 6 minutes vibratory removal per pile = 84 minutes per day

Portion of day impact pile driving noise produced = 6 percent

3.4.3.1.10.1 Model-Predicted Effects

Underwater noise effects from pile driving were modeled using a conservative estimate of geometric spreading loss of sound in shallow coastal waters. A spreading loss of 15*Log(radius) was used to estimate range (r) to the relevant pile driving criteria. A calculation of marine mammal exposures is then estimated by:

Exposure estimate = $(n * (\pi r^2/2)) *$ days of pile installation/removal

Where:

n = density estimate used for each species/season
r = range to pile driving noise criteria threshold(s)
$\pi \approx 3.1415926$

The exposure estimate was calculated separately for the impact and the vibratory pile driving activities and combined to predict the total number of expected exposures. Four species of marine mammals have a density estimate occurring near the coastal pile driving locations. The West Indian manatee has no density estimate available for the Virginia and North Carolina inland coastal waters but may occur during the summer months. Therefore, the West Indian manatee was only qualitatively assessed. The resulting tables of marine mammal exposures are listed in Table 3.4-34 and Table 3.4-35.

Table 3.4-34: Predicted Effects on Marine Mammals from Pile Driving Activities Associated with the Construction and Removal of the Elevated Causeway System at Joint Expeditionary Base Fort Story or Little Creek, Virginia.
(This represents a single event at either location; effect predictions were identical due to the proximity of the proposed sites.)

Species	Impact Pile Driving		Vibratory Pile Driving		Total Predicted Exposures	
	Level A 180 dB rms	Level B 160 dB rms	Level A 180 dB rms	Level B 120 dB rms	MMPA Level A	MMPA Level B
Bottlenose Dolphin	1	302	0	294	1	596
North Atlantic Right Whale	0	0	0	0	0	0
Fin Whale	0	0	0	0	0	0
Humpback Whale	0	0	0	0	0	0

dB: decibel; MMPA: Marine Mammal Protection Act; rms: root mean square

Table 3.4-35: Predicted Effects on Marine Mammals from Pile Driving Activities Associated with the Construction and Removal of the Elevated Causeway System at Marine Corps Base Camp Lejeune, North Carolina

Species	Impact Pile Driving		Vibratory Pile Driving		Total Predicted Exposures	
	Level A 180 dB rms	Level B 160 dB rms	Level A 180 dB rms	Level B 120 dB rms	MMPA Level A	MMPA Level B
Bottlenose Dolphin	0	4	0	743	0	747
North Atlantic Right Whale	0	0	0	0	0	0
Fin Whale	0	0	0	0	0	0
Humpback Whale	0	0	0	0	0	0

dB: decibel; MMPA: Marine Mammal Protection Act; rms: root mean square

3.4.3.1.10.2 No Action Alternative

Under the No Action Alternative, pile driving associated with construction and removal of the elevated causeway system would not occur. No pile driving associated with training or testing is proposed under the No Action Alternative.

3.4.3.1.10.3 Alternative 1 – Training Activities

As described in Table 2.8-1 and Section 3.0.5.3.1.3 (Pile Driving), training activities under Alternative 1 include pile driving associated with constructing and removing the elevated causeway system. This activity would take place nearshore and within the surf zone, once per year at either Marine Corps Base Camp Lejeune, Jacksonville, North Carolina or Joint Expeditionary Base Little Creek and Fort Story, Virginia. The two areas in Virginia are within the Northeast U.S. Continental Shelf Large Marine Ecosystem, and the area in North Carolina is within the Southeast U.S. Continental Shelf Large Marine Ecosystem. The pile driving locations are adjacent to Navy pierside locations in industrialized waterways that carry a high volume of vessel traffic in addition to Navy vessels using the pier. These coastal areas tend to have high ambient noise levels due to natural and anthropogenic sources and have limited numbers of sensitive marine mammal species present.

Impulses from the impact hammer are broadband and carry most of their energy in the lower frequencies. The impulses are within the hearing range of most marine mammals and can produce a shock wave that is transmitted to the sediment and water column (Reinhall and Dahl 2011). Impact pile driving has the potential to cause some permanent hearing loss if the animal is exposed within 47 meters of the pile driving location. However, given the low abundance of marine mammals and the short duration of the activity, it is very unlikely that a marine mammal would be exposed to sound levels high enough to cause injury.

Beyond this range to effects for impact pile driving, only behavioral impacts are expected to occur out to a maximum distance of 1 km. The impulses produced are less than 1 second each and can occur at a rate of 30–50 impulses per minute. Despite the short duration of each impulse, the rate of impulses has the potential to result in some auditory masking in marine mammals and has the potential to cause some temporary physiological stress. However, given the low abundance of marine mammals, the short duration of the activity, and the likelihood that an exposed animal will avoid the immediate area, it is unlikely that a marine mammal would be exposed to noise that would result in a prolonged behavioral response, and any behavioral effect would be temporary and not significant.

Sound produced from a vibratory hammer is similar in frequency range as that of the impact hammer, except the source levels are much lower than the impact hammer. Since the vibrations oscillate at a rate of 1,700 cycles per minute, the sound source is treated as a continuous sound source in this assessment. The range to effect for the injury zone at less than 3 m is much smaller than the impact pile driving range. Given the low abundance of marine mammals and the mitigation measures, it is unlikely that a marine mammal would be exposed to injurious levels of sound from the vibratory hammer.

Though the vibratory hammer produces a much lower source level than the impact hammer, marine mammal behavioral effects can occur out to a range of 22 kilometers due to a much lower behavioral threshold (sound pressure level of 120 dB re 1µPa). Therefore, the potential to behaviorally affect marine mammals is greater, although the threshold used likely overestimates the number of biologically significant reactions, especially at ranges greater than a few kilometers. The vibratory hammer has the potential to cause auditory masking in marine mammals, but the effect would be temporary and would result in the animals most likely avoiding the immediate area if the effects were to be significant to the

individuals. Any avoidance of the area is expected to be temporary and only occur while the vibratory hammer is in use.

Pile driving activities associated with training under Alternative 1 may cause nearshore species of marine mammals (e.g., bottlenose dolphins) to avoid the area near the event, although the activity potentially impacts a small area over a short duration and happens infrequently (once per year). Therefore, long-term consequences to individuals or populations are unlikely. Although ESA-listed North Atlantic right whales, humpback whales, and fin whales are present in the Study Area, it is unlikely that pile driving activities and this species would co-occur based on the expected locations of training, best available science regarding marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density), and the typical short duration of the activities. The quantitative analysis of pile driving impacts predicts that these species are unlikely to be affected by pile driving or removal. Proposed activities do not overlap the habitats of blue whale, sperm whale, sei whale, bowhead whale, ringed seal, or polar bear. Therefore, these species would not be impacted by pile driving noise. Pile driving activities do not occur within or near West Indian manatee or North Atlantic right whale critical habitat and therefore would not affect this resource.

Pursuant to the MMPA, the use of pile driving during training activities as described under Alternative 1:

- *may expose bottlenose dolphins to sound levels up to 747 times per year that would be considered Level B harassment and*
- *may expose one bottlenose dolphin per year to sound levels that would be considered Level A harassment.*

Table 3.4-34 and Table 3.4-35 present the Navy's marine mammal predicted exposures for training activities under Alternative 1.

Pursuant to the ESA, the use of pile driving during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, fin whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, sei whale, blue whale, sperm whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.10.4 Alternative 1 – Testing Activities

Testing activities under Alternative 1 do not include pile driving.

3.4.3.1.10.5 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Section 3.4.3.1.10.3 (Alternative 1 – Training Activities).

Pursuant to the MMPA, the use of pile driving during training activities as described under Alternative 2:

- *may expose bottlenose dolphins to sound levels up to 747 times per year that would be considered Level B harassment and*
- *may expose one bottlenose dolphin per year to sound levels that would be considered Level A harassment.*

Table 3.4-34 and Table 3.4-35 present the Navy's marine mammal predicted exposures for training activities under Alternative 2.

Pursuant to the ESA, the use of pile driving during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, fin whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, sei whale, blue whale, sperm whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.10.6 Alternative 2 (Preferred Alternative) – Testing Activities

Testing activities under Alternative 2 do not include pile driving.

3.4.3.1.11 Impacts from Swimmer Defense Airguns

Marine mammals could be exposed to noise from swimmer defense airguns during pierside swimmer defense and stationary source testing activities. Swimmer defense airgun testing involves a limited number (up to 100 per event) of impulses from a small (60 cubic inch [in.^{3}]) airgun. Section 3.0.5.3.1.4 (Swimmer Defense Airguns) provides additional details on the use and acoustic characteristics of swimmer defense airguns.

Activities using airguns were modeled using the Navy Acoustic Effects Model. Model predictions indicate that no marine mammals would be exposed to sound or acoustic energy from swimmer defense airguns that would likely elicit a physiological or behavioral response.

3.4.3.1.11.1 No Action Alternative – Training Activities

Training activities under the No Action Alternative do not include the use of the swimmer defense airguns.

3.4.3.1.11.2 No Action Alternative – Testing Activities

Testing activities under the No Action Alternative would include the use of swimmer defense airguns up to five times per year pierside at Joint Expeditionary Base Little Creek in Virginia Beach, Virginia, and up to five times per year pierside at Newport, Rhode Island, as described in Table 2.8-3. Both areas are within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Stationary Source Testing at Naval Surface Warfare Center, Panama City Division Testing Range is not analyzed under the No Action Alternative.

Single, small airguns (60 in.^{3}) would not cause direct trauma to marine mammals. Impulses from airguns lack the strong shock wave and rapid pressure increase as would be expected from explosive sources that can cause primary blast injury or barotrauma.

Impulses from swimmer defense airguns could potentially cause temporary hearing loss for animals within a few meters of the sound source, but given the relatively low source levels and mitigation measures, this is very unlikely. The Navy Acoustic Effects Model predicted that no marine mammals would be exposed to levels capable of causing TTS or PTS.

Airguns do produce broadband sounds; however, the duration of an individual impulse is about 0.1 second. Airguns could be fired up to 100 times per event but would generally be used less based on the actual testing requirements. The pierside areas where these activities are proposed are inshore, with high levels of use and therefore high levels of ambient noise (Section 3.0.4.5, Ambient Noise). Additionally these areas have low densities of marine mammals. Therefore, auditory masking to marine mammals due to the limited testing of the swimmer defense airgun associated with integrated pierside swimmer defense is unlikely.

The Navy Acoustic Effects Model predicted that no marine mammals would be exposed to levels likely to cause significant behavioral reactions. The behavioral response of marine mammals to airguns, especially with multiple airguns firing simultaneously and repeating at regular intervals, has been well studied in conjunction with seismic surveys (e.g., oil and gas exploration). Many of these studies are reviewed above in Section 3.4.3.1.2.5 (Behavioral Reactions). However the swimmer defense airgun testing involves the use of only one small (60 $in.^3$) airgun firing a limited number of times, so reactions from marine mammals would likely be much less than what is noted in studies of marine mammal reactions during large-scale seismic studies. Furthermore, the swimmer defense airgun has limited overall use throughout the year. Impacts on marine mammals are not expected from testing of the swimmer defense airgun.

Swimmer defense airgun activities associated with testing under the No Action Alternative do not overlap the habitats of North Atlantic right whale, bowhead whale, blue whale, fin whale, humpback whale, sei whale, sperm whale, ringed seal, bearded seal, or polar bear. Therefore, these species would not be impacted by swimmer defense airgun testing noise. The West Indian manatee is rarely seen in the lower Chesapeake Bay (only in the summer) and, if present, manatees would be unlikely to enter the Joint Expeditionary Base Little Creek harbor due to the high vessel traffic in the area. The proposed activities are not within or near West Indian manatee or North Atlantic right whale critical habitat.

Pursuant to the MMPA, the use of swimmer defense airguns during testing activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of swimmer defense airguns during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed North Atlantic right whale, bowhead whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.11.3 Alternative 1 – Training Activities

Training activities under Alternative 1 do not include the use of swimmer defense airguns.

3.4.3.1.11.4 Alternative 1 – Testing Activities

As described in Table 2.8-3, testing activities under Alternative 1 would include the use of swimmer defense airguns at Joint Expeditionary Base Little Creek, Virginia, up to two times per year, and pierside at Newport, Rhode Island, up to five times per year. Both of these areas are within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Stationary source testing at Naval Surface Warfare Center, Panama City Division includes a limited amount of swimmer defense airgun use that could occur up to 10 times per year. This area is in inland waters, within the Gulf of Mexico Large Marine Ecosystem.

The proposed pierside swimmer defense activities under Alternative 1 represent a decrease of three events per year compared to the No Action Alternative. Therefore, the associated impacts would differ in quantity, but the types and severity of impacts would not be discernible from those discussed above in Section 3.4.3.1.11.2 (No Action Alternative – Testing Activities).

The Navy Acoustic Effects Model predicted no effects on marine mammals due to the use of the swimmer defense airgun within Stationary Source Testing at Naval Surface Warfare Center, Panama City Division Testing Range. The types and severity of impacts would not differ from those described above in Section 3.4.3.1.11.2 (No Action Alternative – Testing Activities); however, the West Indian manatee is an occasional visitor to the inland waters of the panhandle of Florida. As with other marine mammals, manatees may avoid the area immediately around the swimmer defense airgun while it is being used, although the use of the system is very limited in this area.

Pursuant to the MMPA, the use of swimmer defense airguns during testing activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of swimmer defense airguns during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed North Atlantic right whale, bowhead whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.11.5 Alternative 2 (Preferred Alternative) – Training Activities

Training activities under Alternative 2 do not include the use of the swimmer defense airguns.

3.4.3.1.11.6 Alternative 2 (Preferred Alternative) – Testing Activities

As described in Table 2.8-3, testing activities under Alternative 2 would include the use of swimmer defense airguns at Joint Expeditionary Base Little Creek, Virginia, up to three times per year, and pierside at Newport, Rhode Island, up to six times per year. Both of these areas are within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Stationary Source Testing at Naval Surface Warfare Center, Panama City Division Testing Range includes a limited amount of swimmer defense airgun use that could occur up to 11 times per year. This area is in inland waters, within the Gulf of Mexico Large Marine Ecosystem.

The proposed pierside swimmer defense activities under Alternative 2 represents a decrease of one event per year compared to the No Action Alternative. Therefore, the associated impacts would differ in

quantity, but the types and severity of impacts would not be discernible from those discussed above in Section 3.4.3.1.11.2 (No Action Alternative – Testing Activities). Proposed stationary source testing activities under Alternative 2 represent an increase of one event per year over Alternative 1. The associated impacts would differ in quantity; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.11.4 (Alternative 1 – Testing Activities).

Pursuant to the MMPA, the use of swimmer defense airguns during testing activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of swimmer defense airguns during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed West Indian manatee;*
- *will have no effect on the ESA-listed North Atlantic right whale, bowhead whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12 Impacts from Weapons Firing, Launch, and Impact Noise

Marine mammals may be exposed to weapons firing and launch noise, sound from the impact of non-explosive munitions on the water's surface, as well as noise from in-air explosions. A detailed description of these stressors is in Section 3.0.5.3.1.5, Weapons Firing, Launch, and Impact Noise. Reactions by marine mammals to these specific stressors have not been recorded; however, marine mammals would be expected to react to weapons firing, launch, and non-explosive impact noise as they would other transient sounds (Section 3.4.3.1.2.5, Behavioral Reactions).

3.4.3.1.12.1 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives) and Table 2.8-1, training activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions. Activities are spread throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, and JAX Range Complexes, with fewer events in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area but would be concentrated within the Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and Gulf Stream Open Ocean Area. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 12 nm from shore.

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle into the water (Section 3.0.5.3.1.5, Weapons Firing, Launch, and Impact Noise). Average peak sound pressure in the water measured directly below the muzzle of the gun and under the flight path of the shell (assuming it maintains an altitude of only a few meters above the water's surface) was approximately 200 dB re 1 µPa. Animals at the surface of the water, in a narrow footprint under a weapons trajectory, could be exposed to naval gunfire noise and may exhibit brief startle reactions, avoidance, diving, or no reaction at all. Due to the short-term, transient nature of gunfire noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and are unlikely to lead to substantial costs or long-term consequences for individuals or populations.

Sound due to missile and target launches is typically at a maximum at initiation of the booster rocket and rapidly fades as the missile or target travels downrange. These sounds would be transient and of short duration, lasting no more than a few seconds at any given location. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Missiles and targets launched by ships or near the water's surface may expose marine mammals to levels of sound that could produce brief startle reactions, avoidance, or diving. Due to the short-term, transient nature of launch noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and are unlikely to lead to long-term consequences for individuals or populations.

Mines, non-explosive bombs, and intact missiles and targets could impact the water with great force and produce a large impulse and loud noise (Section 3.0.5.3.1.5, Weapons Firing, Launch, and Impact Noise). Marine mammals within a few meters could experience some temporary hearing loss, although the probability is low of the non-explosive munitions landing within this range while a marine mammal is near the surface. Animals within the area may hear the impact of non-explosive munitions on the surface of the water and would likely alert, startle, dive, or avoid the immediate area. Significant behavioral reactions from marine mammals would not be expected due to non-explosive munitions impact noise; therefore, long-term consequences for the individual and population are unlikely.

Manatees prefer inland waters and would not encounter noise from weapons firing, launch, and non-explosive munitions impact with the water's surface associated with proposed Navy training activities that typically occur more than 12 nm from shore. These activities would not take place within or near West Indian manatee critical habitat.

In-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitat (i.e., water temperature and depth in the southeast and copepods in the northeast).

Training activities proposed under the No Action Alternative do not overlap bowhead whale, polar bear, or ringed seal habitat. Therefore, these species would not be impacted by noise from weapons firing, launch, and non-explosive munitions impact with the water's surface associated with proposed Navy training activities. Mitigation measures implemented by the Navy (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) are designed to further reduce potential impacts.

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from training activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the ESA-listed West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12.2 No Action Alternative – Testing Activities

As described in Table 2.8-2 and Table 2.8-3, testing activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions. Activities are spread throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area but would be concentrated within the Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and Gulf Stream Open Ocean Area.

Proposed testing activities under the No Action Alternative that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions differ in number and location from training activities under the No Action Alternative. The associated impacts would differ in quantity and location; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.13.1 (No Action Alternative – Training Activities).

Manatees prefer inland waters and would not encounter noise from weapons firing, launch, and non-explosive munitions impact with the water's surface associated with proposed Navy testing activities that typically occur offshore. These activities would not take place within or near West Indian manatee critical habitat.

Testing activities proposed under the No Action Alternative do not overlap bowhead whale, polar bear, or ringed seal habitat.

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from testing activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the ESA-listed West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12.3 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), training activities under Alternative 1 include activities that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions. Activities may occur throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, and JAX Range Complexes, with fewer events in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area but would be concentrated within the Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and Gulf Stream Open Ocean Area.

Proposed Training Activities under Alternative 1 that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions differ in number from training activities proposed under the No Action Alternative. The associated impacts would differ in quantity; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.4.3.1.12.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from training activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12.4 Alternative 1 – Testing Activities

As described in Tables 2.8-2 to 2.8-3, testing activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions. Activities are distributed throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area but would be concentrated within the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems Gulf Stream Open Ocean Area.

Proposed Testing Activities under Alternative 1 that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions differ in number and location from training activities proposed under the No Action Alternative. The associated impacts would differ in quantity and location; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.12.2 (No Action Alternative – Testing Activities).

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from testing activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the ESA-listed West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12.5 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Training Activities under Section 3.4.3.1.12.3 (Alternative 1 –Training Activities).

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from training activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the ESA-listed West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.12.6 Alternative 2 (Preferred Alternative) – Testing Activities

As described in Tables 2.8-2 to 2.8-3, testing activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions. Activities are spread throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area but would be concentrated within the Northeast U.S. Continental Shelf Gulf of Mexico Large Marine Ecosystems and Gulf Stream Open Ocean Area.

Proposed Testing Activities under Alternative 2 that produce in-water noise from weapons firing, launch, non-explosive munitions impact with the water's surface, and noise from in-air explosions differ in number and location from Training Activities proposed under the No Action Alternative. The associated impacts would differ in quantity and location; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.13.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, weapons firing, launch, and non-explosive impact noise from testing activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, weapons firing, launch, and non-explosive impact noise from testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, and fin whale;*
- *will have no effect on the ESA-listed West Indian manatee, bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13 Impacts from Vessel Noise

Marine mammals may be exposed to noise from vessel movement. A detailed description of the acoustic characteristics and typical sound levels of vessel noise is in Section 3.0.5.3.1.6 (Vessel Noise). Vessel movements involve transits to and from ports to various locations within the Study Area, and many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels).

3.4.3.1.13.1 No Action Alternative – Training Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), training activities under the No Action Alternative include vessel movement in many events. Navy vessel traffic could occur anywhere within the Study Area, but would be concentrated near the Norfolk and Mayport Navy ports and within the VACAPES, Navy Cherry Point, and JAX Range Complexes. A study of Navy vessel traffic found that traffic was heaviest just offshore of Norfolk and Jacksonville, as well as along the coastal waters between the two ports (Mintz and Filadelfo 2011). Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. In addition, a variety of smaller craft will be operated within the Study Area. Small craft types, sizes, and speeds vary. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. During training, speeds generally range from 10 to 14 knots; however, vessels can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions. Section 3.4.3.1.2.5 (Behavioral Reactions) discusses scientific studies and observations of marine mammal reactions and potential auditory masking from vessel presence and noise.

Auditory masking can occur due to vessel noise, potentially masking vocalizations and other biologically important sounds (e.g., sounds of prey or predators) that marine mammals may rely on. Marine mammals have been recorded in several instances altering and modifying their vocalizations to compensate for the masking noise from vessels or other similar sounds (Holt et al. 2011; Parks et al. 2011). Potential masking can vary depending on the ambient noise level within the environment (Section 3.0.4.5, Ambient Noise and Section 3.0.4.6, Underwater Sounds), the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 µPa, especially at lower frequencies (below 100 Hz), and inshore noise levels, especially around busy ports, can exceed 120 dB re 1 µPa. When the noise level is above the sound of interest, and in a similar frequency band, auditory masking could occur (Section 3.0.5.7.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities). This analysis assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to actually cause any substantial masking. Masking by passing ships or other sound sources transiting the Study Area would be short term, intermittent, and therefore unlikely to result in any substantial costs or

consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of auditory masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate. However, Navy vessels make up a very small percentage of the overall traffic, and the rise of ambient noise levels in these areas is a problem related to all ocean users, including commercial and recreational vessels and shoreline development and industrialization.

Surface combatant ships (e.g., guided missile destroyer, guided missile cruiser, and Littoral Combat Ship) and submarines are designed to be very quiet to evade enemy detection and typically travel at speeds of 10 or more knots. Actual acoustic signatures and source levels of combatant ships and submarine are classified; however, they are quieter than most other motorized ships; by comparison a typical commercial fishing vessel produces about 158 dB re 1 µPa at 1 m (Section 3.0.5.3.1.6, Vessel Noise, describes typical noise from commercial and recreational vessels). Therefore, these surface combatants and submarines are likely to be detectable by marine mammals over open-ocean ambient noise levels (Section 3.0.4.5, Ambient Noise) at distances of up to a few kilometers, which could cause some auditory masking to marine mammals for a few minutes as the vessel passes by. Other Navy ships and small craft have higher source levels, similar to equivalently sized commercial ships and private vessels. Ship noise tends to be low frequency and broadband; therefore, it may have the largest potential to mask mysticetes that vocalize and hear at lower frequencies than other marine mammals. Noise from large vessels and outboard motors on small craft can produce source levels of 160 to over 200 dB re 1 µPa at 1 m for some large commercial vessels and outboard engines. Therefore, in the open ocean, noise from noncombatant Navy vessels may be detectable over ambient levels for tens of kilometers, and some auditory masking, especially for mysticetes, is possible. In noisier inshore areas around Navy ports and ranges, vessel noise may be detectable above ambient for only several hundred meters. Some auditory masking to marine mammals is likely from noncombatant Navy vessels, on par with similar commercial and recreational vessels, especially in quieter, open-ocean environments.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. Most studies have reported that marine mammals react to vessel sounds and traffic with short-term interruption of feeding, resting, or social interactions (Magalhães et al. 2002; Richardson et al. 1995; Watkins 1981). Some species respond negatively by retreating or responding to the vessel antagonistically, while other animals seem to ignore vessel noises altogether (Watkins 1986). Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. It is difficult to differentiate between responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals.

Based on studies on a number of species, mysticetes are not expected to be disturbed by vessels that maintain a reasonable distance from them, which varies with vessel size, geographic location, and tolerance levels of individuals. Vessel noise would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitat (i.e., water temperature and depth in the southeast and copepods in the northeast).

Odontocetes could have a variety of reactions to passing vessels, including attraction, increased traveling time, decreased feeding behaviors, diving, or avoidance of the vessel, which may vary depending on their prior experience with vessels. *Kogia* species, harbor porpoises, and beaked whales have been observed avoiding vessels.

For pinnipeds, data indicate tolerance of vessel approaches, especially for animals in the water. Navy vessels do not purposefully approach marine mammals and are not expected to elicit significant behavioral responses. Such reactions are likely to be minor and short term, leading to no long-term consequences. Mitigation measures implemented to detect and avoid marine mammals (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) would further reduce the potential for significant behavioral reactions from marine mammals due to exposure from vessel noise or presence.

Most Navy activities occur more than 3 nm offshore, where manatees are uncommon; however, at pierside locations and within inland waters along the southeastern United States and in the Gulf of Mexico, manatees could co-occur with Navy vessels. In studies, manatees have reacted to vessels by moving away from the approaching vessel, increasing their swimming speed, and moving toward deeper water. Manatees within the Port Canaveral and Mayport portions of the designated West Indian manatee critical habitat areas may be exposed to vessel noise. The primary constituent elements of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presences of seagrasses and warm water refuges. These elements would not be impacted by vessel noise.

Several studies have shown that marine mammals may abandon inshore and nearshore habitats with high vessel traffic, especially in areas with regular marine mammal watching (Section 3.4.3.1.2.5, Behavioral Reactions). Navy ports such as Mayport and Norfolk are heavily trafficked with private and commercial vessels in addition to naval vessels. Because Navy ships make up only a small proportion of the total ship traffic, even in the most concentrated port and inshore areas, proposed Navy vessel transits are unlikely to cause long-term abandonment of habitat by a marine mammal.

Vessel traffic related to the proposed activity would pass near marine mammals only on an incidental basis. Navy mitigation measures include several provisions to avoid approaching marine mammals, which would further reduce any potential impacts. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) describes mitigation measures in detail.

Pursuant to the MMPA, vessel noise from training activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale, ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13.2 No Action Alternative – Testing Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), testing activities under the No Action Alternative include vessel movement in many events. Navy vessel traffic associated with testing could take place anywhere within the Study Area, primarily concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes; the Northeast Range Complexes and adjacent inland waters; and in the Gulf of Mexico, especially in areas near Naval Surface Warfare Center, Panama City Division Testing Range. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. In addition, a variety of smaller craft will be

operated within the Study Area. Small craft types, sizes, and speeds vary. During testing, speeds generally range from 10 to 14 knots; however, vessels can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions. These events would be distributed across the large marine ecosystems and open ocean areas designated within the Study Area.

Proposed testing activities under the No Action Alternative that involve vessel movement differ in number and location from training activities under the No Action Alternative; however the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.13.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, vessel noise from testing activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale, ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13.3 Alternative 1 – Training Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), training activities under Alternative 1 include an increase in vessel movement over the No Action Alternative; however, the locations and predicted impacts would not differ. Proposed Training Activities under Alternative 1 that involve vessel movement differ in number from Training Activities proposed under the No Action Alternative, but the locations, types, and severity of impacts would not be discernible from those described above in Section 3.4.3.1.14.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, vessel noise from training activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale, ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13.4 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), testing activities proposed under Alternative 1 would increase Navy vessel traffic from the No Action Alternative, leading to an increase in vessel-related noise in some portions of the Study Area. Additional ship trials will be conducted in the Northeast, VACAPES, JAX, and GOMEX Range Complexes, and activities that include the use of vessels would increase at the South Florida Ocean Measurement Facility Testing Range. New vessels proposed for testing under Alternative 1, such as the Littoral Combat Ship, the Joint High Speed

Vessel, and the Expeditionary Fighting Vehicle, are all fast moving, designed to operate in nearshore waters, and may increase overall noise levels in these environments. Under Alternative 1, predicted behavioral reactions and auditory masking could increase over the No Action Alternative in nearshore habitats within the Study Area due to testing activities. However, the types and severity of reactions would not differ substantially, and significant behavioral reactions by marine mammals due to passing vessel noise are not expected. Long-term consequences to individuals or populations due to the proposed activities are unlikely.

Proposed testing activities under Alternative 1 that produce underwater noise from vessel movement differ in number and location from Training Activities proposed under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.13.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, vessel noise from testing activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale, ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13.5 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Training Activities under Section 3.4.3.1.14.3 (Alternative 1 – Training Activities).

Pursuant to the MMPA, vessel noise from training activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale,ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.13.6 Alternative 2 (Preferred Alternative) – Testing Activities

As described in Chapter 2, testing activities proposed under Alternative 2 would increase Navy vessel traffic from the No Action Alternative, leading to an increase in vessel-related noise in some portions of the Study Area, as described under Section 3.4.3.1.13.4 (Alternative 1 – Testing Activities). Proposed testing activities under Alternative 2 that produce underwater noise from vessel movement differ in number and location from training activities proposed under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.13.2 (No Action Alternative – Testing Activities).

Pursuant to the MMPA, vessel noise from testing activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, vessel noise from testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, bowhead whale, ringed seal, West Indian manatee, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14 Impacts from Aircraft Noise

Marine mammals may be exposed to aircraft-generated noise wherever aircraft overflights occur in the Study Area. Fixed- and rotary-wing aircraft are used for a variety of training and testing activities throughout the Study Area. Most of these sounds would be concentrated around airbases and fixed ranges within each of the range complexes. Aircraft produce extensive airborne noise from either turbofan or turbojet engines. A severe but infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary-wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al. 2003). A detailed description of aircraft noise as a stressor is in Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

3.4.3.1.14.1 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area.

Marine mammals may respond to both the physical presence and to the noise generated by aircraft, making it difficult to attribute causation to one or the other stimulus. In addition to noise produced, all low-flying aircraft make shadows, which can cause animals at the surface to react. Helicopters may also produce strong downdrafts, a vertical flow of air that becomes a surface wind, which can also affect an animal's behavior at or near the surface.

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the craft in a narrow cone, as discussed in greater detail in Section 3.0.4 (Acoustic and Explosives Primer). Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. The maximum sound levels in water from an aircraft overflight are approximately 150 dB re 1µPa for an F/A-18 aircraft at 300 m altitude; approximately 125 dB re 1µPa for an H-60 helicopter hovering at 50 ft.; and under ideal conditions, sonic booms from aircraft at 1 km could reach up to 178 dB re 1µPa at the water's surface. Section 3.0.5.3.1.7 (Aircraft Overflight Noise) provides additional information on aircraft noise characteristics.

Section 3.4.3.1.2.5 (Behavioral Reactions) reviews research and observations regarding marine mammal behavioral reactions to aircraft overflights; many of the observations cited in this section are of marine mammal reactions to aircraft flown for whale-watching and marine research purposes. Marine mammal survey aircraft are typically used to locate, photograph, track, and sometimes follow animals for long

distances or for long periods of time, all of which results in the animal being much more frequently located directly beneath the aircraft (in the cone of the loudest noise and in the shadow of the aircraft) for extended periods. Navy aircraft would not follow or pursue marine mammals. In contrast to whale-watching excursions or research efforts, Navy overflights would not result in prolonged exposure of marine mammals to overhead noise.

In most cases, exposure of a marine mammal to fixed-wing or rotary-wing aircraft presence and noise would last for only seconds as the aircraft quickly passes overhead. Animals would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Takeoffs and landings occur at established airfields as well as on vessels at sea at unspecified locations across the Study Area. Takeoff and landings from Navy vessels could startle marine mammals; however, these events only produce in-water noise at any given location for a brief period as the aircraft climbs to cruising altitude. Some sonic booms from aircraft could startle marine mammals, but these events are transient and happen infrequently at any given location within the Study Area. Repeated exposure to most individuals over short periods (days) is extremely unlikely, except for animals that are resident in inshore areas around Navy ports, on Navy fixed ranges (e.g., the Undersea Warfare Training Range), or during major training exercises. These animals could be subjected to multiple overflights per day; however, aircraft would pass quickly overhead, typically at altitudes above 3,000 ft., which would make marine mammals unlikely to respond. No long-term consequences for individuals or populations would be expected.

Low flight altitudes of helicopters during some anti-submarine warfare and mine warfare activities, often under 100 ft., may elicit a somewhat stronger behavioral response due to the proximity to marine mammals, the slower airspeed and therefore longer exposure duration, and the downdraft created by the helicopter's rotor. Marine mammals would likely avoid the area under the helicopter. It is unlikely that an individual would be exposed repeatedly for long periods because these aircraft typically transit open ocean areas within the Study Area. The consensus of all the studies reviewed is that aircraft noise would cause only small temporary changes in the behavior of marine mammals. Specifically, marine mammals at or near the surface when an aircraft flies overhead at low altitude may startle, divert their attention to the aircraft, or avoid the immediate area by swimming away or diving. Short-term reactions to aircraft are not likely to disrupt major behavior patterns such as migrating, breeding, feeding, and sheltering, or result in serious injury to any marine mammals. No long-term consequences for individuals or populations would be expected.

The sound from aircraft overflights would not impact the assumed primary constituent elements of the North Atlantic right whale critical habitat (i.e., water temperature and depth in the southeast and copepods in the northeast). Manatees within the Port Canaveral and Mayport portions of the designated West Indian manatee critical habitat areas may be exposed to aircraft overflight noise. The primary constituent element of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presence of seagrasses and warm water refuges. These elements would not be impacted by aircraft overflight noise.

Under the No Action Alternative, Navy training activities within the Study Area do not spatially overlap with seal haul-out sites or bowhead whale or polar bear habitat. Therefore, polar bears, bowhead whales, and phocid seals on land would not be impacted by overflight noise. Other mysticetes, odontocetes, phocid seals in the water, and manatees could be exposed to aircraft overflight noise proposed under the No Action Alternative.

Pursuant to the MMPA, aircraft overflight noise from training activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14.2 No Action Alternative – Testing Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), testing activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. Proposed testing activities under the No Action Alternative that involve aircraft overflights differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.4.3.1.14.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, aircraft overflight noise from testing activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14.3 Alternative 1 – Training Activities

As shown in Table 2.8-1, training activities under Alternative 1 include an increase in the number of activities that involve aircraft compared to the No Action Alternative; however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase, but the locations, types, and severity of impacts would not be discernible from those described above in Section 3.4.3.1.14.1 (No Action Alternative – Training Activities).

Pursuant to the MMPA, aircraft overflight noise from training activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14.4 Alternative 1 – Testing Activities

As shown in Table 2.8-2, testing activities under Alternative 1 include an increase in the number of events that involve aircraft compared to the No Action Alternative; however, the testing locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.4.3.1.14.2 (No Action Alternative – Testing Activities).

Pursuant to the MMPA, aircraft overflight noise from testing activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14.5 Alternative 2 (Preferred Alternative) – Training Activities

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Training Activities under Section 3.4.3.1.14.3 (Alternative 1 – Training Activities).

Pursuant to the MMPA, aircraft overflight noise from training activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.1.14.6 Alternative 2 (Preferred Alternative) – Testing Activities

As shown in Table 2.8-2 and Table 2.8-3, testing activities under Alternative 2 include an increase in the number of events that involve aircraft compared to the No Action Alternative; however, the testing

locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 2 aircraft overflight noise may increase, but the locations, types, and severity of impacts would not be discernible from those described in Section 3.4.3.1.14.4 (Alternative 1 – Testing Activities).

Pursuant to the MMPA, aircraft overflight noise from testing activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, aircraft overflight noise from testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, sei whale, blue whale, sperm whale, humpback whale, fin whale, West Indian manatee, bowhead whale, and polar bear;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts of: (1) electromagnetic devices and (2) high energy lasers.

3.4.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities, primarily for magnetic influence mine sweeping. Section 3.0.5.3.2.1 (Electromagnetic Devices) discusses the types of activities that use electromagnetic devices, where they are used, and how many events will occur under each alternative. The devices producing an electromagnetic field are towed or unmanned mine countermeasure systems. The electromagnetic field is produced to simulate a vessel's magnetic field. In an actual mine clearing operation, the intent is that the electromagnetic field would trigger an enemy mine designed to sense a vessel's magnetic field.

Neither regulations nor scientific literature provide threshold criteria to determine the significance of the potential effects from actions that result in generation of an electromagnetic field. Data regarding the influence of magnetic fields and electromagnetic fields on cetaceans is inconclusive. Dolman et al. (2003) provides a literature review of the influences of marine wind farms on cetaceans. The literature focuses on harbor porpoises and dolphin species because of their nearshore habitats. Teilmann et al. (2002) evaluated the frequency of harbor porpoise presence at wind farm locations around Sweden (the electrical current conducted by undersea power cables creates an electromagnetic field around those cables). Although electromagnetic field influences were not specifically addressed, the presence of cetacean species implies that at least those species are not repelled by the presence of electromagnetic fields around undersea cables associated with offshore wind farms.

Based on the available literature, no evidence of electrosensitivity in marine mammals was found except recently in the Guiana dolphin (Czech-Damal et al. 2011). Based on the available literature, no evidence suggests any magnetic sensitivity for polar bears, sea otters, sea lions, fur seals, walrus, earless seals, and Sirenia (Normandeau et al. 2011). However, as described in the discussion below, some literature suggests that some cetaceans (whales, dolphins, and porpoises) may be sensitive to changes in magnetic fields.

Comparing sighting record locations (Walker et al. 1992) and live stranding record locations (Kirschvink 1990; Kirschvink et al. 1986; Klinowska 1985) with a map of the Earth's magnetic field suggests that cetaceans may be able to sense the earth's magnetic field. Results from one study showed that long-finned and short-finned pilot whales, striped dolphin, Atlantic spotted dolphin, Atlantic white-sided dolphin, fin whale, common dolphin, harbor porpoise, sperm whale, and pygmy sperm whale were found to strand in areas where the earth's magnetic field was locally weaker than surrounding areas (negative magnetic anomaly) (Kirschvink 1990). Results also indicated that certain species may be able to detect total intensity changes of only 0.05 microtesla (Kirschvink et al. 1986). This gives insight into what changes in intensity levels some species are capable of detecting but does not provide experimental evidence of levels to which animals may physiologically or behaviorally respond.

Anatomical evidence suggests the presence of magnetic material in the brain (Pacific common dolphin, Dall's porpoise, bottlenose dolphin, Cuvier's beaked whale, and the humpback whale) and in the tongue and lower jawbones (harbor porpoise) (Bauer et al. 1985). Zoeger et al. (1981) found what appeared to be nerve fibers associated with the magnetic material in a Pacific common dolphin and proposed that it may be used as a magnetic field receptor. The only experimental study comes from Kuzhetsov (1999), who exposed bottlenose dolphins to permanent magnetic fields and showed reactions (both behavioral and physiological) to magnetic field intensities of 32, 108, and 168 microteslas during 79 percent, 63 percent, and 53 percent of the trials, respectively (as summarized in Normandeau et al. 2011). Behavioral reactions included sharp exhalations, acoustic activity, and movement, and physiological reactions such as a change in heart rate.

Potential impacts on marine mammals associated with electromagnetic fields depend on the animal's proximity to the source and the strength of the magnetic field. As discussed in 3.0.5.3.2.1 (Electromagnetic Devices), electromagnetic fields associated with naval training and testing activities are relatively weak (only 10 percent of the earth's magnetic field at 79 ft.), temporary, and localized. Once the source is turned off, the electromagnetic field is gone. A marine mammal would have to be within the electromagnetic field (approximately 656 ft. [200 m] from the source) during the activity to detect it.

3.4.3.2.1.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, training activities involving electromagnetic devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Activities involving electromagnetic devices are concentrated within the VACAPES Range Complex. Marine mammal species that do not occur within these specified areas, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not be exposed to the electromagnetic fields from Navy training. Species that do occur within the range complexes listed above would have the potential to be exposed to the electromagnetic fields.

Although it is not fully understood, based on the available evidence described above, it is probable that marine mammals use the earth's magnetic field for movement or migration (Walker et al. 1992). If an animal was exposed to the magnetic field during a training event, it is possible that the animal would alter its originally intended course or temporarily leave the area. However, impacts would be temporary and minor, and natural behavioral patterns would not be significantly altered or abandoned based on the (1) relatively low intensity of the magnetic fields generated (discussed above), (2) very localized potential impact area, and (3) temporary duration of the activities (hours).

Training activities involving electromagnetic devices may occur within the southeast North Atlantic right whale critical habitat year round. The primary constituent elements of the habitat required by North Atlantic right whales in the Southeast have been suggested as the specific water temperature and depth ranges (Garrison 2007). However, these primary constituent elements will not be impacted by electromagnetic devices. Training activities involving electromagnetic devices will not occur within West Indian manatee critical habitat.

Pursuant to the MMPA, the use of electromagnetic devices during training activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

Testing Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, testing activities involving electromagnetic devices occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex Naval Surface Warfare Center, Panama City Division Testing Range. Activities involving electromagnetic device use are concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. Marine mammal species that do not occur within these specified areas, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear, would not be exposed to the electromagnetic fields from Navy testing activities. Species that do occur within the areas listed above would have the potential to be exposed to the electromagnetic fields.

Although it is not fully understood, based on the available evidence described above, it is probable that marine mammals use the earth's magnetic field for movement or migration (Walker et al. 1992). If an animal was exposed to the magnetic field during a testing event, it is possible that the animal would alter its originally intended course or temporarily leave the area. However, impacts would be temporary and minor, and natural behavioral patterns would not be significantly altered or abandoned based on the (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) very localized potential impact area, and (3) temporary duration of the activities (hours).

Testing activities involving electromagnetic devices will not occur within North Atlantic right whale or West Indian manatee critical habitat.

Pursuant to the MMPA, the use of electromagnetic devices during testing activities as described under the No Action Alternative is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.2.1.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase in the Study Area compared to the No Action Alternative. Training activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. In addition, activities would be introduced within the Gulf of Mexico Large Marine Ecosystem, specifically within the GOMEX Range Complex, as well as the following coastal locations: Sandy Hook Bay, Earle, New Jersey; Lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas. Activities involving electromagnetic device use remains concentrated within the VACAPES Range Complex.

The minor increase in events in previously identified locations and introduction of events in the additional locations as described above would not measurably increase the probability of marine mammals being exposed to electromagnetic energy compared to the No Action Alternative. The species with potential to co-occur with these events remain the same, and potential impacts would be temporary and minor, as discussed above for the No Action Alternative.

Training activities involving electromagnetic devices may occur within the southeast North Atlantic right whale critical habitat area year-round. The primary constituent elements of the habitat required by North Atlantic right whales in the southeast have been suggested as the specific water temperature and depth ranges (Garrison 2007). However, these primary constituent elements will not be impacted by electromagnetic devices. Training activities involving electromagnetic devices will not occur within West Indian manatee critical habitat.

Pursuant to the MMPA, use of electromagnetic devices during training activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

Testing Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase in the Study Area compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, activities would be introduced anywhere within the Gulf of Mexico, as well as the Southeast U.S. Continental Shelf Large Marine Ecosystem, specifically within the South Florida Ocean Measurement Facility Testing Range. Activities involving electromagnetic device use remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. As discussed in 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, the increase in events includes the introduction of kinetic energy weapon testing in the VACAPES Range Complex. The kinetic energy weapon is a new weapon system for which there are neither data nor information available to analyze potential impacts on marine mammals. This is a unique weapons system that charges for approximately two minutes and discharges in less than one second; therefore, any exposure to electromagnetic energy would be temporary and is not expected to result in impacts on organisms (U.S. Department of the Navy 2009a).

The increase in events in previously identified locations and the introduction of events in the additional locations described above would not measurably increase the probability of marine mammals being exposed to electromagnetic energy compared to the No Action Alternative. The species with potential to co-occur with these events remain the same, and potential impacts would be temporary and minor, as discussed above for the No Action Alternative.

Testing activities involving electromagnetic devices will not occur within North Atlantic right whale or West Indian manatee critical habitat.

Pursuant to the MMPA, the use of electromagnetic devices used during testing activities as described under Alternative 1 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

Training activities under Alternative 2 are identical to those described in 3.4.3.2.1.2 (Alternative 1 – Training Activities).

Pursuant to the MMPA, use of electromagnetic devices during training activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

Testing Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, electromagnetic device use would increase in the Study Area compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, activities would be introduced anywhere within the Gulf of Mexico, as well as the Southeast U.S. Continental Shelf Large Marine Ecosystem, specifically within the South Florida Ocean Measurement Facility Testing Range. Activities involving electromagnetic device use remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range.

As discussed in 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, the increase in events includes the introduction of kinetic energy weapon testing in the VACAPES Range Complex. The kinetic energy weapon is a new weapon system for which there are neither data nor information available to analyze potential impacts on marine mammals. This is a unique weapons system that charges for approximately two minutes and discharges in less than one second; therefore, any exposure to electromagnetic energy would be temporary and is not expected to result in impacts on organisms (U.S. U.S. Department of the Navy 2009a).

The increase in events in previously identified locations and introduction of events in the additional locations described above would not measurably increase the probability of marine mammals being exposed to electromagnetic energy compared to the No Action Alternative. The species with potential to co-occur with these events remain the same, and potential impacts would be temporary and minor, as discussed above for the No Action Alternative.

Testing activities involving electromagnetic devices will not occur within North Atlantic right whale or West Indian manatee critical habitat.

Pursuant to the MMPA, the use of electromagnetic devices during testing activities as described under Alternative 2 is not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.2.2 Impacts from High Energy Lasers

This section analyzes the potential impacts of high energy lasers on marine mammals. As discussed in Section 3.0.5.3.2.2 (Lasers), high energy laser weapons are designed to disable surface targets, rendering them immobile. The primary concern is the potential for a marine mammal to be struck with the laser beam at or near the water's surface, which could result in injury or death. However, marine mammals could only be exposed if the laser beam missed the target. The potential for impact from low energy lasers was determined to be extremely low (Section 3.0.5.3.2.2, Lasers) and therefore will not be analyzed in this section.

The potential for marine mammals to be directly struck by a high energy laser beam was evaluated using statistical probability modeling (Appendix G, Statistical Probability Analysis for Estimating Direct Strike Impact and Number of Potential Exposures) to estimate the probability of striking a marine mammal for a worst-case scenario. Model input values include high energy laser use data (frequency and footprint), size of the testing area, marine mammal density data, and animal footprint. To estimate the potential to strike a marine mammal in a worst-case scenario, the impact area of all laser events was totaled over one year in the testing area for each of the alternatives. Finally, the marine mammal species with the highest average seasonal density within the testing area was used.

Within the statistical probability model, the estimated potential for a marine mammal strike is influenced by the following assumptions:

- The model is two-dimensional and assumes that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend up to 90 percent of their time under the water (Costa 1993).
- The model assumes the animal is stationary and does not account for any movement of the marine mammal or any potential avoidance of the testing activity.

3.4.3.2.2.1 No Action Alternative

Under the No Action Alternative, no high energy laser weapons use is planned during training or testing activities.

3.4.3.2.2.2 Alternatives 1 and 2 (Preferred Alternative)

Training Activities

Under Alternatives 1 and 2, no high energy laser weapons use is planned during training activities.

Testing Activities

As discussed in Section 3.0.5.3.2.2 (Lasers), under Alternatives 1 and 2, high energy laser weapons tests are introduced in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area, specifically within the VACAPES Range Complex. Marine mammal species that do not occur within the VACAPES Range Complex, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear, would not be exposed to high energy lasers. Species that do occur within this area would have the potential to be exposed.

Based on the statistical probability model, results indicate that even for the species with the highest average seasonal density in the activity location (Atlantic spotted dolphin), the number of potential strikes annually is 0.0. Considering the assumptions in the model outlined above, there is a high level of certainty in the conclusion that a marine mammal would not be struck by a high energy laser.

Testing activities involving high energy lasers will not occur within North Atlantic right whale or West Indian manatee critical habitat.

Pursuant to the MMPA, the use of high energy lasers during testing activities as described under Alternatives 1 and 2 are not expected to result in Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of high energy lasers during testing activities as described under Alternatives 1 and 2:

- *will have no effect on the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, bowhead whale, West Indian manatee, and polar bear;*
- *will have no effect on the ESA-listed ringed seal; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.3 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance, including the potential for strike during training and testing activities within the Study Area from: (1) Navy vessels; (2) in-water devices; (3) military expended materials, including non-explosive practice munitions and fragments from high-explosive munitions; and (3) seafloor devices.

The way a physical disturbance may affect a marine mammal would depend in part on the relative size of the object, the speed of the object, the location of the mammal in the water column, and reactions of marine mammals to anthropogenic activity, which may include avoidance or attraction. It is not known at what point or through what combination of stimuli (visual, acoustic, or through detection in pressure changes) an animal becomes aware of a vessel or other potential physical disturbances before reacting or being struck. Refer to sections 3.4.3.1.14 (Impacts from Vessel Noise) and 3.4.3.1.15 (Impacts from Aircraft Noise) for the analysis of the potential for disturbance from acoustic stimuli.

If a marine mammal responds to physical disturbance, the individual must stop whatever it was doing and divert its physiological and cognitive attention in response to the stressor (Helfman et al. 2009). The energetic costs of reacting to a stressor depend on the specific situation, but one can assume that the caloric requirements of a response may reduce the amount of energy available to the mammal for other functions, such as reproduction, growth, and homeostasis (Wedemeyer et al. 1990). Given that the presentation of a physical disturbance should be very rare and brief, the cost from the response is likely to be within the normal variation experienced by an animal in its daily routine unless the animal is struck. If a strike does occur, the cost to the individual could range from slight injury to death.

3.4.3.3.1 Impacts from Vessels

Interactions between surface vessels and marine mammals have demonstrated that surface vessels can represent a source of acute and chronic disturbance for marine mammals (Au and Green 2000; Bejder et al. 2006a; Hewitt 1985; Lusseau et al. 2009; Magalhães et al. 2002; Nowacek et al. 2007; Nowacek et al. 2004b; Richter et al. 2006; Richter et al. 2003; Watkins 1986; Wursig and Richardson 2009; Würsig and Richardson 2008). While the analysis of potential impact from the physical presence of the vessel is presented here, the analysis of potential impacts in response to sounds are addressed in Section 3.4.3.1.14 (Impacts from Vessel Noise).

These studies establish that marine mammals engage in avoidance behavior when surface vessels move toward them. It is not clear whether these responses are caused by the physical presence of a surface vessel, the underwater noise generated by the vessel, or an interaction between the two, although the noise generated by the vessels is probably an important contributing factor to the responses of cetaceans to the vessels. In one study, North Atlantic right whales were documented to show little overall reaction to the playback of sounds of approaching vessels, but they did respond to a novel sound by swimming strongly to the surface, which may increase their risk of collision (Nowacek et al. 2004a). Aside from the potential for an increased risk of collision addressed below, physical disturbance from vessel use is not expected to result in more than a momentary behavioral response.

Vessel speed, size, and mass are all important factors in determining potential impacts of a vessel strike to marine mammals. For large vessels, speed and angle of approach can influence the severity of a strike. Silber et al. (2010) found, based on modeling, that whales at the surface experienced impacts that increased in magnitude with the ship's increasing speed. Results of the study also indicated that potential impacts were not dependent on the whale's orientation to the path of the ship, but that vessel speed may be an important factor. At ship speeds of 15 knots or higher, there was a marked increase in intensity of centerline impacts on whales. Results also indicated that when the whale was below the surface (about one to two times the vessel draft), there was a pronounced propeller suction effect. This suction effect may draw the whale into the hull of the ship, increasing the probability of propeller strikes (Silber et al. 2010).

Reviews of the literature on ship strikes mainly involve collisions between commercial vessels and whales (Jensen and Silber 2004; Laist et al. 2001). Navy vessels operate differently from commercial vessels in ways important to the prevention of whale collisions. As described in Section 5.1 (Standard Operating Procedures), surface ships operated by or for the Navy have personnel assigned to stand watch at all times, day and night, when a ship or surfaced submarine is moving through the water (underway). A primary duty of personnel standing watch on surface ships is to detect and report all objects and disturbances sighted in the water that may indicate a threat to the vessel and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per vessel safety requirements, personnel standing watch also report any marine mammals sighted in the path of the vessel as a standard collision avoidance procedure. All vessels use extreme caution and proceed at a safe speed so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions.

The majority of the training and testing activities involve some level of vessel activity. Section 3.0.5.3.3.1 (Vessels) provides specific information on the activity types and locations that involve the use of vessels, and the speed and size characteristics of the vessels.

To determine the potential for Navy vessel strikes, the Navy assessed the probability of Navy vessels hitting individuals of different species of whales that occur in the AFTT Study Area incidental to training and testing activities. A strike probability analysis was completed based on actual data collected from historical use of Navy vessels. These data account for real world variables and any model would be expected to be less accurate than the use of actual data. Trends in the amount and location of vessel traffic and mitigation measures were also considered as important factors in the risk of strike. It is Navy policy (Chief of Naval Operations Instruction [OPNAVINST] 3100.6) to report all marine mammal strikes by Navy vessels. By an informal agreement, the information is collected by Office of the Chief of Naval Operations Environmental Readiness and provided to NMFS on an annual basis. Only Navy and the U.S. Coast Guard report in this manner, so all statistics potentially comparing Navy and Coast Guard

whale strikes to other vessel types and operators are skewed against this history of voluntary reporting (Jensen and Silber 2004).

Navy and NMFS reports for the Study Area indicate that between January 1995 and May 2013, Navy vessels were involved in 20 large whale strikes (Figure 3.4-15). Eight of the strikes resulted in a confirmed death; but in 12 of the 20 strikes, the fate of the animal was undetermined. It is possible that some of the 12 reported strikes resulted only in recoverable injury or were not marine mammals at all but another large marine species (e.g., whale shark). However, it is prudent to consider that all the strikes could have resulted in the death of a marine mammal. The maximum number of strikes in any given year was three strikes, which occurred in 2001 and 2004. The highest average number of strikes over any five-year period was two strikes per year in 2001 to 2005. The average number of strikes for the entire 18.4-year period is 1.086 strikes per year. Since the implementation of the U.S. Navy's Marine Species Awareness Training in 2007, strikes in the Study Area have decreased to an average of 0.6 strikes per year. Over the last 5 years in the AFTT Study Area, the Navy was involved in only three strikes, with no confirmed marine mammal deaths as the result of a vessel strike.

It should be noted that the relatively high proportion of Navy strike reports in the scientific literature and NMFS databases compared to strikes from commercial or recreational strikes is most likely the result of the Navy's commitment to reporting all vessel strikes to NMFS (even if it cannot be confirmed to be a marine mammal) rather than an actual higher frequency of collisions relative to other ship types. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). Given the relative vessel density, the Navy is most likely a minor contributor to the problem of vessel strikes to marine mammals.

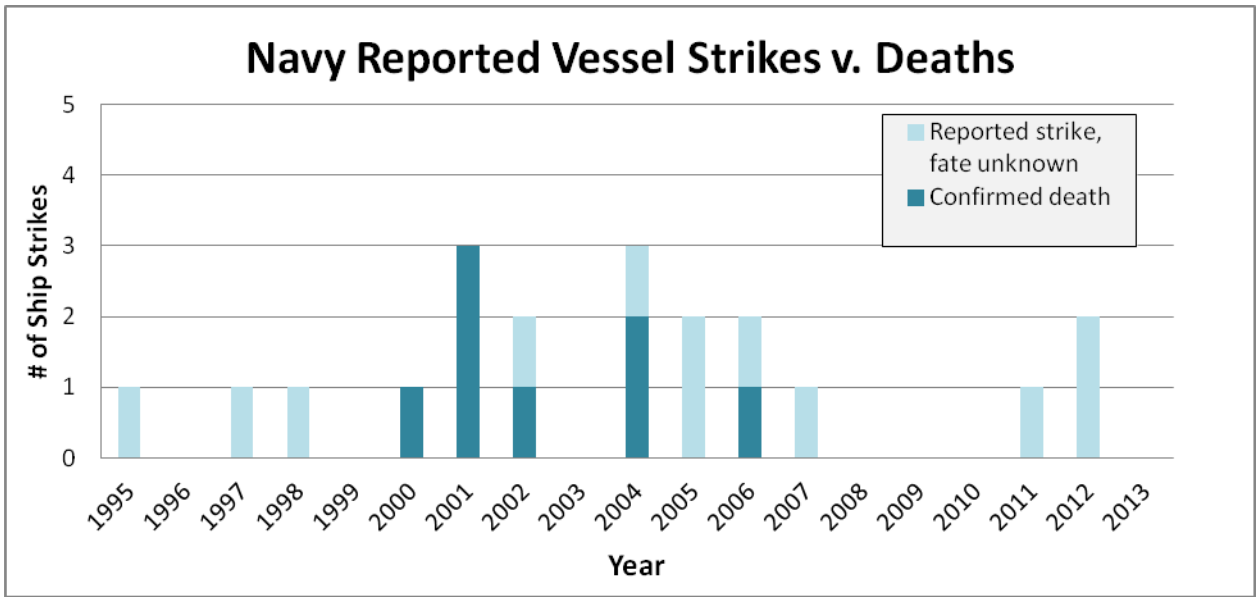


Figure 3.4-15: Navy Vessel Strikes by Type and Year (Jan 1995– May 2013)
#: number

The ability of a ship to detect a marine mammal and avoid a collision depends on a variety of factors, including environmental conditions, ship design, vessel size, number of watch personnel, and the behavior of the animal. The majority of ships participating in AFTT training and testing activities have a

number of advantages for avoiding ship strikes compared to most commercial or private vessels. These advantages include:

- Many Navy ships have their bridges positioned closer to the bow, offering good visibility ahead of the ship;
- There are often aircraft associated with the training or testing activity, which can detect marine mammals in the vicinity or ahead of a vessel's present course.
- Navy ships are generally much more maneuverable than commercial merchant vessels if marine mammals are spotted and the need to change direction is necessary. Navy ships operate at the slowest speed possible consistent with either transit needs or training or testing needs. While minimum speed is intended as a fuel conservation measure particular to a certain ship class, secondary benefits include better ability to spot and avoid objects in the water, including marine mammals. In addition, a standard operating procedure also added as a mitigation measure in previous MMPA permits is for Navy vessels to maneuver at least 500 yd. (457.2 m) away from any observed whale in the vessel's path and avoid approaching whales head-on, so long as safety of navigation is not imperiled.
- In many cases, Navy ships will likely move randomly or with a specific pattern within a sub-area of the AFTT Study Area for a period of time from one day to two weeks as compared to straight line point-to-point commercial shipping.
- Navy overall crew size is much larger than merchant ships allowing for more potential observers on the bridge.
- At all times when vessels are underway, trained Lookouts and bridge navigation teams are used to detect objects on the surface of the water ahead of the ship, including marine mammals. Additional Lookouts, beyond already stationed bridge watch and navigation teams, are stationed during some training events.
- Navy Lookouts receive extensive training, including Marine Species Awareness Training designed to provide marine species detection cues and information necessary to detect marine mammals.

For submarines, when on the surface there are Lookouts serving the same function as they do on surface ships and are thus able to detect and avoid marine mammals at the surface. When submerged, submarines are generally slow moving (to avoid detection) and therefore marine mammals at depth with a submarine are likely able to avoid collision with the submarine. The Navy's mitigation measures are detailed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Even with implementation of mitigation measures, vessel impacts from the Proposed Action represent a risk to large whales and manatees in the Study Area. The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004a). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes.

Information available on the species of cetaceans involved in vessel strikes in the Study Area comes from the National Marine Fisheries Service, Northeast Science Center and Southeast Science Center (unpublished data 1995-2011). These data are from all types of vessels (Navy, commercial and recreational), but give an indication of which species are vulnerable to ship strike in the Study Area. Out of 113 reported strikes the percentage of strikes by species is as follows: humpback whale (28 percent), North Atlantic right whale (19 percent), fin whale (17 percent), unknown species (16 percent), sei whale (6 percent), minke whale (5 percent), Cuvier's beaked whale (3 percent), Bryde's whale (2 percent),

sperm whale (2 percent), Blainville's beaked whale (1 percent), and Gervais' beaked whale (1 percent). West Indian manatees are highly susceptible to boat strikes. In the state of Florida alone, 169 watercraft-related deaths were reported in 2011-2012. As the result of consultation with the U.S. Fish and Wildlife Service and implementation of mitigation measures implemented in 1991, which have been supplemented in subsequent years, there has not been any incident that resulted in injury or mortality of a manatee due to naval activities or operations. Data and information specific to the occurrence and impact of vessel strikes to a species or group are further summarized in the following sections.

3.4.3.3.1.1 Mysticetes

Research suggests that the increasing noise in the ocean has made it difficult for whales to detect approaching vessels, which has indirectly raised the risk of vessel strike (Elvin and Taggart 2008). Some individuals may become habituated to low-frequency sounds from shipping and fail to respond to an approaching vessel (National Marine Fisheries Service 2008a). For example, right whales are documented to show little overall reaction to the playback of sounds of approaching vessels, suggesting that some whales perform only a last-second flight response (Nowacek et al. 2004a). Because surface activity includes feeding, breeding, and resting, whales may be engaged in this activity and not notice an approaching vessel (Silber and Bettridge 2010). Even if they were to hear the vessel, most mysticetes generally move too slowly to avoid vessels approaching at high speeds.

Based on NMFS vessel strike data (unpublished data 1995-2012), humpback whales, North Atlantic right whales, and fin whales are the three species with the highest percentage of reported strikes in the AFTT Study Area (Laist et al. 2001; Waring et al. 2010). Vessels strikes are a threat to these species, as well as sei and blue whales, because of their surface or near-surface feeding behaviors (Waring et al. 2010). Some areas in the Northeast Range Complexes are important feeding areas to these species in the summer months, so strike risk would be higher while these whales are on the feeding grounds.

Vessel strikes are considered a primary threat to North Atlantic right whale survival (Firestone 2009; Fonnesbeck et al. 2008; Knowlton and Brown 2007; Nowacek et al. 2004a; Vanderlaan et al. 2009; Vanderlaan et al. 2008). Studies of North Atlantic right whales tagged in April 2009 on the Stellwagen Bank feeding grounds found that right whales spent most of their time at a depth of 6.5 ft. (2 m), which makes them less visible at the water's surface (Bocconcelli 2009; Parks and Wiley 2009). The Navy will continue to implement mitigation measures in important North Atlantic right whale foraging, calving, and migration habitats. These measures, include increasing awareness, the use of sighting advisory systems, and providing specialized training on North Atlantic right whale observation, and are detailed in Chapter 5, Standard Operating Procedures, Mitigation Measures, and Monitoring. These measures will likely reduce the risk of a strike to the point that a strike of this species is not likely to occur, and will likely reduce the overall risk of strike to all other mysticetes.

3.4.3.3.1.2 Odontocetes

In general, odontocetes move quickly and seem to be less vulnerable to vessel strikes than other cetaceans; however, most small whale and dolphin species have at least occasionally suffered from vessel strikes, including killer whale (Van Waerebeek et al. 2007; Visser and Fertl 2000), short-finned and long-finned pilot whales (Aguilar et al. 2000; Van Waerebeek et al. 2007), bottlenose dolphin (Bloom and Jager 1994; Van Waerebeek et al. 2007; Wells and Scott 1997), white-beaked dolphin (Van Waerebeek et al. 2007), short-beaked common dolphin (Van Waerebeek et al. 2007), spinner dolphin (Camargo and Bellini 2007; Van Waerebeek et al. 2007), striped dolphin (Van Waerebeek et al. 2007), Atlantic spotted dolphin (Van Waerebeek et al. 2007), and pygmy sperm whales (*Kogia breviceps*) (Van Waerebeek et al. 2007). Beaked whales documented in vessel strikes include Arnoux's beaked whale

(Van Waerebeek et al. 2007), Cuvier's beaked whale (Aguilar et al. 2000; Van Waerebeek et al. 2007), and several species of *Mesoplodon* (Van Waerebeek et al. 2007). However, evidence suggests that beaked whales may be able to hear the low-frequency sounds of large vessels and thus avoid collision (Ketten 1998). Sperm whales may be exceptionally vulnerable to vessel strikes as they spend extended periods of time "rafting" at the surface to restore oxygen levels within their tissues after deep dives (Jaquet and Whitehead 1996; Watkins et al. 1999).

3.4.3.3.1.3 Pinnipeds

From the limited data available, it appears that pinnipeds in general appear to suffer fewer impacts from vessel strikes than cetaceans or sirenians. This may be due, at least in part, to the large amount of time they spend on land (especially when resting and breeding) and their high maneuverability in the water. A review of seal stranding data from Cape Cod, Massachusetts found that from 1999 to 2004, 622 pinniped strandings were recorded by the Cape Cod Stranding Network. Of these 622 strandings, 11 (approximately 2 percent) were found to be caused by boat collisions (Swails 2005).

3.4.3.3.1.4 Polar Bears

Richardson et al. (1995) reported that polar bears generally show little reaction (and these tend to be short-term and localized) from shipping traffic. Polar bears spend a large amount of their time on pack ice or land (Monnett and Gleason 2006), where they would not be vulnerable to vessel strikes.

3.4.3.3.1.5 West Indian Manatees

West Indian manatees respond to vessel movement via acoustic and possibly visual cues by moving away from the approaching vessel, increasing its swimming speed, and moving toward deeper water (Miksis-Olds et al. 2007; Nowacek et al. 2004b). The degree of the response varies with the individual manatee and may be more pronounced in deeper water where they are more easily able to locate the direction of the approaching vessel (Nowacek et al. 2004b). This disturbance is a temporary response to the approaching vessel. West Indian manatees have also been shown to seek out areas with a lower density of vessels (Buckingham et al. 1999). West Indian manatees exhibit a clear behavioral response to vessels within distances of 82 to 164 ft. (25 to 50 m), but it is unclear at what distance the manatees first detect the presence of vessels (Nowacek et al. 2004b). Vessel traffic and recreation activities that disturb West Indian manatees may cause them to leave preferred habitats and may alter biologically important behaviors such as feeding, suckling, or resting (Haubold et al. 2006).

In addition to disturbance, West Indian manatees are particularly susceptible to vessel collisions (both collisions with the hull and propeller strikes) because they hover near the surface of the water, move very slowly, and spend most of their time in coastal waters where vessel traffic tends to be more concentrated (Calleson and Frohlich 2007; Gerstein 2002; Haubold et al. 2006; Runge et al. 2007; U.S. Fish and Wildlife Service 2007). Vessel strikes are the direct agent of most human-caused deaths to adult West Indian manatees (Rommel et al. 2007; U.S. Fish and Wildlife Service 2007), accounting for approximately 25 percent of all manatee deaths recorded in Florida since 1976 (Calleson and Frohlich 2007). Though 98 percent of the registered watercraft in Florida are less than or equal to 40 ft. (12.2 m) in length, the analysis of a five-year subset of historical mortality data suggests that a disproportionate number of propeller-caused watercraft-related mortalities could be attributed to propeller diameters greater than or equal to 17 in. (43.2 cm), inferring that these were caused by watercraft greater than 40 ft. (12.2 m) (Rommel et al. 2007). U.S. Fish and Wildlife Service indicates that manatees are probably struck by smaller watercraft more often, but the likelihood of mortality is dependent on the force of collision, which is a factor of the speed and size of the vessel.

Not all collisions are fatal, as evidenced by the fact that most West Indian manatees in Florida bear scars from previous boat strikes (Rommel et al. 2007). However, nonlethal injuries may reduce the breeding success of females (Haubold et al. 2006) and may lower a manatee's immune response (Halvorsen and Keith 2008). Manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida.

3.4.3.3.1.6 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) provides estimates of relative vessel use and location for each of the alternatives. This section provides an estimated number of events predicted for each alternative. While these provide a prediction of vessel use, actual Navy vessel usage depends on military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Training and testing concentrations are most dependent on locations of Navy shore installations and established testing and training areas. Even with the introduction of the Undersea Warfare Training Range, the areas where the Navy primarily transits has not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel use and the manner in which the Navy trains and tests is not expected to change, but would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade and therefore the level which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5, Standard Operating Procedures, Mitigation Measures and Monitoring. The difference in events from the No Action Alternative to Alternative 1 and Alternative 2, shown in Section 3.0.5.3.3.1 (Vessels), is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Section 3.0.5.3.3.1 (Vessels), most training activities involve the use of vessels. Vessel strikes to marine mammals are not associated with any specific training activity but rather a limited, sporadic, and accidental result of Navy ship movement within the Study Area. Vessel movement can be widely dispersed throughout the Study Area but for the most part occur within the established range complexes, and are more concentrated near naval ports, piers, and range areas. Navy training vessel traffic would especially be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and near Naval Station Mayport in Jacksonville, Florida, in the Southeast U.S. Continental Shelf Large Marine Ecosystem. Refer to Section 3.0.5.3.3.1 (Vessels) for the estimated vessel use by range area.

Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. The direct route the Navy predominantly uses between Norfolk and Jacksonville avoids a good portion of the coastal North Atlantic right whale migratory corridor and critical habitat, especially off the coasts of South Carolina and Georgia. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open ocean portions of the Study Area because of the concentration of vessel movements in those areas. There is not expected to be any predictable seasonal differentiation in Navy vessel use.

Support craft would be more concentrated in the coastal areas near naval installations, ports, and ranges. Training activities involving the use of support craft in the coastal, shallow water areas where manatees are likely to occur are limited to a few types of events, including mine neutralization, search and rescue, special warfare and force protection. Navy vessels comply with all federal, state and local Manatee Protection Zones, and vessels reduce speed in accordance with established safety procedures. Where manatees are most likely to be encountered, the Navy has established specific procedures. Section 5.3.3.1.2 (West Indian Manatee) in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a list of the applicable procedures.

The concentration of vessel use and the manner in which the Navy trains is expected to be consistent with the range of variability observed over the last decade. Therefore, historical strike data were used to calculate the probability of a Navy vessel striking a whale during proposed training activities in the Study Area. In the AFTT Study Area, there were a total of 20 reported whale strikes from January 1995–May 2013, for an average of 1.086 per year (20 strikes/18.42 years =1.086). These values were used as the rate parameter to calculate a series of Poisson probabilities (a Poisson distribution is often used to describe random occurrences when the probability of an occurrence is small, e.g., count data such as cetacean sighting data, or in this case strike data, are often described as a Poisson or over-dispersed Poisson distribution). To estimate the Poisson probabilities of 1, 2, 3, 4, 5, etc. occurrences, a simple computation can be generated: $P(X) = P(X-1)\mu/X$.

$P(X)$ is the probability of occurrence in a unit of time (or space), and μ is the mean number of occurrences in a unit of time (or space). For the period from January 1995–May 2013, μ is calculated as 1.086.

To estimate zero occurrences (in this case, no whales being struck), the formula $P(0)=e^{-\mu}$ would apply. Plugging 1.086 into the equation yields a value of P(0) = 0.3376, hence the statement "there is slightly less than a 64 percent probability of a large whale of any species not being struck by a Navy vessel in the Study Area." Thus, continuing the computation series:

- P(1) = (0.3376 * 1.086)/1 = 0.3666 (or a 37 percent probability of striking one whale in 1 year)
- P(2) = (0.3673 * 1.086)/2 = 0.1991 (or a 20 percent probability of striking two whales in 1 year)
- P(3) = (0.1938 * 1.086)/3 = 0.0721 (or a 7 percent probability of striking three whales in 1 year)
- P(4) = (0.0681 * 1.086)/4 = 0.0196 (or a 2 percent probability of striking four whales in 1 year)
- P(5) = (0.0180 * 1.086)/5 = 0.0042 (or a 0.4 percent probability of striking five whales in 1 year)

While the Poisson distribution shows that the probability of striking three or more whales in a single year is low (7 percent chance), it did occur in 2001 and 2004. When averaging the available data over five-year increments, the highest average over a period for which data are available is two strikes per year.

Based on available NMFS data (unpublished data 1995-2012) and a consideration of mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), the Navy predicts that the fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species have the potential to be struck by a vessel as a result of training activities in the Study Area. Most Navy-reported whale strikes are not identified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species. Consequently, the Navy is seeking take authorization for a combination of the following species: fin whale, humpback whale, minke whale, sei

whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species under the Preferred Alternative (Alternative 2). The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than three humpback whales and two fin whales, one sei whale, one blue whale and one sperm whale could be struck over a five-year period based on the percentages that those species have been involved in vessel collisions.

The Navy does not anticipate it will strike a North Atlantic right whale because of the extensive measures in place to reduce the risk of a strike to that species. Vessel use may occur within the North Atlantic right whale's designated critical habitat areas year round. It is possible that North Atlantic right whales encountered could be disturbed by the presence of vessels. Disturbance within the southeast critical habitat is mostly likely to occur in winter months and during summer months within the Northeast critical habitat. Physical disturbance from vessel use is not expected to result in more than a momentary behavioral response.

The primary constituent elements of the habitat required by North Atlantic right whales for feeding and breeding have been reported as the presence of copepods in the Northeast (Pace 2008) and water temperature and depth in the Southeast (Garrison 2007); however, these primary constituent elements are not expected to be impacted by vessels.

The Navy does not anticipate it will strike a manatee. Manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida. Where manatees are most likely to be encountered, mitigation measures are in place. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a full list of these procedures. Specifically within the basin and associated channels at Naval Station Mayport in Jacksonville, Florida, Navy vessels comply with all federal, state, and local Manatee Protection Zones, and vessels reduce speed in accordance with established safety procedures.

At Naval Submarine Base Kings Bay in Kings Bay, Georgia, C-Tractor tugs and all other applicable support boats operating have been retrofitted with manatee guards (U.S. Department of the Navy 2008), which according to the U.S. Fish and Wildlife Service has eliminated this source of mortality at Naval Submarine Base Kings Bay (U.S. Fish and Wildlife Service 2001). In addition, Naval Submarine Base Kings Bay also has an operational instruction that requires the use of Lookouts onboard all Navy vessels operating in port waters to reduce the risk of collision with manatees. Similar protective measures are in place at Naval Station Mayport in Jacksonville, Florida, including small craft vessels with manatee guards, speed restrictions, a manatee notification protocol to report sightings in the basin to Harbor Operations, and manatee awareness training for personnel.

The Navy does not anticipate that vessel transit will injure any manatees as they only occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida, where vessel use is limited to only a few activities. The use of an Early Warning Communication System and idle speed regulations are in place at Kings Bay, Georgia, further reducing potential impacts. The low probability of vessel co-occurrence and the use of mitigation measures around Kings Bay, Georgia and Jacksonville, Florida, indicate that the likelihood of a strike is very low. Physical disturbance from vessels is not expected to result in more than a momentary behavioral response. Manatees also occur in the coastal waters of Puerto Rico, which is within the Study Area, but no training is anticipated in these areas where manatees would occur.

Vessel use may occur in very small portions of the West Indian manatee designated critical habitat near Mayport and Port Canaveral, Florida year round. It is possible that manatees could be disturbed by the presence of vessels in any portion of the Study Area. Disturbance within manatee habitat is mostly likely to occur during spring, summer, or fall, because during winter they generally move farther inland. Physical disturbance from vessels is not expected to result in more than a momentary behavioral response. The primary constituent elements of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presence of seagrass foraging habitat and warm water refuges. These elements would not be impacted by vessel use during training activities within the designated critical habitat.

While it is possible that during training activities, vessels could transit outside of the established range complexes where bowhead whales, ringed seals, or polar bears occur, these transits are expected to be very infrequent; therefore, the Navy does not anticipate it will disturb or strike these species.

Pursuant to the MMPA, *the use of vessels during training activities under the No Action Alternative, Alternative 1, or Alternative 2:*

- *may result in up to 10 Level A harassment or mortality takes of any of the following species over the next 5-year period): the fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, or unidentified whale species and*
- *is not expected to result in Level B harassment of marine mammals.*

Pursuant to the ESA, the use of vessels during training activities as described in the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed humpback whale, sei whale, fin whale, blue whale and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, bowhead whale, ringed seal, polar bear, and West Indian manatee; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

Testing Activities

As indicated in Section 3.0.5.3.3.1 (Vessels), most of the testing activities involve the use of vessels. However, the number of activities that include the use of vessels for testing is comparatively lower (around 10 percent) than the number of training activities. In addition, testing often occurs jointly with a training event, so it is likely that the testing activity would be conducted from a training vessel. Vessel movement in conjunction with testing activities could be widely dispersed throughout the Study Area, but would be concentrated near naval ports, piers, range complexes, testing ranges, and especially off the northeast U.S. coast, off south Florida, and in the Gulf of Mexico. There would be a higher likelihood of vessel strikes in these portions of the Study Area because of the concentration of vessel movement in those areas.

Propulsion testing events, also referred to as high-speed vessel trials, occur infrequently but pose a higher strike risk because of the high speeds at which the vessels need to transit to complete the testing activity. These activities would most often occur in the Gulf of Mexico Large Marine Ecosystem in the Gulf of Mexico, but may also occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem in

the Northeast Range Complexes, the Gulf Stream Open Ocean Area, and the North Atlantic Gyre Open Ocean Area in the VACAPES and JAX Range Complexes. However, there are just a few of these events proposed per year, so the increased risk is nominal compared to all vessel use in the Proposed Action.

The marine mammal species primarily at risk would be large whales in the Gulf of Mexico and Southeast U.S. Large Marine Ecosystems. Of the 20 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the Navy estimates it may take a single marine mammal, by injury or mortality over the next five-year period. Because of the number of incidents in which the struck animal has remained unidentified to species, the Navy cannot quantifiably predict that the proposed takes will be of any particular species and therefore seeks take authorization for any the following species: fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, or unidentified whale species. The Navy's vessel operating procedures are designed to reduce the potential for strikes and to ensure the safety of the vessel and crew; Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a full list of these procedures.

The Navy does not anticipate it will strike a North Atlantic right whale because of the extensive measures in place to reduce the risk of a strike to that species. Vessel use may occur within the North Atlantic right whale designated critical habitat areas year round. As discussed above in the training activities discussion, it is possible that right whales encountered in these areas may be disturbed by the presence of vessels. Disturbance within the Southeast critical habitat is most likely to occur in winter, and during summer within the northeast critical habitat. As discussed above in the training activities discussion, primary constituent elements of North Atlantic right whale critical habitat are not expected to be impacted.

The Navy does not anticipate that vessel transit will injure any manatees during testing activities as manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida. Within these areas, there are just a few testing activities that occur close to shore where manatees would be likely to be encountered. In addition, there are mitigation measures in place (as described above under Training Activities) which make the likelihood of a strike very low. Disturbance is mostly likely to occur during spring, summer, or fall, because during winter manatees generally move farther inland. Physical disturbance from vessel use is not expected to result in more than a momentary behavioral response.

As discussed above in the training activities discussion, vessel use may occur in very small portions of the West Indian manatee designated critical habitat. The primary constituent elements of the habitat required by the West Indian manatee for feeding and breeding have been reported as the presence of seagrass foraging habitat and warm water refuges. These elements would not be impacted by vessel use during testing activities within the designated critical habitat.

While it is possible that during testing activities, vessels could transit outside of the established range complexes where bowhead whales, ringed seals, or polar bears occur, these transits are expected to be very infrequent; therefore, the Navy does not anticipate it will disturb or strike these species.

Pursuant to the MMPA, the use of vessels during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may result in Level A harassment or mortality of a fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, or unidentified whale species and*
- *is not expected to result in Level B harassment of marine mammals.*

Pursuant to the ESA, the use of vessels during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, bowhead whale, ringed seal, polar bear, and West Indian manatee; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.3.2 Impacts from In-Water Devices

In-water devices are generally smaller (several inches to 111 ft. [34 m]) than most Navy vessels. Section 3.0.5.3.3.2 (In-Water Devices) discusses the types of activities that use in-water devices, where they are used, and how many events will occur under each alternative.

Devices that could pose a collision risk to marine mammals are those operated at high speeds and are unmanned. These are mainly limited to the unmanned surface vehicles such as high-speed targets and unmanned underwater vehicles. The Navy reviewed torpedo design features and a large number of previous anti-submarine warfare torpedo exercises to assess the potential of torpedo strikes on marine mammals. The acoustic homing programs of U.S. Navy torpedoes are sophisticated and would not confuse the acoustic signature of a marine mammal with a submarine/target. All exercise torpedoes are recovered and refurbished for eventual re-use. Review of the exercise torpedo records indicates there has never been an impact on a marine mammal or other marine organism. In thousands of exercises in which torpedoes were fired or in-water devices used, there have been no recorded or reported instances of a marine species strike from a torpedo or any other in-water device.

Since some in-water devices are identical to support craft, marine mammals could respond to the physical presence of the device as discussed in Section 3.4.3.3.1 (Impacts from Vessels). Physical disturbance from the use of in-water devices is not expected to result in more than a momentary behavioral response.

Devices such as unmanned underwater vehicles that move slowly through the water are highly unlikely to strike marine mammals because the mammal could easily avoid the object. Towed devices are unlikely to strike a marine mammal because of the mitigation measures that involve Lookouts observing within a mitigation zone when towing in-water devices.

The Navy does not anticipate encountering a manatee during the use of in-water devices during training activities, as manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida. Within these areas, there are just a few training activities that may involve the use of in-water devices that may occur close

to shore where manatees would likely be encountered. In addition, there are mitigation measures in place for towed devices which make the likelihood of a strike very low. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a full list of these mitigation measures.

In-water devices are not anticipated to be used where bowhead whales, ringed seals, or polar bears occur. Therefore, these species are not expected to be affected by the Navy's in-water device use in the Study Area.

3.4.3.3.2.1 No Action Alternative, Alternative 1 and Alternative 2 (Preferred Alternative)

Training

In-water device use could occur in the portions of the Study Area listed in Section 3.0.5.3.3.2 (In-Water Devices) at any time of year. Unmanned surface vehicle use would be concentrated within the Northeast U.S. Continental Shelf Large Marine Ecosystem in the VACAPES Range Complex, within the Southeast U.S. Continental Shelf Large Marine Ecosystem in the Navy Cherry Point and JAX Range Complexes, and within the Gulf of Mexico Large Marine Ecosystem in the GOMEX Range Complex.

As discussed above, in Section 3.4.3.3.2 (Impacts from In-Water Devices), some marine mammal species may encounter in-water devices. However, for the reasons discussed, in-water devices are not likely to strike a marine mammal. It is possible that marine mammals may be disturbed by the presence of these activities, but any disturbance from the use of in-water devices is not expected to result in more than a momentary behavioral response.

The Navy does not anticipate encountering a manatee during the use of in-water devices during training activities, as manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida. Within these areas, there are just a few training activities that may involve the use of in-water devices that may occur close to shore where manatees would likely be encountered. In addition, there are mitigation measures in place for towed devices, which make the likelihood of a strike very low. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a full list of these mitigation measures.

In-water device use may occur within the North Atlantic right whale's designated critical habitat areas year-round. Potential disturbance within the southeast critical habitat is mostly likely to occur in winter, and during summer within the northeast critical habitat. The primary constituent elements of the habitat required by North Atlantic right whales for feeding and breeding have been reported as the presence of copepods in the northeast (Pace and Merrick 2008) and water temperature and depth in the southeast (Garrison 2007); however, these primary constituent elements are not expected to be impacted. In-water device use is not expected to occur in West Indian manatee critical habitat.

Pursuant to the MMPA, the use of in-water devices during training activities as described under the No Action Alternative, Alternative 1, or Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of in-water devices during training activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

Testing

In-water device use could occur in the portions of the Study Area listed in Section 3.0.5.3.3.2 (In-Water Devices) at any time of year. Unmanned surface vehicle use would be concentrated within the Northeast U.S. Continental Shelf Large Marine Ecosystem in Narragansett Bay; the Naval Undersea Warfare Center Division, Newport Testing Range; and the VACAPES Range Complex. Within the Southeast U.S. Continental Shelf Large Marine Ecosystem, use would be concentrated in the JAX Range Complex.

As discussed above, in Section 3.4.3.3.2 (Impacts from In-Water Devices), some marine mammal species may encounter in-water devices. However, for the reasons discussed, in-water devices are not likely to strike a marine mammal. It is possible that marine mammals may be disturbed by the presence of these activities, but any disturbance from the use of in-water devices is not expected to result in more than a momentary behavioral response.

The Navy does not anticipate encountering a manatee during the use of in-water devices during testing activities, as manatees generally occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida. Within these areas, there are just a few testing activities that may involve the use of in-water devices that may occur close to shore where manatees would likely be encountered. In addition, there are mitigation measures in place, which make the likelihood of a strike very low. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides a full list of these mitigation measures.

In-water device use may occur within the North Atlantic right whale's designated critical habitat areas year-round Potential disturbance within the southeast critical habitat is mostly likely to occur in winter, and during summer within the northeast critical habitat. The primary constituent elements of the habitat required by North Atlantic right whales for feeding and breeding have been reported as the presence of copepods in the northeast (Pace and Merrick 2008) and water temperature and depth in the southeast (Garrison 2007); however, these primary constituent elements are not expected to be impacted. In-water device use is not expected to occur in West Indian manatee critical habitat.

Pursuant to the MMPA, the use of in-water devices during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of in-water devices during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.3.3 Impacts from Military Expended Materials

This section analyzes the strike potential to marine mammals from the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, expendable targets and aircraft stores (fuel tanks, carriages, dispensers, racks, carriages, or similar types of support systems on aircraft that could be expended or recovered). Section 3.0.5.3.3.3 (Military Expended Materials) discusses the types of activities that use military expended materials, where they are used, and how many events will occur under each alternative.

While disturbance or strike from an item falling through the water column is possible, it is not very likely because the objects generally sink slowly through the water and can be avoided by most marine mammals. Therefore, the discussion of military expended materials strikes will focus on the potential of a strike at the surface of the water. While no strike from military expended materials has ever been reported or recorded, the possibility of a strike still exists. Therefore, the potential for marine mammals to be struck by military expended materials was evaluated using statistical probability modeling to estimate the likelihood. Specific details of the modeling approach including model selection and calculation methods can be found in Appendix G (Statistical Probability Analysis for Estimating Direct Strike Impact and Number of Potential Exposures).

To estimate the likelihood of a strike, the highest probability of a strike was calculated by using the marine mammal with the highest average density in areas with the highest military expended material expenditures. These highest estimates would then provide a point of comparison for all other areas and species. The areas with the greatest amount of expended materials are expected to be the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, and the Gulf Stream Open Ocean Area (specifically within the VACAPES and JAX Range Complexes). 3.0.5.3.3.3 (Military Expended Materials) provides estimates of expended materials throughout the entire Study Area.

For all the remaining marine mammals with lesser densities, this highest likelihood would overestimate the likelihood or probability of a strike. Because the ESA has specific standards for understanding the likelihood of impacts on each endangered species, estimates are provided for all endangered marine mammals. These estimates were also calculated with the highest average mammal densities and the highest levels of military expended materials would be expended. In this way, the appropriate ESA conclusions could be based on the highest estimated probabilities of a strike for those species.

Input values include munitions data (frequency, footprint, and type), size of the training or testing area, marine mammal density data, and size of the animal. To estimate the potential of military expended materials to strike a marine mammal, the annual total impact of all military expended materials with the potential to strike a marine mammal was calculated each of the alternatives.

The analysis of the potential for a marine mammal strike is influenced by the following assumptions:

- The model is two-dimensional and assumes that all marine mammals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend up to 90 percent of their time under the water (Costa and Block 2009).
- The model also does not take into account the fact that most of the projectiles fired during training and testing activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force.
- The model assumes the animal is stationary and does not account for any movement of the marine mammal or any potential avoidance of the training or testing activity.

The potential of fragments from high-explosive munitions or expended material other than munitions to strike a marine mammal would be much lower than for the worst-case scenario calculated above because those events happen with much lower frequency. Fragments may include metallic fragments from the exploded target, as well as from the exploded munitions.

Marine mammal species that occur in the Study Area may be exposed to the risk of military expended material strike. The risk of the West Indian manatee to be exposed to this stressor during training events is highly unlikely because its primarily inland/coastal distribution does not overlap the offshore areas where the Navy generally conducts the types of activities that expend these materials. Manatees may be exposed to this stressor in the Gulf of Mexico during testing events conducted in the nearshore environment, though they are very rarely encountered in those areas.

Species such as the bowhead whale and polar bear whose ranges are outside of the areas where these materials would be normally be expended are not likely to be exposed to this stressor. The primary constituent elements of the habitat required by North Atlantic right whales and West Indian manatees, as described previously, would not be impacted by military expended materials.

The model output provides a reasonably high level of certainty that marine mammals would not be struck by military expended materials. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) describes mitigation measures proposed to help further reduce the potential impacts of military expended material strikes on marine mammals.

3.4.3.3.3.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training Activities

The model results presented in Table 3.4-36 present the probability of a strike as percent. The results indicate with a reasonable level of certainty that marine mammals would not be struck by non-explosive practice munitions and expended materials other than munitions. Results range from zero, or a zero percent chance that a North Atlantic right whale would be struck by any military expended material, to a 4 percent chance that a spotted dolphin may be struck by any military expended material over the course of a year. However, as discussed above, this does not take into account the assumptions that likely overestimate impact probability and the behavior of marine mammals (e.g., spotted dolphins travel in groups and are relatively easy to spot), which would make the risk of a strike even lower. Alternatives 1 and 2 have an increased amount of expended materials from training activities compared to the No Action Alternative, as shown in Section 3.0.5.3.3.3 (Military Expended Materials). The increase in expended materials and a proposed expansion of the Study Area from the No Action Alternative to Alternatives 1 and 2 result in a corresponding increase of the risk of a strike, as shown in Table 3.4-36. While the Study Area is expanded under Alternatives 1 and 2, species such as the bowhead whale and

polar bear ranges are outside of the areas where these materials would be expended under Alternatives 1 and 2 and are not likely to be exposed to this stressor.

Table 3.4-36: Probability of a Military Expended Material Strike for Representative Marine Mammals by Area and Alternative

Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
VACAPES Range Complex						
Species	Training			Testing		
	No Action	Alternative 1	Alternative 2	No Action	Alternative 1	Alternative 2
North Atlantic Right Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Humpback Whale	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%
Sei Whale	0.02%	0.05%	0.05%	0.04%	0.06%	0.06%
Fin Whale	0.01%	0.03%	0.03%	0.03%	0.04%	0.05%
Blue Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sperm Whale	0.08%	0.18%	0.18%	0.16%	0.23%	0.25%
Atlantic Spotted Dolphin	1.84%	4.42%	4.42%	3.76%	5.69%	6.01%
Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
JAX Range Complex						
Species	Training			Testing		
	No Action	Alternative 1	Alternative 2	No Action	Alternative 1	Alternative 2
North Atlantic Right Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Humpback Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sei Whale	0.01%	0.02%	0.02%	0.00%	0.00%	0.00%
Fin Whale	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
Blue Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sperm Whale	0.01%	0.02%	0.02%	0.00%	0.01%	0.01%
Atlantic Spotted Dolphin	0.45%	0.94%	0.94%	0.15%	0.25%	0.28%

JAX: Jacksonville; VACAPES: Virginia Capes; %: percent

Proposed training activities involving the use of military expended materials do not overlap with bowhead whale, ringed seal, or polar bear habitat.

Pursuant to the MMPA, the use of military expended materials during training activities as described under the No Action Alternative, Alternative 1, or Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of military expended materials for training activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right, humpback, sei, fin, blue, and sperm whales and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.3.3.2 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Testing Activities

The model results presented in Table 3.4-36 indicate a reasonable level of certainty that marine mammals would not be struck by non-explosive practice munitions and expended materials other than munitions. Results range from zero, or a zero percent chance that a North Atlantic right whale would be struck by any military expended material to a 6 percent chance that a spotted dolphin may be struck by any military expended material over the course of a year. However, as discussed above, this does not take into account the assumptions that likely overestimate impact probability and the behavior of marine mammals (e.g., spotted dolphins travel in groups and are relatively easy to spot), which would make the risk even lower. Alternatives 1 and 2 have an increased amount of expended materials from testing activities compared to the No Action Alternative, as shown in Section 3.0.5.3.3.3 (Military Expended Materials). The increase in expended materials and a proposed expansion of the Study Area from the No Action Alternative to Alternatives 1 and 2 may result in a corresponding increase of the risk of a strike, as shown in Table 3.4-36. While the Study Area is expanded under Alternatives 1 and 2, species such as the bowhead whale and polar bear occur outside of the areas where these materials would be expended under Alternatives 1 and 2, and are not likely to be exposed to this stressor.

Proposed testing activities that involve the use of military expended materials do not overlap with bowhead whale, ringed seal, or polar bear habitat.

Pursuant to the MMPA, the use of military expended materials during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of military expended materials for testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.3.4 Impacts from Seafloor Devices

Section 3.0.5.3.3.4 (Seafloor Devices) discusses the types of activities that use seafloor devices, where they are used, and how many events will occur under each alternative. These include items placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, and bottom-crawling unmanned underwater vehicles. As discussed in Section 3.4.3.3.3 (Impacts from Military Expended Materials), objects falling through the water column will slow as they sink toward the bottom and could be avoided by most marine mammals. The only seafloor device used during training and testing activities that has the potential to strike a marine mammal at or near the surface is an aircraft-deployed mine shape, which is used during aerial mine laying activities. These devices are identical to non-explosive practice bombs; therefore, the analysis of the potential impacts from those devices are considered in the military expended material strike analysis (Section 3.4.3.3.3, Impacts from Military Expended Materials).

The primary constituent elements of the habitat required by North Atlantic right whales and West Indian manatees, as described previously, would not be impacted by seafloor devices.

Proposed activities involving the use of seafloor devices do not overlap with bowhead whale, ringed seal, or polar bear habitat.

Pursuant to the MMPA, the use of seafloor devices during training and testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of seafloor devices during training and testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *will have no effect on ESA-listed bowhead whale, North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, ringed seal, polar bear and West Indian manatee; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.4 Entanglement Stressors

This section analyzes the potential for entanglement of marine mammals as the result of proposed training and testing activities within the Study Area. This analysis includes the potential impacts from two types of military expended materials: (1) fiber optic cables and guidance wires and (2) parachutes. The number and location of training and testing events that involve the use of items that may pose an entanglement risk are provided in Section 3.0.5.3.4 (Entanglement Stressors). This section does not analyze impacts on critical habitat because Section 3.4.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of expended materials on designated critical habitat.

These materials may have the potential to entangle and could be encountered by marine mammals in the Study Area at the surface, in the water column, or along the seafloor, though the properties and size of these items makes entanglement unlikely. In addition, there has never been a reported or recorded instance of a marine mammal entangled in military expended materials; however, the possibility still exists. Since potential impacts depend on how a marine mammal encounters and reacts to items that pose an entanglement risk, the following subsections discuss research relevant to specific groups or species.

3.4.3.4.1 Mysticetes

Mysticetes, like all marine mammals, are susceptible to becoming entangled in floating debris. They may be especially vulnerable when they lunge feed at the surface (Derraik 2002). Entanglement of many large whales, including the North Atlantic right whale (a species that shows scars in almost every individual from entanglements with lobster trap lines) most often begins with rope being caught in its baleen plates. Trailing lengths of rope then become wrapped around the animal's appendages as it struggles to free itself (Kozuck 2003). In the western North Atlantic, 41 percent of all documented entangled humpbacks were entangled in crab pots and 50 percent in gillnets (Nielsen 2009). In a study of humpback whales in northern southeast Alaska, the percentage of whales thought to have been non-lethally entangled in their lifetimes based on scarring ranged between 52 and 78 percent (Nielsen 2009). Available data indicate males typically have more scars than females and may become entangled more frequently. Juvenile humpback whales and North Atlantic right whales in the western North Atlantic were found to have a higher rate of entanglement and be more at risk of serious injury when entangled than mature animals (Robbins 2009, 2010). Entanglement is more likely for animals that feed on the bottom (humpback and possibly fin whales).

3.4.3.4.2 Odontocetes

Heezen (1957) reported two confirmed instances of sperm whales entangled in the slack lengths of telegraph cable near cable repair sites along the seafloor. These whales likely became entangled while feeding along the bottom, as the cables were most often found wrapped around the jaw. Juvenile harbor porpoises exposed to 0.5 in. diameter (13 millimeters [mm] diameter) white nylon ropes in both vertical and horizontal planes treated the ropes as barriers, more frequently swimming under than over them. However, porpoises feeding on fish in the area crossed the ropes more frequently and became less cautious, suggesting that rope poses a greater risk in a feeding area than in a transit area. For porpoises feeding on the bottom, rope suspended near the seafloor is more likely to entangle than rope higher in the water column because the animals' natural tendency is to swim beneath barriers (Kastelein 2009).

3.4.3.4.3 Pinnipeds

Fur seals appear to be attracted to floating debris and consequently suffer a high rate of entanglement in derelict fishing lines and nets (Derraik 2002) than other pinniped species. Their unique habit of rolling on the surface of the water leads to complex entanglement. A young pup may become so entangled that its body becomes constricted by the material as it grows. Death may occur by strangulation or severing of the arteries (Derraik 2002). Other species of seals, such as harbor seals, gray seals, and harp seals can also get entangled in nets and fishing line when young and then grow with the lines wrapped around their necks or appendages, causing deep wounds and eventually death.

The primary constituent elements of the habitat required by North Atlantic right whales and West Indian manatees, as described previously, would not be impacted by cables, wires or parachutes.

3.4.3.4.4 Impacts from Fiber Optic Cables and Guidance Wires

Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) discusses the types of activities that use cables and wires, where they are used, and how many events will occur under each alternative. This section does not analyze impacts on critical habitat because Section 3.4.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of expended materials on designated critical habitat.

The likelihood of a marine mammal encountering and becoming entangled in a fiber optic cable depends on several factors. The amount of time that the cable is in the same vicinity as a marine mammal can increase the likelihood of it posing an entanglement risk. Since the cable will only be within the water column during the activity and while it sinks, the likelihood of a marine mammal encountering and becoming entangled within the water column is extremely low. The length of the cable varies (up to about 900 ft. [3,000 m]), and greater lengths may increase the likelihood that a marine mammal could become entangled. The behavior and feeding strategy of a species can determine whether they may encounter items on the seafloor, where cables will be available for longer periods. There is potential for those species that feed on the seafloor to encounter cables and potentially become entangled; however, the relatively few cables being expended within the Study Area limits the potential for encounters. The physical characteristics of the fiber optic material render the cable brittle and easily broken when kinked, twisted, or bent sharply (i.e., to a radius greater than 360 degrees). Thus, the physical properties of the fiber optic cable would not allow the cable to loop, greatly reducing or eliminating any potential issues of entanglement with regard to marine life.

Similar to fiber optic cables discussed above, guidance wires may pose an entanglement threat to marine mammals either in the water column or after the wire has settled to the sea floor. The likelihood of a marine mammal encountering and becoming entangled in a guidance wire depends on several factors. With the exception of a chance encounter with the guidance wire while it is sinking to the seafloor (at an estimated rate of 0.7 ft. [0.2 m] per second), it is most likely that a marine mammal would only encounter a guidance wire once it had settled on the sea floor. Since the guidance wire will only be within the water column during the activity and while it sinks, the likelihood of a marine mammal encountering and becoming entangled within the water column is extremely low. In addition, based on degradation times, the guide wires would break down within one to two years and therefore no longer pose an entanglement risk. The length of the guidance wires vary, but greater lengths increase the likelihood that a marine mammal could become entangled. The behavior and feeding strategy of a species can determine whether they may encounter items on the seafloor, where guidance wires will most likely be available. There is potential for those species that feed on the seafloor to encounter guidance wires and potentially become entangled; however, the relatively few guidance wires being expended within the Study Area limits the potential for encounters.

Marine mammal species that occur within the Study Area were evaluated based on the likelihood of encountering these items. Mysticete species that occur where these training and testing activities take place could encounter these items once they settle to the seafloor if they feed on the bottom in the areas where these activities occur. Although manatees may occur in these areas, these training and testing activities would not take place in shallow waters where manatees would be feeding and therefore potentially encounter these items on the seafloor. Odontocete and pinniped species, which occur in these areas and that forage on the bottom, could potentially encounter these items. The bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear do not occur in these areas.

The chance that an individual animal would encounter expended cables or wires is most likely low based on the distribution of both the cables and wires expended, the fact that the wires and cables will sink upon release, and the relatively few marine mammals that are likely to feed on the bottom in the deeper waters where these would be expended. It is probably very unlikely that an animal would get entangled even if it encountered a cable or wire while it was sinking or upon settling to the seafloor. An animal would have to swim through loops or become twisted within the cable or wire to become entangled, and given the properties of the expended cables and wires (low breaking strength and sinking rates) this seems unlikely. Furthermore, an animal may initially become entangled in a cable or wire but easily become free, and therefore no long-term impacts would occur. Based on the estimated concentration of expended cables and wires, impacts from cables or wires are extremely unlikely to occur.

3.4.3.4.4.1 No Action Alternative

Training Activities

Refer to Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) for the approximate number of events and locations where cables and wires would be expended.

The area that will have the greatest concentration of expended fiber optic cables or guidance wires is within the VACAPES Range Complex (specifically W-50). The W-50 location includes 123 nautical square miles (nm^2) of sea space. Under the No Action Alternative, there would be approximately seven cables per nm^2 if they were expended evenly throughout the area. There has never been a reported or

recorded incidence of any marine mammal being entangled by guidance wires or fiber optic cables, or by any other military expended material.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during training activities as described in the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Refer to Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) for the approximate number of events and locations where cables and wires would be expended.

Cables and wires would be expended with greatest concentration in the Gulf of Mexico Large Marine Ecosystem (specifically Naval Surface Warfare Center, Panama City Division Testing Range). Under the No Action Alternative, there would be approximately one cable per 17 nm^2 if they were expended evenly throughout area. Based on this low concentration, likelihood of an animal encountering one of these items is extremely low.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during testing activities as described in the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.4.4.2 Alternative 1

Training Activities

Under Alternative 1, fiber optic cables expended during training activities would increase about 240 percent and guidance wires expended would increase about 22 percent above the No Action Alternative. As with the No Action Alternative, they could be expended anywhere within the Study Area but would be expended with greatest concentration in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically the VACAPES Range Complex). This would result in a maximum concentration of approximately one cable every 16 nm^2 if they were expended evenly throughout the area. While there is an increase in fiber optic cables and guidance

wires that would be expended under Alternative 1, the resulting concentration is lower than for the No Action Alternative because the area where the cables would be expended is larger. Based on this low concentration, likelihood of an animal encountering one of these items is extremely low.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during training activities as described in Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires for training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 1, fiber optic cables expended during testing activities would increase by 117 percent and guidance wires expended would increase to about six times the No Action Alternative. As with the No Action Alternative, they could be expended anywhere within the Study Area but would be expended with greatest concentration in the Gulf of Mexico Large Marine Ecosystem (specifically, Naval Surface Warfare Center, Panama City Division Testing Range). This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended evenly throughout the area. While there is an increase in fiber optic cables and guidance wires that would be expended under Alternative 1, the resulting concentration is lower than for the No Action Alternative because the area where the cables would be expended is larger. Based on this low concentration, likelihood of an animal encountering one of these items is extremely low.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during testing activities as described in Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.4.4.3 Alternative 2 (Preferred Alternative)

Training Activities

Under Alternative 2, fiber optic cables expended during training activities would increase about 240 percent and guidance wires expended would increase about 22 percent above the No Action Alternative. As with the No Action Alternative, they could be expended anywhere within the Study Area but would be expended with greatest concentration in the Northeast U.S. Continental Shelf Large

Marine Ecosystem and Gulf Stream Open Ocean Area (specifically the VACAPES Range Complex). This would result in a maximum concentration of approximately one cable every 16 nm^2 if they were expended evenly throughout the area. While there is an increase in fiber optic cables and guidance wires that would be expended under Alternative 2, the resulting concentration is lower than for the No Action Alternative because the area where the cables would be expended is larger. Based on this low concentration, likelihood of an animal encountering one of these items is extremely low.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during training activities as described in Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 2, fiber optic cables expended during testing activities would increase approximately 155 percent and guidance wires expended would increase to about 6 times the No Action Alternative. As with the No Action Alternative, they could be expended anywhere within the Study Area but would be expended with greatest concentration in the Northeast U.S. Continental Shelf Large Marine Ecosystem (specifically, Naval Undersea Warfare Center Division, Newport Testing Range). This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended randomly in this area. While there is an increase in cables and wires that would be expended under Alternative 2, the resulting concentration is lower than for the No Action Alternative because the area where the cables would be expended is larger. Based on this low concentration, likelihood of an animal encountering one of these items is extremely low.

Pursuant to the MMPA, the use of fiber optic cables and guidance wires during testing activities as described in Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.4.5 Impacts from Parachutes

Refer to Section 3.0.5.3.4.2 (Parachutes) and Table 3.0-72 for the number of training and testing events that involve the use of parachutes and the geographic areas where they would be expended. Training

and testing activities that introduce parachutes into the water column can occur anywhere in the Study Area. However, there would be higher use within the range complexes and testing ranges. This section does not analyze impacts to critical habitat, because Section 3.4.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of parachutes on designated critical habitat.

Entanglement of a marine mammal in a parachute assembly at the surface or within the water column would be unlikely, since the parachute would have to land directly on an animal, or an animal would have to swim into it before it sinks. Once on the seafloor, if bottom currents are present, the canopy may temporarily billow and pose an entanglement threat to marine animals with bottom-feeding habits; however, the probability of a marine mammal encountering a parachute assembly on the seafloor and accidental entanglement in the canopy or suspension lines is unlikely.

The chance that an individual animal would encounter expended parachutes is low based on the distribution of the parachutes expended, the fact that parachute assemblies are designed to sink upon release, and the relatively few animals that feed on the bottom. If a marine mammal did become entangled in a parachute, it could easily become free of the parachute because the parachutes are made of very lightweight fabric. Based on the information summarized within the introduction to Section 3.4.3.4 (Entanglement Stressors), mysticetes found within the Study Area are not expected to encounter parachutes on the seafloor because, with a few exceptions, they do not feed there. Species occurring outside of the range complexes, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not be expected to encounter parachutes, eliminating the possibility of entanglement.

The possibility of odontocetes, pinnipeds, and manatees becoming entangled exists when they are feeding on the bottom in areas where parachutes have been expended. This is unlikely because parachutes are used in events that generally occur in deeper waters, where these species are not likely to be feeding on the bottom (except sperm whales), though even if momentarily entangled, a marine mammal would likely be able to free itself of the light-weight fabric of a parachute. There has never been any recorded or reported instance of a marine mammal becoming entangled in a parachute.

3.4.3.4.5.1 No Action Alternative

Training Activities

Parachutes could be expended anywhere in the Study Area. However, there would be higher use within the range complexes. Section 3.0.5.3.4.2 (Parachutes) shows the approximate number of events and locations where parachutes would be expended under each alternative.

To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For training events, this is in the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 2 nm^2 if they were evenly expended throughout the area.

Pursuant to the MMPA, the use of parachutes during training activities as described under the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Parachutes could be expended anywhere in the Study Area. However, there would be higher use within the testing ranges and range complexes. Section 3.0.5.3.4.2 (Parachutes) shows the approximate number of events and locations where parachutes would be expended under each alternative.

To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, this is in Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 22 nm^2 if the parachutes were expended evenly throughout the area.

Pursuant to the MMPA, the use of parachutes during testing activities as described under the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.4.5.2 Alternative 1

Training Activities

Under Alternative 1 for training activities, parachutes use would increase by 5 percent above the No Action Alternative. Section 3.0.5.3.4.2 (Parachutes) shows the approximate number of events and locations where parachutes would be expended under each alternative. As with the No Action Alternative, parachutes could be expended anywhere in the Study Area. However, there would be higher use within the range complexes. Less than 2 percent of the parachutes would be expended outside of range complexes.

To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For training events under Alternative 1, parachutes would be expended with greatest concentration in the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under Alternative 1, there would be a concentration of approximately one parachute per 2 nm^2 if the parachutes were expended evenly throughout the area.

Pursuant to the MMPA, the use of parachutes during training activities as described under Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 1 for testing activities, parachutes use would increase from the No Action Alternative by approximately 3.2 times. These could be expended anywhere in the expanded Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives), though they will continue to be expended in greater concentrations within the testing ranges and range complexes. Refer to Section 3.0.5.3.4.2 (Parachutes) for the approximate number of events and locations where parachutes would be expended under each alternative. Less than 2 percent of the parachutes would be expended outside of range complexes.

To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, this is in Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under Alternative 1, there would be a concentration of approximately one parachute per 5 nm^2 if the parachutes were expended evenly throughout the area.

Pursuant to the MMPA, the use of parachutes during testing activities as described under Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.4.5.3 Alternative 2 (Preferred Alternative)

Training Activities

Under Alternative 2 for training activities, parachutes use would increase by 5 percent above the No Action Alternative. However, less than 2 percent of the parachutes would be expended outside of range complexes. These could be expended anywhere in the expanded Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives), though they will continue to be expended in greater concentrations within the range complexes. Section 3.0.5.3.4.2 (Parachutes) shows the approximate number of events and locations where parachutes would be expended under each alternative. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For training events under Alternative 2, parachutes would be expended with greatest concentration in the Southeast U.S. Continental Shelf Large Marine Ecosystem

and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under Alternative 2, there would be a concentration of approximately one parachute per 2 nm^2 if the parachutes were expended randomly throughout the area.

Pursuant to the MMPA, the use of parachutes during training activities as described under Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 2, parachutes use would increase from the No Action Alternative by 4 times. These could be expended anywhere in the expanded Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives), though they will continue to be expended in greater concentrations within the testing ranges and range complexes. Section 3.0.5.3.4.2 (Parachutes) shows the approximate number of events and locations where parachutes would be expended under each alternative. Less than 3 percent of the parachutes would be expended outside of range complexes.

To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, this is in the Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under Alternative 2, there would be a concentration of approximately one parachute per 4 nm^2 if the parachutes were expended evenly throughout the area.

Pursuant to the MMPA, the use of parachutes during testing activities as described under Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, the use of parachutes during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5 Ingestion Stressors

This section analyzes the potential impacts of the various types of ingestion stressors used during training and testing activities within the Study Area. This analysis includes the potential impacts from two categories of military expended materials: (1) munitions (both non-explosive practice munitions and fragments from high-explosive munitions), and (2) materials other than munitions, including fragments from targets, chaff, flares, and parachutes. Section 3.0.5.3.5 (Ingestion Stressors) discusses the types of activities that use these materials, where they are used, and how many events will occur under each alternative. This section does not analyze impacts on critical habitat because Section 3.4.3.3.3 (Impacts

from Military Expended Materials) already analyzed the potential impacts of expended materials on designated critical habitat.

Since potential impacts depend on where these items are expended and how a marine mammal feeds, the following subsections discuss important information for specific groups or species.

3.4.3.5.1 Mysticetes

Blue, fin, North Atlantic right, and sei whales feed at the surface or in the water column. While humpback whales feed predominantly by lunging through the water after krill and fish, there are instances of humpback whales disturbing the bottom in an attempt to flush prey, the northern sand lance (*Ammodytes dubius*) (Hain et al. 1995). Although observations of humpback whales feeding in mid-Atlantic waters (Smith et al. 1996; Swingle et al. 1993) have led to the supposition that a supplemental winter feeding ground may exist in the U.S. mid-Atlantic (Barco et al. 2002), humpback whale feeding primarily takes place farther north than the VACAPES Range Complex (Cetacean and Turtle Assessment Program 1982; Kenney and Winn 1986; Weinrich et al. 1997; Whitehead 1982). In a comprehensive review of documented ingestion of debris by marine mammals, there are two species of mysticetes (bowhead and minke whale) with ingestion records (Laist 1997). The items ingested included plastic sheeting and a polythene bag (Laist 1997). Based on the available evidence, it is possible that mysticetes may ingest items found on the surface or within the water column. However, with the exception of the humpback whale, it is not likely that mysticetes would encounter items found on the seafloor.

3.4.3.5.2 Odontocetes

Beaked whales use suction feeding to ingest benthic prey and may incidentally ingest other items (MacLeod et al. 2003). Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to health or vitality (Laist 1997; Walker and Coe 1990). Recently weaned juveniles who are investigating multiple types of prey items, may be particularly vulnerable to ingesting non-food items, as found in a study of juvenile harbor porpoise (Baird and Hooker 2000). A male pygmy sperm whale reportedly died from blockage of two stomach compartments by hard plastic, and a Blainville's beaked whale (*Mesoplodon densirostris*) washed ashore in Brazil with a ball of plastic thread in its stomach (Derraik 2002). In a comprehensive review of documented ingestion of debris by marine mammals, odontocetes had the most ingestion records, with 21 species represented (Laist 1997).

3.4.3.5.3 Pinnipeds

Most of the seal species within the Study Area feed both within the water column and on the seafloor, and walrus feed primarily on benthic invertebrates (Bluhm and Grandinger 2008). In a comprehensive review of documented ingestion of debris by marine mammals, pinnipeds only had two species (northern elephant seal and Steller sea lion) with ingestion records, both were documented as ingesting Styrofoam cups (Laist 1997).

3.4.3.5.4 Polar Bear

Polar bears feed primarily on other marine mammals (especially ringed seals, bearded seals, and harp seals) while on land and ice or out at sea (Bluhm and Grandinger 2008).

3.4.3.5.5 West Indian Manatee

Manatees feed on sea grass beds in relatively shallow coastal or estuarine waters. In a comprehensive review of documented ingestion of debris by marine mammals, the West Indian manatee had ingestion

records that included monofilament line, plastic bags, string, twine, rope, fish hooks, wire, paper, cellophane, and rubber bands (Laist 1997).

3.4.3.5.6 Impacts from Munitions

Many different types of explosive and non-explosive practice munitions are expended at sea during training and testing activities. This section analyzes the potential for marine mammals to ingest non-explosive practice munitions and fragments from high-explosive munitions. This section does not analyze impacts to critical habitat, because Section 3.4.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of munitions on designated critical habitat.

Types of non-explosive practice munitions generally include projectiles, missiles, and bombs. Of these, only small- or medium-caliber projectiles would be small enough for a marine mammal to ingest. Small- and medium-caliber projectiles include all sizes up to and including 2.25 in. (57 mm) in diameter. These solid metal materials would quickly move through the water column and settle to the sea floor. Ingestion of non-explosive practice munitions is not expected to occur in the water column because the munitions sink quickly. Instead, they are most likely to be encountered by species that forage on the bottom.

Types of high-explosive munitions that can result in fragments include demolition charges, grenades, projectiles, missiles, and bombs. Fragments would result from fractures in the munitions casing and would vary in size depending on the size of the net explosive weight and munitions type; however, typical sizes of fragments are unknown. These solid metal materials would quickly move through the water column and settle to the seafloor; therefore, ingestion is not expected by most species. Fragments are primarily encountered by species that forage on the bottom.

Based on the information summarized above in 3.4.3.5.1 (Mysticetes), mysticetes found within the Study Area, with the exception of bottom-feeding humpback whales, are not expected to encounter non-explosive practice munitions on the seafloor. Ingestion of non-explosive practice munitions by odontocetes is likely to be incidental, with items being potentially consumed along with bottom-dwelling prey. Although incidental ingestion of non-explosive practice munitions by pinnipeds is not likely based on records of ingestion from stranded animals, it is possible because they feed on the seafloor. Polar bears feed primarily on other marine mammals and are not likely to encounter non-explosive practice munitions on the sea floor. Although manatees feed on the bottom, their distribution and foraging is limited to shallow coastal and estuarine waters, thus preventing them from encountering non-explosive practice munitions.

3.4.3.5.6.1 No Action Alternative

Training Activities

Non-explosive practice munitions

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under the No Action Alternative, training activities involving small- and medium-caliber non-explosive practice munitions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the VACAPES, Navy Cherry Point, JAX, GOMEX, and Key West Range Complexes. Small- and medium-caliber non-explosive practice rounds would be expended with greatest concentration within the VACAPES Range Complex. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear, would not encounter small- and medium-caliber non-explosive practice munitions.

Marine mammal species occurring within the range complexes listed above, which are within the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as portions of the Gulf Stream Open Ocean Area, need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these training activities take place are not expected to encounter small- or medium-caliber projectiles because they feed near the surface or within the water column. Although manatees may occur in these areas, these training activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species that occur in these areas, some of which forage on the bottom, could potentially ingest small- or medium-caliber projectiles if encountered.

The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and an animal's feeding habitat. In addition, an animal would not likely ingest every projectile it encountered. Furthermore, an animal may attempt to ingest a projectile and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of non-explosive practice munitions ingestion would be limited to the unlikely event where a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Fragments from high-explosive munitions

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under the No Action Alternative, training activities involving high-explosive munitions including bombs, medium- and large-caliber projectiles, missiles, and rockets would be used in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. High-explosive munition use would be most concentrated in the VACAPES and JAX Range Complexes. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not encounter fragments from high-explosive munitions.

Marine mammal species occurring within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these training activities take place are not expected to encounter high-explosive munitions fragments because they feed near the surface or within the water column. Although manatees may occur in these areas, these training activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest high-explosive munitions fragments if encountered.

The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and an animal's feeding habitat. In addition, an animal would not likely ingest every fragment it encountered. Furthermore, an animal may attempt to ingest a fragment and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of high-explosive munitions fragment ingestion would be limited to the unlikely event where a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Pursuant to the MMPA, ingestion of munitions used during training activities as described under the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of munitions used during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Non-explosive practice munitions

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under the No Action Alternative, testing activities involving small- and medium-caliber non-explosive practice munitions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, within Naval Surface Warfare Center, Panama City Division Testing Range and the VACAPES, JAX, and Key West Range Complexes, the Gulf of Mexico, and in other areas outside of the range complexes. Small- and medium-caliber non-explosive practice rounds would be expended with greatest concentration within the Naval Surface Warfare Center, Panama City Division Testing Range. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not encounter small- and medium-caliber non-explosive practice munitions.

Marine mammal species that occur within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these testing activities take place are not expected to encounter small- or medium-caliber projectiles because they feed near the surface or within the water column. Although manatees may occur in these areas, these testing activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest small- or medium-caliber projectiles if encountered.

The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and an animal's feeding habits. In addition, an animal would not likely ingest every projectile it encountered. Furthermore, an animal may attempt to ingest a projectile and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of non-explosive practice munitions ingestion would be limited to the unlikely event where a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Fragments from high-explosive munitions

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under the No Action Alternative, testing activities involving high-explosive munitions, including bombs, medium- and large-caliber projectiles, missiles, and

rockets, would be used in the Northeast U.S. Continental Shelf and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area and Naval Surface Warfare Center, Panama City Division Testing Range. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, white-beaked dolphin, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not encounter fragments from high-explosive munitions.

Marine mammal species occurring within the areas listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these testing activities take place are not expected to encounter high-explosive munitions fragments because they feed near the surface or within the water column. Although manatees may occur in these areas, these testing activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest high-explosive munitions fragments if encountered.

The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and an animal's feeding habits. In addition, an animal would not likely ingest every fragment it encountered. Furthermore, an animal may attempt to ingest a fragment and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of high-explosive munitions fragment ingestion would be limited to the unlikely event where a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Pursuant to the MMPA, ingestion of munitions used during testing activities as described under the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of munitions used during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5.6.2 Alternative 1

Training Activities

Non-explosive practice munitions

Under Alternative 1, small- and medium-caliber non-explosive practice munitions use would increase by approximately 220 percent as compared to the No Action Alternative, and a small portion of these activities may also occur outside the range complexes within the remainder of the Study Area.

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under Alternative 1, training activities involving small- and medium-caliber non-explosive practice munitions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf

Stream Open Ocean Area within the Northeast, VACAPES, Navy Cherry Point, JAX, GOMEX, and Key West Range Complexes, as well as other areas outside of the range complexes. Small- and medium-caliber non-explosive practice rounds would be expended with greatest concentration within the VACAPES Range Complex. Marine mammal species that occur within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these training activities take place are not expected to encounter small- or medium-caliber projectiles because they feed near the surface or within the water column. Although manatees may occur in these areas, these training activities would not take place in shallow coastal and estuarine waters where manatees would be feeding. Odontocete and pinniped species, which occur in these areas and forage on the bottom, could potentially ingest small- or medium-caliber projectiles if encountered.

The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and an animal's feeding habits. In addition, an animal would not likely ingest every projectile it encountered. Furthermore, an animal may attempt to ingest a projectile and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of non-explosive practice munitions ingestion would be limited to the unlikely event in which a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Fragments from high-explosive munitions

Under Alternative 1, training activities involving high-explosive munitions, including bombs, medium- and large-caliber projectiles, missiles, and rockets, would increase substantially compared to the No Action Alternative. The majority of this increase is due to the inclusion of high-explosive, medium-caliber projectiles that were accounted for as non-explosive practice munitions under the No Action Alternative. In addition, a small portion of these activities may occur outside the range complexes within the remainder of the Study Area.

Section 3.0.5.3.5 (Ingestion Stressors) provides the number and location of activities that expend fragments from high-explosive munitions. Activities would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Use of high-explosive munitions would be most concentrated in the VACAPES and JAX Range Complexes.

Marine mammal species occurring within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these training activities take place are not expected to encounter high-explosive munitions fragments because they feed near the surface or within the water column. Although manatees may occur in these areas, these training activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest high-explosive munitions fragments if encountered.

The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and an animal's feeding habits. In addition, an animal would not likely ingest every fragment it encountered. Furthermore, an animal may attempt to ingest a fragment and then reject it when it realizes it is not a food item. Even ingestion of

certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of high-explosive munitions fragment ingestion would be limited to the unlikely event in which a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Pursuant to the MMPA, ingestion of munitions used during training activities as described under Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of munitions used during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Non-explosive practice munitions

Under Alternative 1, small- and medium-caliber non-explosive practice munitions use would increase by approximately 4.4 times as compared to the No Action Alternative, and a small portion of these activities may occur outside of the range complexes within the remainder of the Study Area.

As discussed in Section 3.0.5.3.5 (Ingestion Stressors), under Alternative 1, testing activities involving small- and medium-caliber non-explosive practice munitions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, within Naval Surface Warfare Center, Panama City Division Testing Range and the VACAPES, JAX, and Key West Range Complexes, the Gulf of Mexico, and in other areas outside of the range complexes. Small- and medium-caliber non-explosive practice rounds would be expended with greatest concentration within the Naval Surface Warfare Center, Panama City Division Testing Range.

Marine mammal species that occur within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these testing activities take place are not expected to encounter small- or medium-caliber projectiles because they feed near the surface or within the water column. Although manatees may occur in these areas, these testing activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest small- or medium-caliber projectiles if encountered.

The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and an animal's feeding habitat. In addition, an animal would not likely ingest every projectile it encountered. Furthermore, an animal may attempt to ingest a projectile and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of non-explosive practice munitions ingestion would be limited to the unlikely event in which a marine mammal might suffer a

negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Fragments from high-explosive munitions

Under Alternative 1, testing activities involving high-explosive munitions, including bombs, medium- and large-caliber projectiles, missiles, and rockets, would increase substantially compared to the No-Action-Alternative. The majority of this increase is due to the inclusion of high-explosive, medium-caliber projectiles that were accounted for as non-explosive practice munitions under the No Action Alternative. In addition a small portion of these activities may occur outside the range complexes within the remainder of the Study Area.

Section 3.0.5.3.5 (Ingestion Stressors) provides the number and location of activities that expend fragments from high-explosive munitions. Activities would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Naval Surface Warfare Center, Panama City Division Testing Range, Northeast, VACAPES, JAX, and Key West Range Complexes, Gulf of Mexico, and other locations outside of the range complexes.

Marine mammal species occurring within the range complexes listed above need to be evaluated based on their feeding habits and potential to encounter projectiles. Mysticete species that occur where these training activities take place are not expected to encounter high-explosive munitions fragments because they feed near the surface or within the water column. Although manatees may occur in these areas, these training activities would not take place in shallow coastal and estuarine waters where manatees feed. Odontocete and pinniped species, which occur in these areas, some of which forage on the bottom, could potentially ingest high-explosive munitions fragments if encountered.

The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and an animal's feeding habits. In addition, an animal would not likely ingest every fragment it encountered. Furthermore, an animal may attempt to ingest a fragment and then reject it when it realizes it is not a food item. Even ingestion of certain items (hooks), if they do not become embedded in tissue, do not end up resulting in injury or mortality to the individual (Wells et al. 2008a). Therefore, potential impacts of high-explosive munitions fragment ingestion would be limited to the unlikely event in which a marine mammal might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system.

Pursuant to the MMPA, ingestion of munitions used during testing activities as described under Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of munitions used during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5.6.3 Alternative 2 (Preferred Alternative)

Training Activities

Training activities under Alternative 2 are identical to those described in Section 3.4.3.5.6.2 (Alternative 1), Training Activities.

Pursuant to the MMPA, ingestion of munitions used during training activities as described under Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of munitions used during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Testing activities under Alternative 2 are similar those described in Section 3.4.3.5.6.2 (Alternative 1), Testing Activities, with only a 10 percent difference in the number of small- and medium-caliber non-explosive practice munitions and high-explosive munitions being used.

Pursuant to the MMPA, ingestion of munitions used during testing activities as described under Alternative 2 is *not expected to result in mortality or Level A or Level B harassment of marine mammals.*

Pursuant to the ESA, ingestion of munitions used during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5.7 Impacts from Military Expended Materials Other than Munitions

Several different types of materials other than munitions are expended at sea during training and testing activities. The following military expended materials other than munitions have the potential to be ingested by marine mammals:

- Target-related materials
- Chaff (including fibers, end caps, and pistons)
- Flares (including end caps and pistons)
- Parachutes (cloth, nylon, and metal weights)

This section does not analyze impacts to critical habitat, because Section 3.4.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of these military expended materials on designated critical habitat.

Target-Related Materials

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. If they are severely damaged or displaced, targets may sink before they can be retrieved. Expendable targets include air-launched decoys, marine markers (smoke floats), cardboard boxes, and 10-ft. diameter red balloons tethered by a sea anchor. Most target fragments would sink quickly in the sea. Floating material, such as Styrofoam, may be lost from target boats and remain at the surface for some time.

Chaff

Chaff is an electronic countermeasure designed to reflect radar waves and obscure aircraft, vessels, and other equipment from radar tracking sources. Chaff is composed of an aluminum alloy coating on glass fibers of silicon dioxide (U.S. Air Force 1997). It is released or dispensed in cartridges or projectiles that contain millions of chaff fibers. When deployed, a diffuse cloud of fibers undetectable to the human eye is formed. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (Arfsten et al. 2002; U.S. Air Force 1997). Doppler radar has tracked chaff plumes containing approximately 900 grams of chaff drifting 200 mi. (322 km) from the point of release, with the plume covering greater than 400 cubic miles ($mi.^3$) (1,667 cubic kilometers [km^3]) (Arfsten et al. 2002).

The chaff concentrations that marine mammals could be exposed to following release of multiple cartridges (e.g., following a single day of training) is difficult to accurately estimate because it depends on several unknown factors. First, specific release points are not recorded and tend to be random, and chaff dispersion in air depends on prevailing atmospheric conditions. After falling from the air, chaff fibers would be expected to float on the sea surface for some period, depending on wave and wind action. The fibers would be dispersed further by sea currents as they float and slowly sink toward the bottom. Chaff concentrations in benthic habitats following release of a single cartridge would be lower than the values noted in this section, based on dispersion by currents and the enormous dilution capacity of the receiving waters.

Several literature reviews and controlled experiments have indicated that chaff poses little risk, except at concentrations substantially higher than those that could reasonably occur from military training (Arfsten et al. 2002; Hullar et al. 1999; U.S. Air Force 1997). Nonetheless, some marine mammal species within the Study Area could be exposed to chaff through direct body contact and ingestion. Chemical alteration of water and sediment from decomposing chaff fibers is not expected to result in exposure. Based on the dispersion characteristics of chaff, it is likely that marine mammals would occasionally come in direct contact with chaff fibers while at the water's surface and while submerged, but such contact would be inconsequential. Chaff is similar to fine human hair (U.S. Air Force 1997). Because of the flexibility and softness of chaff, external contact would not be expected to impact most wildlife (U.S. Air Force 1997) and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (U.S. Air Force 1997). Arfsten et al (2002), Hullar et al. (1999), and U.S. Air Force (1997) reviewed the potential effects of chaff inhalation on humans, livestock, and animals and concluded that the fibers are too large to be inhaled into the lung. The fibers are predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled; however, these reviews did not specifically consider marine mammals.

Based on the small size of chaff fibers, it appears unlikely that marine mammals would confuse the fibers with prey or purposefully feed on chaff fibers. However, marine mammals could occasionally

ingest low concentrations of chaff incidentally from the surface, water column, or seafloor. While no studies were conducted to evaluate the effects of chaff ingestion on marine mammals, the effects are expected to be negligible, based on the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of chaff and aluminum. In laboratory studies conducted by the University of Delaware (Hullar et al. 1999), blue crabs and killifish were fed a food-chaff mixture daily for several weeks, and no significant mortality was observed at the highest exposure treatment. Similar results were found when chaff was added directly to exposure chambers containing filter-feeding menhaden. Histological examination indicated no damage from chaff exposures. A study on calves that were fed chaff found no evidence of digestive disturbance or other clinical symptoms (U.S. Air Force 1997).

Chaff cartridge plastic end caps and pistons would also be released into the marine environment, where they would persist for long periods and could be ingested by marine mammals. Chaff end caps and pistons sink in saltwater (Spargo 2007), which reduces the likelihood of ingestion by marine mammals at the surface or in the water column.

Flares

Flares are designed to burn completely. The only material that would enter the water would be a small, round, plastic end cap and piston (approximately 1.4 in. [3.6 cm] in diameter).

An extensive literature review and controlled experiments conducted by the U.S. Air Force demonstrated that self-protection flare use poses little risk to the environment or animals (U.S. Air Force 1997). Nonetheless, marine mammals within the vicinity of flares could be exposed to light generated by the flares. Pistons and end caps from flares would have the same impact on marine mammals as discussed under chaff cartridges. It is unlikely that marine mammals would be exposed to any chemicals that produce either flames or smoke since these components are consumed in their entirety during the burning process. Animals are unlikely to approach or get close enough to the flame to be exposed to any chemical components.

Parachutes

Aircraft-launched sonobuoys, lightweight torpedoes (such as the MK 46 and MK 54), and targets use nylon parachutes ranging in size from 18 to 48 in. (46 to 122 cm) in diameter. Parachutes are made up of cloth and nylon, with weights attached to the lines for rapid sinking upon impact with the water. At water impact, the parachute assembly is expended, and it sinks away from the unit. The parachute assembly may remain at the surface for a short time before it and its housing sink to the seafloor, where it becomes flattened (Environmental Sciences Group 2005). Some parachutes are weighted with metal clips to hasten their descent to the seafloor.

Ingestion of a parachute by a marine mammal at the surface or within the water column would be unlikely, since the parachute would not be available for very long before it sinks. Once on the seafloor, if bottom currents are present, the canopy may temporarily billow and be available for potential ingestion by marine animals with bottom-feeding habits.

Based on the information summarized above within the introduction to Section 3.4.3.5.1 (Mysticetes), mysticetes found within the Study Area, with the exception of bottom-feeding humpback whales are not expected to encounter parachutes on the seafloor because they do not feed there. Polar bears feed primarily on other marine mammals and are not likely to encounter parachutes on the sea floor. Ingestion of parachutes by odontocetes and pinnipeds is unlikely but is possible if individuals are feeding

on the bottom. Although manatees may occur in these areas, these activities would not take place in shallow coastal and estuarine waters where manatees feed.

3.4.3.5.7.1 No Action Alternative

Training Activities

Section 3.0.5.3.5 (Ingestion Stressors), lists the number and locations of activities that expend parachutes, target materials, chaff, and flares. Under the No Action Alternative, training activities involving military expended materials other than munitions take place in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Target-related material, chaff, flares, parachutes, and their subcomponents have the potential to be ingested by a marine mammal, although most of these materials would quickly drop through the water column and settle on the seafloor, some Styrofoam, plastic endcaps, and other small items may float for some time before sinking. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not encounter these items.

While the smaller items discussed here may pose a hazard to marine mammals, as discussed for non-explosive practice munitions ingestion, the impacts of ingesting these forms of expended materials on marine mammals would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- Limited period of time these military expended materials would remain in the water column
- Unlikely chance that a marine mammal might encounter and swallow these items on the seafloor
- The ability of many marine mammals to reject and not swallow nonfood items incidentally ingested

The impacts of ingesting military expended materials other than munitions would be limited to cases where an individual marine mammal might eat an indigestible item too large to be passed through the gut. The marine mammals would not be preferentially attracted to these military expended materials, with the possible exception of parachutes that may appear similar to the prey of some species such as sperm whales and beaked whales. For the most part, these military expended materials would most likely only be incidentally ingested by individuals feeding on the bottom in the precise location where these items were deposited. Military expended materials other than munitions that would remain floating on the surface are too small to pose a risk of intestinal blockage to any marine mammal that happened to encounter it.

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during training activities as described under the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of military expended materials other than munitions used during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Section 3.0.5.3.5 (Ingestion Stressors) provides the number and locations of activities that expend parachutes, target materials, chaff, and flares. Under the No Action Alternative, testing activities involving military expended materials other than munitions take place in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Northeast, Navy Cherry Point, VACAPES, and JAX Range Complexes, and the Naval Surface Warfare Center, Panama City Division Testing Range. Target-related material, chaff, flares, parachutes, and their subcomponents have the potential to be ingested by a marine mammal, although most of these materials would quickly drop through the water column and settle on the seafloor, some Styrofoam, plastic endcaps, and other small items may float for some time before sinking. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear, would not encounter these items.

While the smaller items discussed here may pose a hazard to marine mammals, as discussed for non-explosive practice munitions ingestion, the impacts of ingesting these forms of expended materials on marine mammals would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- Limited period of time these military expended materials would remain in the water column
- Unlikely chance that a marine mammal might encounter and swallow these items on the seafloor
- The ability of many marine mammals to reject and not swallow nonfood items incidentally ingested

The impacts of ingesting military expended materials other than munitions would be limited to cases where an individual marine mammal might eat an indigestible item too large to be passed through the gut. The marine mammals would not be preferentially attracted to these military expended materials, with the possible exception of parachutes that may appear similar to the prey of some species such as sperm whales and beaked whales. For the most part, these military expended materials would most likely only be incidentally ingested by individuals feeding on the bottom in the precise location where these items were deposited. Military expended materials other than munitions that would remain floating on the surface are too small to pose a risk of intestinal blockage to any marine mammal that happened to encounter it.

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during testing activities as described in the No Action Alternative is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of military expended materials other than munitions used during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5.7.2 Alternative 1

Training Activities

Under Alternative 1, training activities involving military expended materials other than munitions will increase or decrease as follows – 10 percent increase in parachutes, 35 percent decrease in chaff, 25 percent increase in flares, and 77 percent increase in airborne, surface, and sub-surface targets. Activities will take place in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Target-related material, chaff, flares, parachutes, and their subcomponents have the potential to be ingested by a marine mammal, although most of these materials would quickly drop through the water column and settle on the seafloor, some Styrofoam, plastic endcaps, and other small items may float for some time before sinking. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear, would not encounter these items.

While the smaller items discussed here may pose a hazard to marine mammals, as discussed for non-explosive practice munitions ingestion, the impacts of ingesting these forms of expended materials on marine mammals would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- Limited period of time these military expended materials would remain in the water column
- Unlikely chance that a marine mammal might encounter and swallow these items on the seafloor
- The ability of many marine mammals to reject and not swallow nonfood items incidentally ingested

The impacts of ingesting military expended materials other than munitions would be limited to cases where an individual marine mammal might eat an indigestible item too large to be passed through the gut. The marine mammals would not be preferentially attracted to these military expended materials, with the possible exception of parachutes that may appear similar to the prey of some species such as sperm whales and beaked whales. For the most part, these military expended materials would most likely only be incidentally ingested by individuals feeding on the bottom in the precise location where these items were deposited. Nonmunition military expended materials that would remain floating on the surface are too small to pose a risk of intestinal blockage to any marine mammal that happened to encounter it.

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during training activities as described under Alternative 1 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of military expended materials other than munitions used during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 1, testing activities involving military expended materials other than munitions will increase as follows – a four-fold increase in parachutes, a two-fold increase in chaff, a 110 percent increase in flares, and a two-fold increase in airborne, surface, and sub-surface targets. Activities will take place in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area within the Northeast, VACAPES, Navy Cherry Point, Key West, and JAX Range Complexes, Gulf of Mexico, and Naval Surface Warfare Center, Panama City Division Testing Range. Target-related material, chaff, flares, parachutes, and their subcomponents have the potential to be ingested by a marine mammal, although most of these materials would quickly drop through the water column and settle on the seafloor, some Styrofoam, plastic endcaps, and other small items may float for some time before sinking. Species not occurring in these areas, including the bowhead whale, narwhal, beluga whale, long-beaked common dolphin, ringed seal, bearded seal, harp seal, walrus, and polar bear would not encounter these items.

While the smaller items discussed here may pose a hazard to marine mammals, as discussed for non-explosive practice munitions ingestion, the impacts of ingesting these forms of expended materials on marine mammals would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- Limited period of time these military expended materials would remain in the water column
- Unlikely chance that a marine mammal might encounter and swallow these items on the seafloor
- The ability of many marine mammals to reject and not swallow nonfood items incidentally ingested

The impacts of ingesting military expended materials other than munitions would be limited to cases where an individual marine mammal might eat an indigestible item too large to be passed through the gut. The marine mammals would not be preferentially attracted to these military expended materials, with the possible exception of parachutes that may appear similar to the prey of some species such as sperm whales and beaked whales. For the most part, these military expended materials would most likely only be incidentally ingested by individuals feeding on the bottom in the precise location where these items were deposited. Military expended materials other than munitions that would remain floating on the surface are too small to pose a risk of intestinal blockage to any marine mammal that happened to encounter it.

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during testing activities as described under Alternative 1 is *not expected to result in mortality or Level A or Level B harassment of marine mammals.*

Pursuant to the ESA, ingestion of military expended materials other than munitions used during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.5.7.3 Alternative 2 (Preferred Alternative)

Training Activities

Training activities under Alternative 2 are identical to those training activities described in Section 3.4.3.5.7.2 (Alternative 1).

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during training activities as described under Alternative 2 is *not expected to result in mortality or Level A or Level B harassment of marine mammals.*

Pursuant to the ESA, ingestion of military expended materials other than munitions used during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

Testing Activities

Under Alternative 2, testing activities involving military expended materials other than munitions will increase as follows – a five-fold increase in parachutes, a two-fold increase in chaff, a 130 percent increase in flares, and a two and a half-fold increase in airborne, surface, and sub-surface targets.

Pursuant to the MMPA, ingestion of military expended materials other than munitions used during testing activities as described under Alternative 2 is not expected to result in mortality or Level A or Level B harassment of marine mammals.

Pursuant to the ESA, ingestion of military expended materials other than munitions used during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, West Indian manatee, ringed seal, and polar bear.*

3.4.3.6 Secondary Stressors

This section analyzes potential impacts on marine mammals exposed to stressors indirectly through impacts on their habitat (i.e., sediment or water quality) or prey. For the purposes of this analysis, indirect impacts on marine mammals via sediment or water that do not require trophic transfer (e.g., bioaccumulation) in order to be observed are considered here. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences but instead describe how the impact may occur in an organism. Bioaccumulation is considered in the *Ecosystem Technical Report for the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement* (U.S. Department of the Navy 2012b).

Stressors from Navy training and testing activities could pose indirect impacts on marine mammals via habitat or prey. These include: (1) explosives and byproducts, (2) metals, (3) chemicals, and (4) transmission of disease and parasites. Analyses of the potential impacts on sediment and water quality are discussed in Section 3.1 (Sediments and Water Quality).

3.4.3.6.1 Explosives

In addition to directly impacting marine mammals, underwater explosions could impact other species in the food web, including prey species that marine mammals feed upon. The impacts of explosions would differ depending on the type of prey species in the area of the blast.

In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to explosions that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Hanlon and Messenger 1996). The abundances of prey species near the detonation point could be diminished for a short period before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms and in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting effect on prey availability or the pelagic food web would be expected.

3.4.3.6.2 Explosion Byproducts and Unexploded Ordnance

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of royal demolition explosive, 98 percent of the products are common seawater constituents, and the remainder is rapidly diluted below threshold effect level (Section 3.1, Sediments and Water Quality, Table 3.1-13 and Table 3.1-14). Explosion byproducts associated with high-order detonations present no indirect stressors to marine mammals through sediment or water. However, low-order detonations and unexploded ordnance present elevated likelihood of impacts on marine mammals.

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high-explosives (Section 3.1, Sediments and Water Quality, Table 3.1-10). Marine mammals may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

Indirect impacts of explosives and unexploded ordnance to marine mammals via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds through several pathways, as discussed in Section 3.1.3.1 (Explosives and Explosion Byproducts). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6 to 12 in. (0.15 to 0.3 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (1 to 2 m) from the degrading ordnance (Section 3.1.3.1, Explosives and Explosion Byproducts). Taken together, it is possible that marine mammals could be exposed to degrading explosives, but it would be within a very small radius of the explosive (1 to 6 ft. [0.3 to 2 m]).

3.4.3.6.3 Metals

Metals are introduced into seawater and sediments as a result of training and testing activities involving ship hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2, Metals). Some metals bioaccumulate and physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals (Chapter 4.0, Cumulative Impacts). Indirect impacts of metals to marine mammals via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Marine mammals may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that marine mammals would be indirectly impacted by metals via the water, and few marine mammal species feed primarily on the seafloor, where they would come into contact with marine sediments.

3.4.3.6.4 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, principally, flares and propellants for rockets, missiles, and torpedoes. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment. The greatest risk to marine mammals from flares, missile, and rocket propellants that operationally fail is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Marine mammals may be exposed by contact with contaminated water. However, rapid dilution would occur, and toxic concentrations are unlikely to be encountered in seawater.

3.4.3.6.5 Transmission of Marine Mammal Diseases and Parasites

The U.S. Navy deploys trained Atlantic bottlenose dolphins (*Tursiops truncatus*) and California sea lions (*Zalophus californianus*) for integrated training involving two primary mission areas: to find objects such as inert mine shapes, and to detect swimmers or other intruders around Navy facilities such as piers. When deployed, the animals are part of what the Navy refers to as Marine Mammal Systems. These Marine Mammal Systems include one or more motorized small boats, several crew members, and a trained marine mammal. Based on the standard procedures with which these systems are deployed, it is not reasonably foreseeable that use of these marine mammals systems would result in the transmission of disease or parasites to cetacea or pinnipeds in the Study Area based on the following.

Each trained animal is deployed under behavioral control to find the intruding swimmer or submerged object. Upon finding the target of the search, the animal returns to the boat and alerts the animal handlers that an object or swimmer has been detected. In the case of a detected object, the human handlers give the animal a marker that the animal can bite onto and carry down to place near the detected object. In the case of a detected swimmer, animals are given a localization marker or leg cuff that they are trained to deploy via a pressure trigger. After deploying the localization marker or leg cuff, the animal swims free of the area to return to the animal support boat. For detected objects, human divers or remote vehicles are deployed to recover the item. Swimmers that have been marked with a leg cuff are reeled in by security support boat personnel via a line attached to the cuff.

Marine mammal systems deploy approximately one to two weeks before the beginning of a training exercise to allow the animals to acclimate to the local environment. Four to 12 marine mammals are involved per exercise. Systems typically participate in object detection and recovery, both participating in mine warfare events and assisting with the recovery of non-explosive mine shapes at the conclusion of an event. Marine Mammal Systems may also participate in civilian port defense activities.

During the past 40 years, the Navy Marine Mammal Program has deployed globally. To date, there have been no known instances of deployment-associated disease transfer to or from Navy marine mammals. Navy animals are maintained under the control of animal handlers and are prevented from having sustained contact with indigenous animals.

When not engaged in the training event, Navy marine mammals are either housed in temporary enclosures or aboard ships involved in training exercises. All marine mammal waste is disposed of in a manner approved for the specific holding facilities. When working, sea lions are transported in boats, and dolphins are transferred in boats or by swimming alongside the boat under the handler's control. Their open-ocean time is under stimulus control and is monitored by their trainers.

Navy marine mammals receive excellent veterinarian care (per Secretary of the Navy Instruction [SECNAVINST] 3900.41E). Appendix A, Section 8, of the Swimmer Interdiction Security System Final EIS (U.S. Department of the Navy 2009b) presents an overview of the veterinary care provided for the Navy's marine mammals. Appendix B, Section 2, of the Swimmer Interdiction Security System Final EIS presents detailed information on the health screening process for communicable diseases. The following is a brief summary of the care received by all of the Navy's marine mammals:

1. Qualified veterinarians conduct routine and predeployment health examinations on the Navy's marine mammals; only animals determined as healthy are allowed to deploy.
2. Restaurant-quality frozen fish are fed to prevent diseases that can be caused by ingesting fresh fish (e.g., parasitic diseases).
3. Navy animals are routinely dewormed to prevent parasitic and protozoal diseases.
4. If a valid and reliable screening test is available for a regionally relevant pathogen (e.g., polymerase chain reaction assays for morbillivirus), such tests are run on appropriate animal samples to ensure that animals are not shedding these pathogens.

The Navy Marine Mammal Program routinely does the following to further mitigate the low risk of disease transmission from captive to wild marine mammals during training events:

1. Marine mammal waste is disposed of in an approved system dependent upon the animal's specific housing enclosure and location.

2. Onsite personnel are made aware of the potential for disease transfer, and report any sightings of wild marine mammals so that all personnel are alert to the presence of the animal.
3. Marine mammal handlers visually scan for indigenous marine animals for at least five minutes before animals are deployed and maintain a vigilant watch while the animal is working in the water. If a wild marine mammal is seen approaching or within 100 m, the animal handler will hold the marine mammal in the boat or recall the animal immediately if the animal has already been sent on the mission.
4. The Navy obtains appropriate state agriculture and other necessary permits and strictly adheres to the conditions of the permit.

Due to the very small amount of time that the Navy marine mammals spend in the open ocean, the control that the trainers have over the animals, the collection and proper disposal of marine mammal waste, the exceptional screening and veterinarian care given to the Navy's animals, the visual monitoring for indigenous marine mammals, and more than 40 years with zero known incidents, there is no scientific basis to conclude that the use of Navy marine mammals during training activities will have an impact on wild marine mammals.

3.4.3.6.6 No Action Alternative, Alternative 1, and Alternative 2 – Training

Pursuant to the MMPA, secondary stressors resulting from training activities as described under the No Action Alternative, Alternative 1, and Alternative 2 are not expected to result in mortality, Level A or Level B harassment of marine mammals.

Pursuant to the ESA, secondary stressors resulting from training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, West Indian manatee, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.3.6.7 No Action Alternative, Alternative 1, and Alternative 2 – Testing

Pursuant to the MMPA, secondary stressors resulting from testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2 are not expected to result in mortality, Level A or Level B harassment of marine mammals.

Pursuant to the ESA, secondary stressors resulting from testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, West Indian manatee, and sperm whale;*
- *will have no effect on the ESA-listed bowhead whale, ringed seal, and polar bear; and*
- *will have no effect on North Atlantic right whale and West Indian manatee critical habitats.*

3.4.4 SUMMARY OF IMPACTS ON MARINE MAMMALS

3.4.4.1 Combined Impact of All Stressors

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all the stressors from the proposed action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above and summarized in Sections 3.4.4.2 (Endangered Species Act Determinations) and 3.4.4.3 (Marine Mammal Protection Act Determinations).

There are generally two ways that a marine mammal could be exposed to multiple stressors. The first would be if a marine mammal were exposed to multiple sources of stress from a single event or activity (e.g., a mine warfare event may include the use of a sound source and a vessel). The potential for a combination of these impacts from a single activity would depend on the range to effects of each of the stressors and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a marine mammal were within the potential impact range of those activities, it may be impacted by multiple stressors simultaneously. This would be even more likely to occur during large-scale exercises or events that span days or weeks (such as a sinking exercise or composite training unit exercise).

Secondly, a marine mammal could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where testing and training activities are more concentrated (e.g., near ports, piers, testing ranges, and routine event locations) and an individual marine mammal frequents the area because it is within the animal's home range, migratory corridor, calving or feeding area. Except for the few concentration areas discussed above, combinations are unlikely to occur because training and testing activities are generally separated in space and time so that it would be very unlikely that any individual marine mammal would be exposed to stressors from multiple activities. However, animals with a home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory corridor. The majority of the proposed activities are unit level. Unit level events occur over a small spatial scale (1 to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Time is a factor with respect to the probability of exposure. Because most Navy stressors persist for a time shorter than or equal to the duration of the activity, the odds of exposure to combined stressors is lower than would be the case for persistent stressors. For example, strike stressors cease with the passage of the object; ingestion stressors cease (mostly) when the object settles to the seafloor. The animal would have to be present during each of the brief windows that the stressors exist.

Multiple stressors may also have synergistic effects. For example, marine mammals that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Marine mammals that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors are difficult to predict in any meaningful way. Navy research and monitoring efforts include data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to

contribute to the overall understanding of what impacts may be occurring overall to animals in these areas.

Although potential impacts on certain marine mammal species from the Proposed Action may include injury or mortality, impacts are not expected to decrease the overall fitness of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Sections 3.4.4.2 (Endangered Species Act Determinations) through 3.4.4.3 (Marine Mammal Protection Act Determinations) for each regulation applicable to marine mammals.

3.4.4.2 Endangered Species Act Determinations

The U.S. Fish and Wildlife Service and NMFS jointly administer the ESA. The guidelines followed to make a determination of no effect; may affect not likely to adversely affect; or may affect likely to adversely affect can be found in the *ESA Consultation Handbook* (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998).

Table 3.4-37 provides the determinations made for each substressor and ESA-listed marine mammal species from the analysis presented in the sections previously. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with NMFS and U.S. Fish and Wildlife Service for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative). For all substressors, training and testing activities will have no effect on North Atlantic right whale or West Indian manatee critical habitat. The U.S. Fish and Wildlife Service consultation is complete and the Service concurred with the Navy's determinations.

3.4.4.3 Marine Mammal Protection Act Determinations

Pursuant to the MMPA, the Navy is seeking two Letters of Authorization from NMFS for certain training and testing activities (the use of sonar and other active acoustic sources, explosives, pile driving, and vessels), as described under the Preferred Alternative (Alternative 2). The use of sonar, other active sources, and explosives may result in Level A harassment, Level B harassment, or mortality of certain marine mammals; pile driving may result in Level A or Level B harassment of bottlenose dolphins. The use of vessels may result in mortality or Level A harassment of certain marine mammal species. Refer to Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) for details on the estimated impacts from acoustic sources (sonar and other active acoustic sources), Section 3.4.3.1.9 (Impacts from Explosives) for impacts from explosives, Section 3.4.3.1.10 (Impacts from Pile Driving) for impacts from pile driving, and Section 3.4.3.3.1 (Impacts from Vessels) for details on the estimated impacts from vessels.

Navy training and testing activities involving swimmer defense airguns, weapons firing, launch, and impact noise, vessel noise, aircraft noise, energy sources, in-water devices, expending military materials, and secondary stressors are not expected to result in Level A or Level B harassment of any marine mammals.

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Table 3.4-37: Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative (Alternative 2)

Stressor		North Atlantic Right Whale	Bowhead Whale	Humpback Whale	Sei Whale	Fin Whale	Blue Whale	Sperm Whale	Polar Bear	West Indian Manatee	Ringed Seal
Acoustic Stressors											
Sonar and Other Active Acoustic Sources	Training Activities	May affect likely to adversely affect	No effect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	May affect likely to adversely affect	No effect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
Explosives	Training Activities	May affect likely to adversely affect	No effect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
Pile Driving	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect	No effect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Swimmer Defense Airguns	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	May affect not likely to adversely affect	No effect
Weapons Firing, Launch, and Impact Noise	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Aircraft Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
Vessel Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Energy Stressors											
Electromagnetic	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
High Energy Lasers	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table 3.4-37: Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative (Alternative 2) (Continued)

Stressor		North Atlantic Right Whale	Bowhead Whale	Humpback Whale	Sei Whale	Fin Whale	Blue Whale	Sperm Whale	Polar Bear	West Indian Manatee	Ringed Seal
Physical Disturbance and Strike Stressors											
Vessels	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
In-Water Devices	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
Military Expended Materials	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Seafloor Devices	Training Activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Entanglement Stressors											
Fiber Optic Cables and Guidance Wires	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Parachutes	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Ingestion Stressors											
Munitions	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Military Expended Materials Other Than Munitions	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Secondary Stressors											
Secondary Stressors	Training	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect

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3.5 SEA TURTLES AND OTHER MARINE REPTILES

SEA TURTLES AND OTHER MARINE REPTILES SYNOPSIS

The Navy considered all potential stressors and the following have been analyzed for sea turtles and other marine reptiles:

- Acoustic (sonar and other active acoustic sources, explosives, pile driving, swimmer defense airguns, weapons firing, launch, and impact noise, and aircraft and vessel noise)
- Energy (electromagnetic devices, high energy lasers)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables, guidance wires, and parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (explosives and byproducts, metals, and chemicals)

Preferred Alternative

- Acoustics: Pursuant to the Endangered Species Act (ESA), the use of sonar, other active sources, and explosives may affect and is likely to adversely affect ESA-listed sea turtles; and may affect but is not likely to adversely affect the American crocodile or American alligator. Pile driving, swimmer defense airguns and weapons firing noise may affect but are not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. Aircraft and vessel noise may affect but is not likely to adversely affect ESA-listed sea turtles, the American crocodile, or the American alligator. Acoustic stressors will have no effect on critical habitat for any ESA-listed marine reptiles.
- Energy: Pursuant to the ESA, the use of electromagnetic devices may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator. The use of high energy lasers will have no effect on any ESA-listed sea turtle species, the American alligator, or the American crocodile. The use of electromagnetic devices and high energy lasers will have no effect on critical habitat for any ESA-listed marine reptile.
- Physical Disturbance and Strike: Pursuant to the ESA, vessel use may affect and is likely to adversely affect ESA-listed sea turtles. The use of in-water devices and military expended materials may affect but is not likely to adversely affect ESA-listed sea turtles. The use of vessels, in-water devices, and military expended materials will have no effect on the American crocodile or American alligator. The use of vessels, in-water devices, and military expended materials will have no effect on critical habitat for any ESA-listed marine reptiles.
- Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator.
- Ingestion: Pursuant to the ESA, the use of munitions with the potential for ingestion may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, and loggerhead sea turtles; and will have no effect on the leatherback sea turtle, American crocodile, or American alligator. The potential for ingestion of military expended materials other than munitions may affect but is not likely to adversely affect ESA-listed sea turtles; and will have no effect on the American crocodile or American alligator.
- Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed sea turtles, the American crocodile, or the American alligator and will have no effect on critical habitat for any ESA-listed marine reptile.

3.5.1 INTRODUCTION

This section provides a brief introduction to sea turtles and other marine reptiles that occur within the boundaries of the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) and whose distribution may overlap with stressors associated with the Proposed Action. As shown in Table 3.5-1, there are five species of sea turtles, the American crocodile (*Crocodylus acutus*), and the American alligator (*Alligator mississippiensis*) which occur within the Study Area; all are listed under the Endangered Species Act (ESA) as either threatened or endangered. The National Marine Fisheries Service (NMFS) and the United States (U.S.) Fish and Wildlife Service share jurisdictional responsibility for sea turtles under the ESA. The U.S. Fish and Wildlife Service has responsibility in the terrestrial environment (e.g., nesting beaches), while NMFS has responsibility in the marine environment. Jurisdictional management of the American crocodile and American alligator is the responsibility of the U.S. Fish and Wildlife Service.

Sea turtles are found in coastal waters and on nesting beaches of the U.S. Atlantic Coast, Gulf of Mexico, Caribbean Sea, and in open ocean areas. The American crocodile and American alligator occur in fresh and brackish waters, and are occasionally observed in nearshore marine waters. Each species is discussed further in Section 3.5.2 (Affected Environment).

The olive ridley sea turtle (*Lepidochelys olivacea*) was considered for inclusion in this document, but because its occurrence in the Study Area is extralimital (outside the species' normal range), the species will not be analyzed. Western Atlantic olive ridley sea turtle populations are centered near Suriname/French Guiana and Brazil. Olive ridleys are not known to move among ocean basins. Within a region, they move only occasionally between the ocean and coastal zone, usually remaining in coastal waters (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007e). Occurrences as far north as Puerto Rico, the Dominican Republic, and Cuba are considered rare. Between 1999 and 2001, three individuals were reported in coastal south Florida; however, all were strandings (Foley et al. 2003). The two turtles sighted in the Florida Keys were floating and debilitated with net entanglement injuries. The third was a dead turtle found covered in tar on a beach in Miami. These are the first known sightings in Florida and the northernmost occurrences of olive ridleys in the western North Atlantic. These sightings are considered extralimital occurrences because these fatally injured turtles were likely carried outside of their range by vessels or currents, and genetic analysis confirmed that these three turtles were members of the Suriname/French Guiana population (Foley et al. 2003). Currently, there are no olive ridley nesting beaches in the eastern United States, and there are no known feeding, breeding, or migration areas within the Study Area; therefore, there does not appear to be a nexus between olive ridley sea turtles and U.S. Department of the Navy (Navy) training and testing activities.

3.5.2 AFFECTED ENVIRONMENT

Sea turtles are highly migratory, long-lived reptiles that occur throughout the open-ocean and coastal regions of the Study Area, generally within tropical to subtropical latitudes. Leatherbacks (*Dermochelys coriacea*), because of their unique physiology among sea turtles, occur with more regularity in colder waters at higher latitudes (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991; Prescott 2000). Habitat and distribution vary depending on species and life stages and is discussed further in the species profiles.

Little information is available regarding a sea turtle's stage of life after hatching. Open-ocean juveniles spend an estimated 2 to 14 years drifting, foraging, and developing. Due to the general lack of knowledge of this period, it has been described as "the lost years." After this period, juvenile

Table 3.5-1: Regulatory Status and Presence of Endangered Species Act–Listed Sea Turtles and Other Marine Reptiles in the Study Area

Species Name and Regulatory Status			Presence in Study Area		
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean Area**	**Large Marine Ecosystem[1]**	**Bays, Rivers, and Estuaries**
Family Cheloniidae (hard-shelled sea turtles)					
Green Turtle	*Chelonia mydas*	Threatened/ Endangered[2]	North Atlantic Subtropical Gyre, Gulf Stream	Northeast U.S. Continental Shelf*, Southeast U.S. Continental Shelf*, Caribbean Sea*, Gulf of Mexico*	Narragansett Bay, Kings Bay, Port Canaveral, St. Andrew Bay, Corpus Christi Bay
Hawksbill Turtle	*Eretmochelys imbricata*	Endangered	North Atlantic Subtropical Gyre, Gulf Stream	Northeast U.S. Continental Shelf[3], Southeast U.S. Continental Shelf*, Caribbean Sea*, Gulf of Mexico*	–
Kemp's Ridley Turtle	*Lepidochelys kempii*	Endangered	North Atlantic Subtropical Gyre, Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf*, Caribbean Sea, Gulf of Mexico*	Narragansett Bay, Chesapeake Bay, Corpus Christi Bay
Loggerhead Turtle	*Caretta caretta*	Threatened/ Endangered[4]	North Atlantic Subtropical Gyre, Gulf Stream	Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf*, Southeast U.S. Continental Shelf*, Caribbean Sea*, Gulf of Mexico*	Narragansett Bay, Delaware Bay, Chesapeake Bay, St. Andrew Bay, Kings Bay, Port Canaveral
Family Dermochelyidae (leatherback sea turtle)					
Leatherback Turtle	*Dermochelys coriacea*	Endangered	North Atlantic Subtropical Gyre, Gulf Stream	Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf*, Southeast U.S. Continental Shelf*, Caribbean Sea*, Gulf of Mexico*	Narragansett Bay, Chesapeake Bay, Port Canaveral
Family Crocodylidae (true crocodiles)					
American Crocodile	*Crocodylus acutus*	Threatened	–	Southeast U.S. Continental Shelf*, Gulf of Mexico*	–
American Alligator	*Alligator mississippiensis*	Threatened due to similarity of appearance**	–	Southeast U.S. Continental Shelf*, Gulf of Mexico*	Kings Bay, Port Canaveral, St. Andrew Bay, Corpus Christi Bay

Sources: Federal Register [FR] 35 (233): 18319-18322, December 2, 1970; FR 35 (106): 8491-8498, June 2, 1970; FR 43 (146): 32800-32811, July 28, 1978; FR 76 (184): 58868-58952, September 22, 2011.

* Nesting occurs within this large marine ecosystem.

** The American alligator is listed under the Endangered Species Act (ESA) classification of "threatened due to similarity of appearance" to the American crocodile.

[1] The large marine ecosystems of the Study Area are characterized by coastal waters.

[2] As a species, the green turtle is listed under the ESA as threatened, but the Florida and Mexican Pacific coast nesting populations are listed as endangered. Note that green turtles found in the Study Area might not all be from the Florida population.

[3] Hawksbills have been recorded here rarely; occurrence in the Northeast U.S. Continental Shelf Large Marine Ecosystem is extralimital (outside of their normal range).

[4] Nine distinct population segments exist for loggerhead sea turtles. The North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea distinct population segments of the loggerhead sea turtle are listed as endangered under the ESA. The Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, and South Atlantic Ocean distinct population segments are listed as threatened under the ESA. Of these, the Northwest Atlantic Ocean distinct population segment is the only one that occurs entirely in the Study Area.

hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), loggerhead (*Caretta caretta*), and green (*Chelonia mydas*) sea turtles settle into coastal habitat, with individuals often remaining faithful to a specific home range until adulthood (Bjorndal and Bolten 1988; National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991). Leatherback turtles remain primarily in the open ocean throughout their lives, except for mating in coastal waters and females going ashore to lay eggs. All species have the ability to migrate long distances across large expanses of the open ocean, primarily between nesting and feeding grounds (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009).

All sea turtle species are believed to use a variety of orientation mechanisms on land and at sea (Lohmann et al. 1997). After emerging from the nest, hatchling turtles use visual cues, such as light wavelengths and shape patterns, to find the ocean (Lohmann et al. 1997; Salmon et al. 1992). Once in the ocean, hatchlings use wave cues to navigate offshore (Lohmann and Lohmann 1992). In the open ocean, turtles in all life stages are thought to orient to the earth's magnetic field to position themselves in oceanic currents; this helps them locate seasonal feeding and breeding grounds and return to their nesting sites (Benhamou et al. 2011; Lohmann and Lohmann 1996b; Lohmann et al. 1997). The stimuli that help sea turtles find their nesting beaches are still poorly understood, particularly the fine-scale navigation that occurs as turtles approach the site, and could also include chemical and acoustic cues.

Crocodilians (alligators and crocodiles) are long-lived reptiles. They are ectotherms ("cold-blooded"), meaning they rely on external sources of heat to regulate their body temperature. Crocodilians control their body temperature by basking in the sun or moving to areas with warmer or cooler air and water temperatures. The American crocodile inhabits freshwater, including rivers, lakes, and reservoirs, and can also be found in brackish environments such as estuaries and swamps (Fishman et al. 2009), and occurs within the Study Area in coastal portions of the Caribbean and in Florida. The Florida population marks the northern extent of this species' range and is classified as a distinct population segment due to its genetic isolation (U.S. Fish and Wildlife Service 2010). American alligators are usually found in freshwater, in slow moving rivers, or in the brackish waters of swamps, marshes, and lakes. They can tolerate saltwater for only brief periods because they do not have salt glands (Britton 2009). The alligator is found throughout the southeastern United States, from the Carolinas to Texas (U.S. Fish and Wildlife Service 2008). Neither species occurs in offshore oceanic waters.

3.5.2.1 Diving

While the American crocodile and the American alligator do submerge, they do not dive in the traditional sense; thus these species are not discussed in this section.

3.5.2.1.1 Sea Turtles

Sea turtle dive depth and duration varies by species, the age of the animal, the location of the animal, and the activity (e.g., foraging, resting, and migrating). Dive durations are often a function of turtle size, with larger turtles being capable of diving to greater depths and for longer periods. The diving behavior of a particular species or individual has implications for mitigation and monitoring. In addition, their relative distribution through the water column is an important consideration when conducting acoustic exposure analyses. Information and data on diving behavior for each species of sea turtle was compiled in a technical report (Watwood and Buonantony 2012) that provides a detailed summary of time at depth used for the purpose of distributing animals through the water column within the acoustic exposure model. The following text below briefly summarizes the dive behavior of each species.

Green turtle. In the open ocean, Hatase et al. (2006) observed that adult green turtles dive to a maximum of 260 feet (ft.), or 80 meters (m). Open-ocean resting dives rarely exceed 50 ft. (15 m), while most open-ocean foraging dives average about 80 ft. (25 m) (Hatase et al. 2006). While studying migrations of green turtles between the Northwest and the main Hawaiian Islands, Rice and Balazs (2008) noted a difference between night and day dives in both their duration and depth. During the day, dives lasted between 1 and 18 minutes and rarely exceeded 14 ft. (4 m) in depth. At night, green turtles began a pattern consisting of deep dives, with a mean duration of 35 to 44 minutes and a mean maximum dive depth of 115 to 164 ft. (35 to 55 m) (Rice and Balazs 2008). During this study, an adult female made two nocturnal dives in excess of 443 ft. (135 m), which represent the deepest dives ever recorded for this species. In their coastal habitat, green turtles (adults) typically make dives shallower than 100 ft. (30 m), with most dives not exceeding 58 ft. (17.5 m) (Hays et al. 2004; Rice and Balazs 2008). Green turtles are known to forage and also rest at depths of 65 to 165 ft. (20 to 50 m) (Balazs 1980; Brill et al. 1995).

Hawksbill turtle. Adult hawksbill turtles make short, active foraging dives during the day, while longer resting dives occur at night (Blumenthal et al. 2009; Storch et al. 2005; Van Dam and Diez 1996). Starbird et al. (1999) reported that during inter-nesting periods, adult females' dives at Buck Island, U.S. Virgin Islands averaged 56.1 minutes in duration. Lutcavage and Lutz (1997) cited a maximum dive duration of 73.5 minutes for a female hawksbill in the U.S. Virgin Islands. Van Dam and Diez (1996) reported that foraging dives at a study site in the northern Caribbean ranged from 19 to 26 minutes at depths of 25 to 35 ft. (8 to 10 m), with resting night dives ranging from 35 to 47 minutes (Van Dam and Diez 1996). Foraging dives of immature hawksbills are of shorter duration, ranging from 8.6 to 14 minutes (Van Dam and Diez 1996), with a mean and maximum depth of 5 ft. (1.5 m) and 65 ft. (20 m), respectively (Blumenthal et al. 2009; Van Dam and Diez 1996).

Kemp's ridley turtle. In shallow summer foraging waters of the Atlantic Ocean, juveniles remain submerged during the day, generally feeding on the bottom (National Marine Fisheries Service 2010). Sasso and Witzell (2006) reported longer dives at night than during the day for this species. In offshore waters, juvenile Kemp's ridley turtles dove less than 49 ft. (15 m) regardless of bottom depth, with generally longer surface intervals than exhibited in coastal waters. Dive times ranged from a few seconds to 167 minutes, with routine dives lasting between 16.7 and 33.8 minutes (Mendonça and Pritchard 1986; Renaud 1995). Submergence time varies seasonally; dives are longest during the winter (greater than 30 minutes), and during the remainder of the year, dives are 15 minutes (Renaud and Williams 2005). Over a 12-hour period, Kemp's ridley turtles spend as much as 96 percent of their time submerged (Gitschlag 1996; Sasso and Witzell 2006). In Cedar Keys, Florida, the mean surface duration was 18 seconds, while submergence duration was 8.4 minutes (Schmid et al. 2002).

Loggerhead turtle. Studies of loggerhead diving behavior indicate varying mean depths and surface intervals, depending on whether they were located in shallow coastal waters (short surface intervals) or in deeper, offshore areas (longer surface intervals) (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009). Loggerhead turtles foraging in the nearshore habitat dive to the seafloor (average depth 165–490 ft. [50–150 m]), and those in the open-ocean habitat dive in the 0–80 ft. (0–25 m) depth range (Hatase et al. 2007). Dive duration was significantly longer at night and increased in warmer waters. The average overall dive duration was 25 minutes, although dives exceeding 300 minutes were recorded. Turtles in the open-ocean habitat exhibited mid-water resting dives at around 45 ft. (14 m), where they could remain for many hours. This appears to be the main function of many of the night dives recorded (Hatase et al. 2007). Another study on coastal foraging loggerheads by Sakamoto et al. (1993) found that virtually all dives were shallower than 100 ft. (30 m).

Immature loggerheads and adults in neritic habitats can spend more than 90 percent of their time underwater (Byles 1988; Renaud and Carpenter 1994). Studies investigating dive characteristics of loggerheads under various conditions confirm that loggerheads do not dive particularly deep in the open-ocean environment (about 80 ft. [25 m]) but will forage to bottom depths of at least 490 ft. (150 m) in coastal habitats (Hatase et al. 2007; Polovina et al. 2003; Soma 1985).

Leatherback turtle. The leatherback is the deepest diving sea turtle with a recorded maximum depth of 4,200 ft. (1,280 m), although most dives are much shallower, usually less than 820 ft. (250 m) (Hays et al. 2004; Sale et al. 2006). Diving activity (including surface time) is influenced by a suite of environmental factors (e.g., water temperature, availability and vertical distribution of food resources, bathymetry) that result in spatial and temporal variations in dive behavior (James et al. 2006; Sale et al. 2006). Leatherbacks dive deeper and longer in the lower latitudes versus the higher latitudes (James et al. 2005a; James et al. 2005b), where they are known to dive in waters with temperatures just above freezing (James et al. 2006; Jonsen et al. 2007). James et al. (2006) noted that dives in higher latitudes are punctuated by longer surface intervals and more time at the surface, perhaps in part to regulate body temperature (i.e., bask). Tagging data also revealed that changes in individual turtle diving activity appear to be related to water temperature, suggesting an influence of seasonal prey availability on diving behavior (Hays et al. 2004). While transiting, leatherbacks make longer and deeper dives (James et al. 2006; Jonsen et al. 2007). It is suggested that leatherbacks make scouting dives while transiting as an efficient means for sampling prey density and perhaps also to feed opportunistically at these times (James et al. 2006; Jonsen et al. 2007). In the Atlantic, Hays et al. (2004) determined that migrating and foraging adult leatherbacks spent 71 to 94 percent of their diving time at depths from 230 to 361 ft. (70 to 110 m).

During nesting, dive depths are likely constrained by the bathymetry adjacent to the nesting site (Myers and Hays 2006). For example, patterns of relatively deep diving are recorded off St. Croix in the Caribbean (Eckert et al. 1986) and Grenada (Myers and Hays 2006) in areas where deep waters are close to shore. A maximum depth of 1,560 ft. (475 m) was recorded (Eckert et al. 1986), although even deeper dives were inferred where dives exceeded the maximum range of the time depth recorder (Eckert et al. 1989b). Shallow diving occurs where shallow water is close to the nesting beach in areas such as the China Sea (Eckert et al. 1996), Costa Rica (Southwood et al. 1999), and French Guiana (Fossette et al. 2007).

3.5.2.2 Hearing and Vocalization

3.5.2.2.1 Sea Turtles

The auditory system of the sea turtle appears to work via water and bone conduction, with lower frequency sound conducted through to skull and shell, and does not appear to function well for hearing in air (Lenhardt 1982; Lenhardt et al. 1983). Sea turtles do not have external ears (pinnae) or ear canals to channel sound to the middle ear, nor do they have a specialized eardrum. Rather, sound is conducted through the shell and bone to the inner ear (Lenhardt et al. 1983). Fibrous and fatty tissue layers on the side of the head may serve as a sound-receiving tympanic membrane in the sea turtle, a function similar to that of the eardrum in mammals, but more likely dampen vibrations received via bone conduction at the inner ear (Lenhardt et al. 1983). The columella, a thin bone connecting the fatty tissues of the tympanum to the oval window at the inner ear, applies a dampening load to the oval window, and may also assist detection of vibrations by inertial displacement (Lenhardt et al. 1985). Unlike mammals, the cochlea of the sea turtle is not elongated and coiled and likely does not respond well to high

frequencies, a hypothesis supported by the limited amount of research on sea turtle auditory sensitivity (Bartol et al. 1999; Ridgway et al. 1969).

Investigations suggest that sea turtle auditory sensitivity is limited to low-frequency bandwidths, such as the sounds of waves breaking on a beach. The role of underwater low-frequency hearing in sea turtles is unclear. Sea turtles may use acoustic signals from their environment as guideposts during migration and as cues to identify their natal beaches (Lenhardt et al. 1983). Sea turtles are low-frequency hearing specialists, typically hearing frequencies from 30 to 2,000 Hertz (Hz), with a range of maximum sensitivity between 100 and 800 Hz (Bartol and Ketten 2006; Bartol et al. 1999; Lenhardt 2002; Lenhardt 1994; Martin et al. 2012; Ridgway et al. 1969). Hearing below 80 Hz is less sensitive but still potentially usable (Lenhardt 1994). Greatest sensitivities are 300 to 400 Hz for the green turtle (Ridgway et al. 1969) and around 250 Hz or below for juvenile loggerheads (Bartol et al. 1999). Bartol et al. (1999) reported that the range of effective hearing for juvenile loggerhead turtles is from at least 250 to 750 Hz using the auditory brainstem response technique. Behavioral and audio evoked potential audiogram methods showed an adult loggerhead to have best sensitivity between 100 and 400 Hz, with no detection of 1131 Hz tones via the behavioral method (Martin et al. 2012). Juvenile and sub-adult green turtles detect sounds from 100 to 500 Hz underwater, with maximum sensitivity at 200 and 400 Hz (Bartol and Ketten 2006). Auditory brainstem response recordings on green turtles showed peak response at 300 Hz (Yudhana et al. 2010). Juvenile Kemp's ridley turtles were found to detect underwater sounds from 100 to 500 Hz, with a maximum sensitivity between 100 and 200 Hz (Bartol and Ketten 2006). There is a lack of audiometric information for leatherback turtles; however, their anatomy suggests they would hear similarly to other sea turtles. Functional hearing of all species of sea turtles, for the purposes of this analysis, is assumed to be 10 Hz to 2 kilohertz (kHz).

Few sea turtles have been tested to determine auditory thresholds. Sub-adult green turtles show, on average, the lowest hearing threshold at 300 Hz (93 decibels [dB] referenced to (re) 1 micropascal [µPa]), with thresholds increasing at frequencies above and below 300 Hz, when thresholds were determined by auditory brainstem response (Bartol and Ketten 2006). Auditory brainstem response testing was also used to detect thresholds for juvenile green turtles (lowest threshold 93 dB re 1 µPa at 600 Hz) and juvenile Kemp's ridley turtles (thresholds above 110 dB re 1 µPa across hearing range)(Bartol and Ketten 2006). Auditory thresholds for yearling and two-year old loggerhead sea turtles were also recorded. Both yearling and two-year old loggerheads had the lowest hearing threshold at 500 Hz (yearling: about 81 dB re 1 µPa and two-year-olds: about 86 dB re 1 µPa), with thresholds increasing rapidly above and below that frequency (Bartol and Ketten 2006). An adult loggerhead exhibited behavioral thresholds between 98 and 106 dB re 1 µPa and electrophysiological thresholds between 110 and 112 dB re 1 µPa over its best hearing range of 100 to 400 Hz, with thresholds rapidly increasing over 400 Hz in both cases (Martin et al. 2012). Electrophysiological audiometry techniques used in the above studies measure small electrical voltages produced by neural activity when the auditory system is stimulated by sound but do not measure behavioral responses to sounds.

Sea turtles are only known to produce sounds during nesting. Nesting leatherback turtles were recorded producing sounds (sighs or belch-like sounds) up to 1,200 Hz with most energy ranging from 300 to 500 Hz (Mrosovsky 1972).

3.5.2.2.2 Crocodilians (Crocodiles and Alligators)

Overall, crocodilians (crocodiles and alligators), like other amphibious species, have both in-air and underwater hearing capabilities. However, crocodilians appear to be structurally adapted for detection

of airborne sound based on the similarities between crocodilian and avian ear morphology and the corresponding auditory brainstem structures (Gleich and Manley 2000).

While crocodilians detect airborne sound via the tympanic membrane, sounds in water appear to be detected via bone conduction (Higgs et al. 2002). Crocodilians have external muscular flaps (ear lids) both above and below the opening of the external auditory canal that reflexively seal off the canal when submerged and then relax above water (Wever 1971).

Crocodilian hearing is most sensitive at lower frequencies, both in air and in water. Ranges and thresholds of sound detection have not been studied for adult crocodilians but have been studied in juveniles. A study of young crocodilians showed best in-air hearing sensitivity from 100 to 1,000 Hz (American alligator) and 100 to 3,000 Hz (American crocodile) using electrophysiological measures (Wever 1971). Evaluation of in-air hearing sensitivity of juvenile American crocodiles using auditory brainstem response showed responses to sounds from 100 Hz to 8 kilohertz (kHz)(Higgs et al. 2002). The best hearing range between 1 and 1.5 kHz was similar to the previous study, with lowest thresholds around 36 to 38 dB re 20 µPa and poor sensitivity above 2 kHz (Higgs et al. 2002). In water, auditory brainstem responses by juvenile American crocodiles were observed during sound exposures from 100 Hz to 2 kHz, with best sensitivity at 800 Hz (about 85 dB re 1 µPa), and no responses to exposures at 4 kHz (Higgs et al. 2002). Electrophysiological audiometry techniques used in the above studies measure small electrical voltages produced by neural activity when the auditory system is stimulated by sound but do not measure behavioral responses to sounds.

With regard to sound production, crocodilian calls are typically low-frequency, short, and repetitive. Types of calls include bellows at the air-water interface (20 to 250 Hz), grunts (up to one kHz), hisses, and coughs, with bellows having a notable in-water component (Vergne et al. 2009). Adult American alligators make a variety of communication sounds, including infrasonic signals at the air-water interface (Garrick and Lang 1977), bellows with a dominant frequency around 100 Hz with harmonics up to 400 Hz (Vliet 1989), and a broadband hiss during threat displays (Garrick et al. 1978). Hatchling and juvenile alligators such as those used in the auditory studies discussed above have a more restricted communication repertoire (Higgs et al. 2002).

3.5.2.3 General Threats

The discussion below represents general threats to sea turtles and crocodilians. Additional threats to individual species within the Study Area are described below in the accounts of those species.

3.5.2.3.1 Sea Turtles

Many threats are common among all sea turtle species. Bycatch in commercial fisheries, ship strikes, and marine debris (Triessnig et al. 2012) are some of the primary threats to sea turtles (Lutcavage et al. 1997). One comprehensive study estimates that worldwide, 447,000 sea turtles are killed each year from bycatch in commercial fisheries (Wallace et al. 2010). Precise data are lacking for sea turtle mortalities directly caused by ship strikes; however, live and dead turtles are often found with deep cuts and fractures indicative of collision with a boat hull or propeller (Hazel et al. 2007; Lutcavage et al. 1997). Marine debris can also be a problem for sea turtles through entanglement or ingestion (Lazar and Gracan 2011; Macedo et al. 2011). Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherback turtles to have ingested various types of plastic (Mrosovsky et al. 2009). Plastic ingestion was identified as the cause of death in 9 percent of these cases. Other marine debris, including derelict fishing gear and cargo nets, can entangle and drown turtles in all life stages.

On beaches, wild and domestic dogs, feral pigs, raccoons, and other predators ravage sea turtle nests and emerging hatchlings. In some parts of the world, humans continue to harvest eggs and nesting females (Maison et al. 2010; National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998a). Habitat destruction or degradation is also an issue for sea turtles. Coastal development can cause beach erosion and introduce invasive vegetation, destroying or rendering nesting habitat inaccessible. It can also create or increase the intensity of artificial light, which confuses hatchlings and increases their mortality rates (National Marine Fisheries Service 2010). In aquatic habitats, degradation issues such as poor water quality and invasive species can alter ecosystems, limit food availability, and decrease survival rates (National Marine Fisheries Service 2010). Environmental degradation can also increase susceptibility to diseases such as fibropapillomatosis, a debilitating tumor-forming disease that primarily affects green turtles (Santos et al. 2010).

Global climate change, with predictions of increased ocean and air temperatures as well as sea level rise, may also negatively affect turtles in all life stages from egg to adult (Griffin et al. 2007; Poloczanska et al. 2009; Santidrián Tomillo et al. 2012; Witt et al. 2007). Potential impacts include embryo death caused by high nest temperatures, skewed sex ratios because of increased sand temperature, loss of nesting habitat due to beach erosion, coastal habitat degradation (e.g., coral bleaching and disease), and spatial shifts in suitable habitat, as well as alteration of the marine food web (Doney et al. 2012), which can decrease the amount of prey species.

Of particular note to sea turtles in the Gulf of Mexico is the 2010 BP *Deepwater Horizon* oil spill, the impacts of which are only beginning to be understood. Oil impacts on turtles include increased egg mortality and developmental defects; direct deaths resulting from oil exposure in hatchlings, juveniles, and adults; direct deaths due to spill containment efforts; and negative impacts on the skin, blood, digestive and immune systems, and salt glands (Milton et al. 2010). Sea turtles continually surface to breathe, and as they rapidly inhale air before diving they may inhale petroleum fumes or ingest oil floating on the water's surface (Milton et al. 2010). Several agencies conducted missions to rescue and rehabilitate sea turtles harmed by the oil spill (Restore The Gulf 2010). For example, during the 2010 nesting season, eggs from loggerhead turtle nests in the Florida panhandle and Alabama were collected and transported to the east coast of Florida, and the hatchlings were released into the Atlantic Ocean near Cape Canaveral. As of August 2010, more than 14,000 hatchlings had been released (Restore The Gulf 2010). According to preliminary data through 15 February 2011, 537 juvenile and adult turtles have been recovered alive and 609 have been found dead during rescue efforts in the Gulf of Mexico. Data were compiled from both strandings and offshore captures, and necropsies are currently being completed to determine the exact causes of death (National Marine Fisheries Service 2011a). Species found were green, hawksbill, Kemp's ridley, and loggerhead turtles; the majority of these were Kemp's ridley turtles (328 alive, 481 dead). At the time of this writing, research is ongoing in an attempt to learn more about the oil spill's long-term impacts on sea turtles and their habitats in the Gulf of Mexico.

Detailed descriptions of threats in the nesting and marine environment, as well as the seriousness of each threat, can be found in the sea turtle recovery plans for each species that occurs in U.S. waters (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991, 1992a, b, 1993, 1998c, 2009). These recovery plans are used as a primary source of information regarding each sea turtle species' population status and threats (Sections 3.5.2.4 through 3.5.2.8).

3.5.2.3.2 Crocodilians

Habitat loss is a primary threat to the American crocodile and the American alligator. Human development diminishes crocodilian habitat and restricts the species' breeding range. In addition to

direct habitat loss, alteration of habitat is a concern as water management programs are developed. Development restricts freshwater flow into swamps and estuaries, which may limit crocodilian growth, survival, and abundance (Mazzotti et al. 2007). Erosion, water contaminants, and sea level rise may further increase vulnerability of nesting sites for both species (Mazzotti et al. 2007; Savannah River Ecology Laboratory 2012b). Short-term effects on crocodilians and their habitat also include the potential impacts caused by hurricanes (Elsey et al. 2006; Elsey and Woodward 2010). Detailed information about threats to these species and life history information can be found in the ESA listing documentation and their recovery plans (FR 44 (244): 75074-75076, December 18, 1979; FR 52 (107): 21059-21064, June 4, 1987; FR 72 (53): 13027-13040, March 20, 2007; (U.S. Fish and Wildlife Service 1999).

The sections that follow contain specific details on the five species of sea turtles, the American crocodile, and the American alligator, and their occurrence in the Study Area.

3.5.2.4 Green Sea Turtle (*Chelonia mydas*)

3.5.2.4.1 Status and Management

The green sea turtle is listed as two populations under the ESA: the Florida and Mexico Pacific coast breeding colonies, and sea turtles from all other populations. The Florida and Mexico Pacific coast breeding colonies are designated as endangered and all other colonies are designated as threatened (FR 43 (146): 32800-32811, July 28, 1978). Individuals from both populations may be present in the Study Area. As of the 2007 status report, NMFS and the U.S. Fish and Wildlife Service determined that the current population listing remains valid and green turtles will not undergo a distinct population segment analysis (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). In 1998, critical habitat was designated for green sea turtles in coastal waters around Culebra Island, Puerto Rico, from the mean high water line seaward to 3 nautical miles (nm) to include Culebra's outlying Keys as shown in Figure 3.5-1 (FR 63 (170): 46693-46701, September 2, 1998). The essential physical and biological features of this critical habitat include (1) seagrass beds, which provide valuable foraging habitat; (2) coastal waters of Culebra, which serve as a developmental habitat and support juvenile, subadult, and adult green sea turtle populations; and (3) coral reefs and other topographic features that provide shelter (FR 63 (170): 46693-46701, September 2, 1998).

3.5.2.4.2 Habitat and Geographic Range

The green sea turtle is distributed worldwide across tropical and subtropical coastal waters between 45° N and 40° S (The State of the World's Sea Turtles Team 2011). After emerging from the nest, green turtle hatchlings swim to offshore areas where they float passively in major current systems. Post-hatchling green turtles forage and develop in floating *Sargassum* habitats of the open ocean. At the juvenile stage (estimated at 5 to 6 years) they leave the open-ocean habitat and retreat to protected lagoons and open coastal areas that are rich in seagrass or marine algae (Bresette et al. 2006), where they will spend most of their lives (Bjorndal and Bolten 1988). The optimal developmental habitats for late juveniles and foraging habitats for adults are warm shallow waters (3–5 m [10–16 ft.] deep), with abundant submerged aquatic vegetation and close to nearshore reefs or rocky areas (Holloway-Adkins 2006; Seminoff et al. 2002).

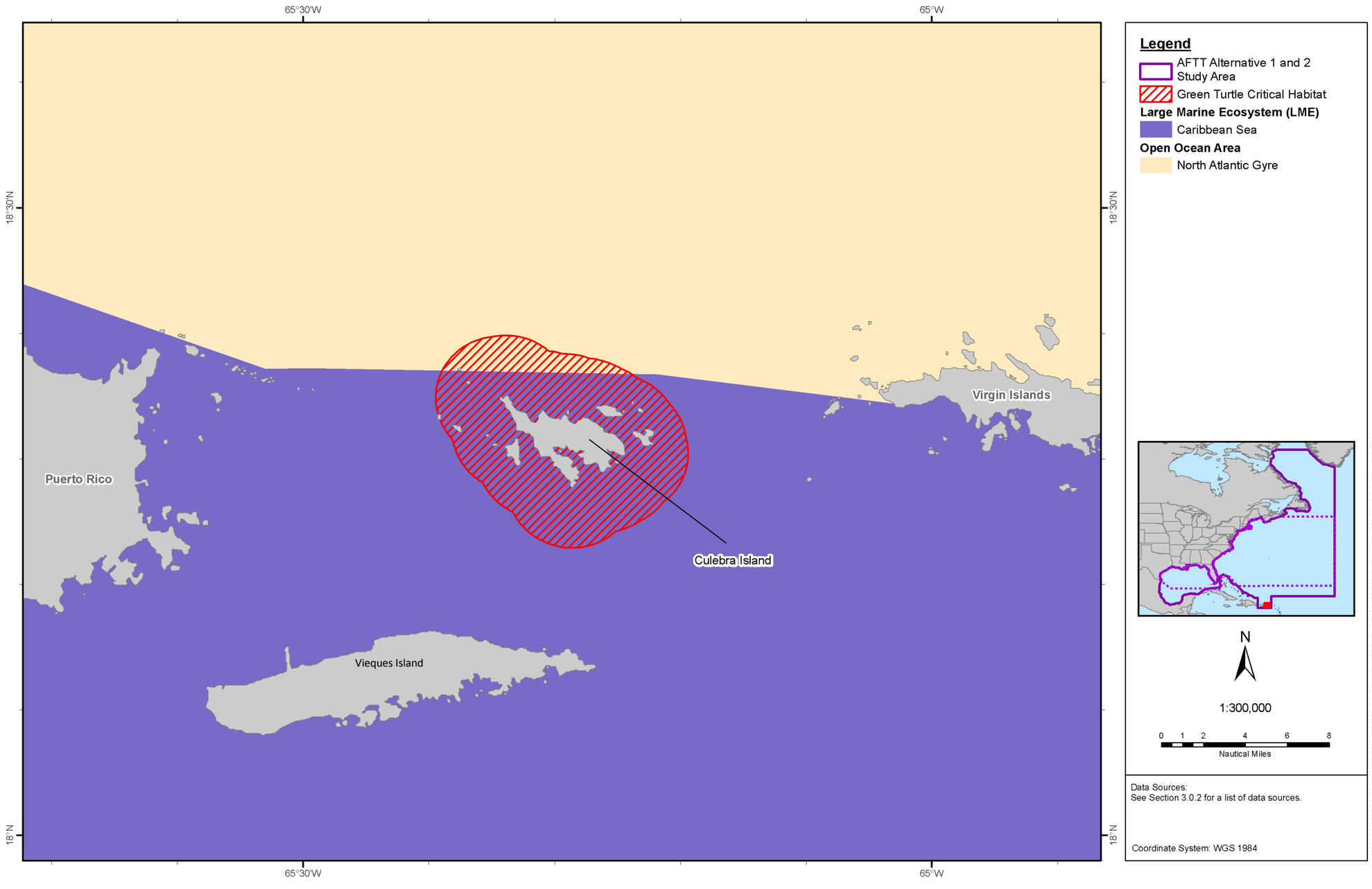

Figure 3.5-1: Critical Habitat Areas for Green Sea Turtles in the Study Area
AFTT: Atlantic Fleet Training and Testing

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When green sea turtles reach sexual maturity, they begin breeding migrations between foraging grounds and nesting areas every few years (Hirth 1997). Both males and females migrate, often traversing geographically disparate habitats and crossing ocean basins that span thousands of miles (Carr 1986, 1987; Mortimer and Portier 1989). Female green sea turtles return to their natal beaches to nest every two to five years (Hirth 1997). Nesting season varies with locality; in the Study Area, the season is roughly June to September (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). Moderate green turtle nesting occurs in the southeastern contiguous United States, Puerto Rico, and the U. S. Virgin Islands. Green sea turtles often return to the same foraging areas after subsequent nesting migrations (Godley et al. 2002; National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a), where they have specific home ranges and movement patterns (Seminoff et al. 2002). During nonbreeding periods, adults reside in coastal nearshore feeding areas that sometimes correspond with juvenile developmental habitats (Marine Turtle Specialist Group 2004). Regardless of the chosen habitat for any given age class of green turtles, all exhibit high fidelity to foraging home ranges (Bresette et al. 1998; Makowski et al. 2006).

Gulf Stream and North Atlantic Gyre Open Ocean Areas. Green sea turtles are known to live in the open-ocean waters of the Gulf Stream and North Atlantic Gyre during the first 5–6 years of life, but little is known about preferred habitat or general distribution during this life phase beyond the information presented in the introduction to this resource. Information on migratory routes within this area is limited. The main source of information on distribution in the Study Area comes from U.S. fisheries bycatch.

Northeast U.S. Continental Shelf Large Marine Ecosystem. As ocean temperatures increase in the spring, green sea turtles migrate from southeastern U.S. waters to the estuarine habitats of Long Island Sound, Peconic Bay, and possibly Nantucket Sound, where an abundance of algae and eelgrass occurs (Lazell 1980; Morreale and Standora 1998). Peak occurrence in the Northeast U.S. Continental Shelf Large Marine Ecosystem is likely in September (Berry et al. 2000). During nonbreeding periods, adult and juvenile distributions may overlap in coastal feeding areas (Hirth 1997).

Southeast U.S. Continental Shelf Large Marine Ecosystem. Juvenile green turtles are the second-most abundant sea turtle species in North Carolina summer developmental habitats, occurring year-round within continental shelf waters, while adults are restricted to more southern latitudes (Epperly et al. 1995c). Most green sea turtle sightings north of Florida are of juveniles and occur during late spring to early fall (Burke et al. 1992; Epperly et al. 1995a; Lazell 1980).

During in-water research projects conducted at sites around Florida, the green sea turtle was the second-most frequently captured species after the loggerhead in northwest Florida, along the west coast, and on the east coast. The majority of captured green sea turtles were juveniles; subadult and adult turtles were only captured occasionally at Port St. Lucie and around the Marquesas Keys (Eaton et al. 2008). Juvenile green sea turtles in Florida appear to use nearshore areas year-round for an average of 7 years (Eaton et al. 2008). Along Florida's Atlantic coast, juvenile green turtles occur in high-wave-energy, nearshore reef environments less than 2 m deep that support an abundance of macroalgae (Holloway-Adkins 2006). Several nearshore habitats have been identified as important, including Mosquito and Indian River lagoons, Port Canaveral, St. Lucie Inlet, and Biscayne Bay (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). During the winter, the highest concentration of green turtles occurs just north of Cape Canaveral, a known wintering area for juveniles.

Caribbean Sea Large Marine Ecosystem. Adult green sea turtles may be found year-round in small numbers in the U.S. Virgin Islands and Puerto Rico (Boulon and Frazer 1990; Collazo et al. 1992; The State of the World's Sea Turtles Team 2011). Critical habitat was designated for green sea turtles in coastal waters around Culebra Island, Puerto Rico, as shown in Figure 3.5-1. Culebra is an important green sea turtle habitat for juveniles, subadults, and a small population of adults (FR 63 (170): 46693-46701, September 2, 1998). Green sea turtles are most abundant at Culebrita, Mosquito Bay, Puerto Manglar, and Tamarindo Grande, probably due to the presence of dense seagrass beds in those areas (Collazo et al. 1992).

Gulf of Mexico Large Marine Ecosystem. Juveniles use the estuarine and nearshore waters of central Florida throughout the year, including Pensacola Bay, St. Joseph Bay, Charlotte Harbor, Cedar Keys, Homosassa Springs, Crystal River, and Tampa Bay (Renaud et al. 1995). In the northern Gulf of Mexico, green sea turtles prefer the coastal habitats of southern Texas (e.g., lagoons, channels, inlets, bays) where seagrass beds and macroalgae are abundant, including Texas' Laguna Madre (Renaud et al. 1995). As water temperatures rise from April to June, green sea turtle numbers increase in the continental shelf waters of the Gulf of Mexico Large Marine Ecosystem, off Galveston Bay, and in those waters associated with the continental shelf break northeast of Corpus Christi. Green sea turtles found in these deeper waters are likely adults migrating from resident foraging grounds to distant nesting grounds (Meylan 1995). The sparse sighting records in Louisiana and Texas waters, as well as nesting records on the southern Texas coast, indicate that green turtles are found in the northwestern Gulf of Mexico during spring but in far fewer numbers than in the northeastern Gulf. Suitable nesting beaches are located throughout the Gulf region, from the shores of northern Mexico and southern Texas in the western Gulf of Mexico to southern Florida and the Florida panhandle in the eastern Gulf of Mexico.

3.5.2.4.3 Population and Abundance

The greatest concentration of green turtle nesting within the Study Area occurs in Monroe County, Florida, which includes most of the Florida Keys and the Dry Tortugas (Meylan et al. 1995). An annual average of 8,927 green sea turtles nested in Florida from 2006 to 2010, making this the second largest green sea turtle nesting population in the wider Caribbean (Florida Fish and Wildlife Conservation Commission 2011; Meylan et al. 2006). Records of green sea turtle nestings have also been reported from the Florida panhandle, Georgia, Alabama, South Carolina, North Carolina, and Texas (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a; The State of the World's Sea Turtles Team 2011). A green turtle nested at Cape Henlopen State Park in Delaware in August 2011, which was the first green turtle nesting ever observed north of Virginia (Murray 2011). While nesting abundance has been monitored at these sites for decades, in-water abundance in the Gulf of Mexico or along the Atlantic coast remains unavailable (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). Adult and juvenile males and females from nesting colonies in the Yucatan Peninsula (Mexico), Aves Island (Venezuela), Galibi Reserve (Suriname), and Isla Trinidade (Brazil) could also occur in the waters of the Study Area.

The Marine Turtle Specialist Group (under the International Union for Conservation of Nature's Species Survival Commission) conducted a worldwide analysis of the green sea turtle population based on 32 index nesting sites around the world (Marine Turtle Specialist Group 2004). The analysis concluded there has been a 48 to 65 percent decline in the number of females nesting annually over the past 100 to 150 years. NMFS and the U.S. Fish and Wildlife Service (2007a) assessed nesting abundance at 46 sites in all regions inhabited by green sea turtles. Of these 46 sites, six occur in the Western Atlantic Ocean and one (Florida) occurs in the Study Area. About 80 percent of nesting in the Western Atlantic Ocean occurs at Tortuguero, Costa Rica. Generally, nesting trends in the Western Atlantic Ocean are

stable to increasing and are increasing in Florida. Although these data appear to present an encouraging global outlook, datasets for fewer than half of these sites (9 of 23) document a time span of longer than 20 years, which limits the strength of the data. A standard timeframe of data that would be necessary to properly assess population trends is three generations, which for the green sea turtle is between 100 and 150 years. Consequently, the impact of changes in juvenile recruitment that occurred four decades ago may not yet be manifested in changes in nesting abundance (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a).

3.5.2.4.4 Predator and Prey Interactions

The green sea turtle is the only species of sea turtle that, as an adult, primarily consumes plants and other types of vegetation (Mortimer 1995). They have a finely serrated jaw that assists with tearing vegetation, and the esophagus is lined with papillae (spiny projections) that trap food before swallowing. While primarily herbivorous, a green sea turtle's diet changes substantially throughout its life. Very young green sea turtles are omnivorous (Bjorndal 1997). Salmon et al. (2004) reported that post-hatchling green sea turtles were found to feed near the surface on seagrasses or at shallow depths on comb jellies and unidentified gelatinous eggs off the coast of southeastern Florida. Pelagic juveniles smaller than 8–10 in. (20.3–25.4 cm) in length eat worms, young crustaceans, aquatic insects, grasses, and algae (Bjorndal 1997). After settling in coastal juvenile developmental habitat at 8–10 in. (20.3–25.4 cm) in length, they eat mostly mangrove leaves, seagrass and algae (Balazs et al. 1994; Nagaoka et al. 2012). Recent research indicates that green sea turtles in the open-ocean environment, and even in coastal waters, also consume jellyfish, sponges, and sea pens (Godley et al. 1998; Hatase et al. 2006; Heithaus et al. 2002; National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a; Parker and Balazs 2008; Russell et al. 2011).

The loss of eggs to land-based predators such as mammals, snakes, crabs, and ants occurs on some nesting beaches. As with other sea turtles, hatchlings may be preyed on by birds and fish. Sharks are the primary nonhuman predators of juvenile and adult green sea turtles at sea (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991).

3.5.2.4.5 Species-Specific Threats

In addition to the general threats described in Section 3.5.2.3 (General Threats), damage to seagrass beds and declines in seagrass distribution can reduce foraging habitat for green sea turtles (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991; Williams 1988). Green sea turtles are susceptible to the disease fibropapillomatosis, which causes tumor-like growths (fibropapillomas) resulting in reduced vision, disorientation, blindness, physical obstruction to swimming and feeding, increased susceptibility to parasites, and increased susceptibility to entanglement (Balazs 1986; National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991). Some populations have begun to show resistance to the disease, but it remains an issue for others (Chaloupka et al. 2009). Green sea turtles are also captured and killed in commercial fisheries. Gillnets account for the highest number of green sea turtle mortalities; green sea turtles are also captured in trawls, traps and pots, longlines, and dredges. NMFS estimated that almost 19,000 green sea turtles are captured in shrimp trawl fisheries each year in the Gulf of Mexico, with 514 of those sea turtles dying as a result of their capture. Each year, several hundred green sea turtles are captured in herring, mackerel, squid, butterfish, and monkfish fisheries; pound net, summer flounder, and scup fisheries; Atlantic pelagic longline fisheries; and gillnet fisheries in Pamlico Sound. Although most of these turtles are released alive, these fisheries are expected to kill almost 100 green sea turtles each year (National Marine Fisheries Service 2011b). In the Atlantic, outside of the United States, green sea turtles are captured and killed in fisheries in

Colombia, Grenada, the Lesser Antilles, Nicaragua, St. Vincent, and the Grenadines (Brautigam and Eckert 2006; Grazette et al. 2007). The turtle fishery along the Caribbean coast of Nicaragua alone captures more than 11,000 green sea turtles each year (Brautigam and Eckert 2006).

3.5.2.5 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

3.5.2.5.1 Status and Management

The hawksbill turtle is listed as endangered under the ESA (FR 35 (106): 8491-8498, June 2, 1970). While the current listing as a single global population remains valid, data may support separating populations at least by ocean basin under the distinct population segment policy (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). Critical habitat was designated for hawksbill terrestrial nesting areas in Puerto Rico in 1982, which includes portions of Mona Island, Culebra Island, Cayo Norte, and Island Culebrita, from the mean high tide line to a point 490 ft. (150 m) from shore (FR 47 (122): 27295-27298, June 24, 1982). Critical marine habitat was designated in 1998 for the coastal waters surrounding Mona and Monito Islands, Puerto Rico from the mean high water line seaward to three nm (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998a). These critical habitat areas are shown in Figure 3.5-2. Critical habitat includes (1) coral reefs for food and shelter and (2) nesting beaches. The essential physical and biological features of coral reefs support a large, long-term juvenile hawksbill population, in addition to subadults and adults. The types of sponges that hawksbills prefer are found on the reefs around these islands. Reef ledges and caves also provide resting areas and protection from predators. Nesting beaches on Mona Island support the largest population of nesting hawksbill turtles in the U.S. Caribbean (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998a).

3.5.2.5.2 Habitat and Geographic Range

The hawksbill is the most tropical of the world's sea turtles, rarely occurring above 35° N or below 30° S (The State of the World's Sea Turtles Team 2008; Witzell 1983). Hatchlings are believed to occupy open-ocean waters, associating themselves with surface algal mats in the Atlantic Ocean (Parker 1995; Witherington and Hirama 2006; Witzell 1983). Juveniles leave the open-ocean habitat after 3 to 4 years and settle in coastal foraging areas, typically coral reefs but occasionally seagrass beds, algal beds, mangrove bays, and creeks (Mortimer and Donnelly 2008). Juveniles and adults share the same foraging areas, including tropical nearshore waters associated with coral reefs, hard bottoms, or estuaries with mangroves (Musick and Limpus 1997). In nearshore habitats, resting areas for late juvenile and adult hawksbills are typically in deeper waters, such as sandy bottoms at the base of a reef flat (Houghton et al. 2003). As they mature into adults, hawksbills move to deeper habitats and may forage to depths greater than 295 ft. (90 m). During this stage, hawksbills are seldom found in waters beyond the continental or insular shelf unless they are in transit between distant foraging and nesting grounds (Renaud et al. 1996; Shaver and Rubio 2008; Shaver et al. 2005). Ledges and caves of coral reefs provide shelter for resting hawksbills during both day and night, where an individual often inhabits the same resting spot. Hawksbills are also found around rocky outcrops and high-energy shoals, where sponges are abundant, and in mangrove-fringed bays and estuaries (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). Female hawksbills return to their natal beach every 2 to 3 years to nest at night, every 14 to 16 days during the nesting season. During nesting season in the Caribbean, adult females tend to settle up-current and within 7 km (3.8 nm) of the nesting beach between nesting attempts (Walcott et al. 2012). In the Caribbean Sea and Gulf of Mexico Large Marine Ecosystems, the principal nesting season is from June to November (Hillis 1990). Limited nesting occurs in the Study Area.

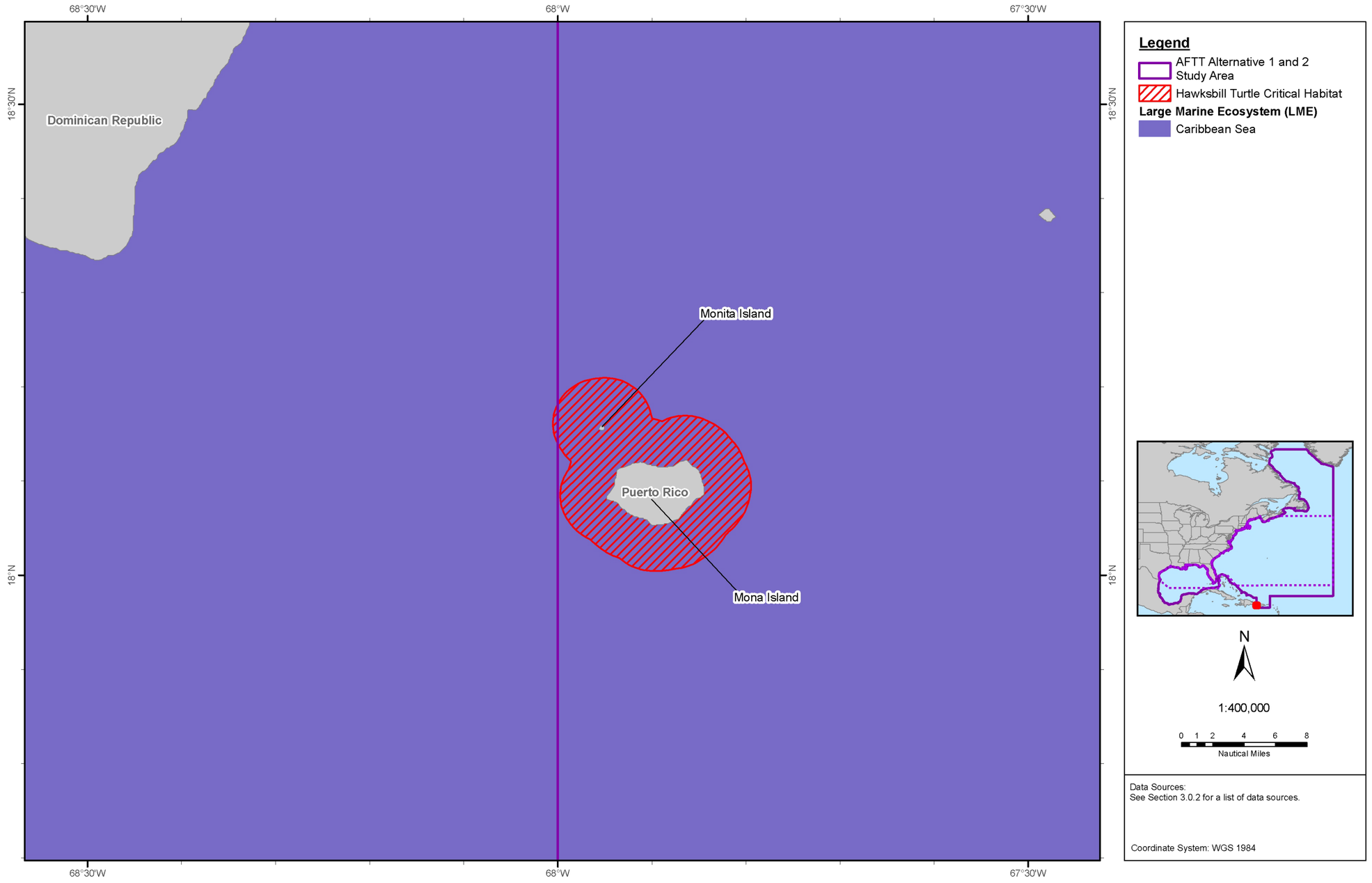

Figure 3.5-2: Critical Habitat Areas for Hawksbill Sea Turtles in the Study Area
AFTT: Atlantic Fleet Training and Testing

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Gulf Stream and North Atlantic Gyre Open Ocean Areas. While hawksbills are known to occasionally migrate long distances in the open ocean, they are primarily found in coastal habitats and use nearshore areas more exclusively than other sea turtles. Despite a lack of information regarding the hawksbill turtle's use of the open ocean in all life stages, they have been reported rarely off of Cape Cod and in North Carolina (The State of the World's Sea Turtles Team 2008; Witzell 1983). Due to these sightings and the relative warmth of the Gulf Stream into the higher latitudes of the North Atlantic, hawksbills are assumed to be present in the North Atlantic Gyre and Gulf Stream Open Ocean Areas.

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. Hawksbill turtles occur regularly in the nearshore waters of southern Florida and the Gulf of Mexico (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). In the continental United States, the species is recorded from all the gulf states and along the east coast as far north as Massachusetts. However, sightings north of Florida are rare, and Texas is the only other state where hawksbills are sighted with any regularity (Keinath et al. 1991; Lee and Palmer 1981; Parker 1995; Plotkin 1995).

The greatest hawksbill turtle numbers in the southeastern United States are found in the autumn off southern Florida. There, hawksbills are documented from winter to summer from Palm Beach, Broward, and Dade Counties to the Florida Keys, and to coastal waters just northwest of Tampa Bay, where the northernmost stranding records typically occur (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). Foraging juveniles and adults settle on coral reef and hard bottom habitats off southern Florida throughout the year (Musick and Limpus 1997). Hawksbill turtle sightings in waters off the Florida panhandle, Alabama, Mississippi, Louisiana, and Texas (Rabalais and Rabalais 1980; Rester and Condrey 1996; Witzell 1983), though rare, are likely of early juveniles born on nesting beaches in Mexico that have drifted north with the dominant currents (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993).

Caribbean Sea Large Marine Ecosystem. Hawksbills occur year-round in the nearshore waters of the Caribbean Islands. They nest throughout the Caribbean and along Columbia and Venezuela in Central America (Dow et al. 2007). Major nesting areas in the United States are on Mona Island in Puerto Rico and on Buck Island Reef National Monument off St. Croix in the U.S. Virgin Islands (Hillis 1990; National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b).

3.5.2.5.3 Population and Abundance

The 2007 five-year review (2007b) assessed nesting abundance and nesting trends in all regions inhabited by hawksbill turtles. An estimated 21,212–28,138 turtles nest each year in the Atlantic, Indian, and Pacific oceans; of these, 3,072 to 5,603 occur in the Atlantic Ocean alone. Historical population trends showed overall declines for the 20- to 100-year period of evaluation. An analysis of 25 index sites around the world indicated that hawksbill nesting has declined globally by at least 80 percent over the last three hawksbill generations (105 years in the Atlantic Ocean and 135 years in the Indo-Pacific Ocean) (Meylan and Donnelly 1999). In the Study Area, population trends vary within the Caribbean, and trends are not known for many locations (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). For example, populations in Jumby Bay, Antigua, are increasing but are decreasing in Antigua outside of Jumby Bay. On Mona Island in Puerto Rico, 199 to 332 female hawksbills nest annually, and trends are increasing. On Buck Island Reef National Monument off St. Croix in the U.S. Virgin Islands, an estimated 56 females nest annually, and trends are increasing (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b). A large rookery of 534 to 891 female hawksbills nest on the Yucatán Peninsula (Campeche, Yucatán, and Quintana Roo) each year, and trends there are increasing (Abreu-Grobois et al. 2005).

3.5.2.5.4 Predator and Prey Interactions

Hawksbill turtles fill a unique ecological niche in marine and coastal ecosystems, supporting the natural functions of coral reefs by keeping sponge populations in check (Hill 1998; Leon and Bjorndal 2002). Feeding on sponges helps to control populations of sponges that may otherwise compete for space with reef-building corals (Hill 1998; Leon and Bjorndal 2002). Post-hatchling hawksbills feed on floating *Sargassum* in the open ocean (Plotkin and Amos 1998). During the later juvenile stage, hawksbills are considered omnivorous, feeding on sponges, sea squirts, algae, molluscs, crustaceans, jellyfish, and other aquatic invertebrates (Bjorndal 1997). Older juveniles and adults are more specialized, feeding primarily on sponges, which compose as much as 95 percent of their diet in some locations (Meylan 1988; Witzell 1983). In the Caribbean, as hawksbills grow, they begin feeding exclusively on only a few types of sponges (Hill 1998; Leon and Bjorndal 2002). Their beak-like mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges as well as other invertebrates. As with other sea turtle species, the hawksbill's esophagus is lined with papillae (spiny projections) that trap food before swallowing.

The loss of hawksbill eggs to predators such as feral pigs, mongoose, rats, snakes, crabs, and ants is a severe problem on some nesting beaches. As with other sea turtles, hatchlings may be preyed on by birds and fish. Sharks are the primary nonhuman predators of juvenile and adult hawksbills at sea (Witzell 1983).

3.5.2.5.5 Species-Specific Threats

In addition to the general threats described in Section 3.5.2.3 (General Threats), the greatest threat to hawksbills is harvest for commercial and subsistence use. Direct harvest of eggs and nesting adult females from beaches, as well as direct hunting of turtles in foraging areas, continues in many countries. International trade of tortoise shells is thought to be the most important factor endangering the species worldwide (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b).

Until relatively recently, tens of thousands of hawksbills were captured and killed each year to meet demand for jewelry, ornamentation, and whole stuffed turtles (Milliken and Tokunaga 1987). Because the hawksbill shell is prized for jewelry and other crafts, the trade of this species and the products it produces is prohibited under the Convention on International Trade in Endangered Species of Wild Flora and Fauna. Despite this protection, illegal trade remains a threat to the species (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b).

The second most significant threat to hawksbill sea turtles is loss of nesting habitat caused by the expansion of resident human populations in coastal areas of the world, as well as the increased destruction or modification of coastal ecosystems to support tourism (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998a). Coastal pollution as a result of increased development degrades water quality, particularly coral reefs, which are primary foraging areas for hawksbills.

Bycatch in commercial fisheries is also an issue for hawksbill sea turtles. Along the Atlantic coast of the United States, NMFS estimates that about 650 hawksbill sea turtles are captured in shrimp trawl fisheries each year in the Gulf of Mexico, with most sea turtles dying as a result of their capture. In addition, about 35 hawksbills are captured and potentially killed each year in Atlantic pelagic longline fisheries (National Marine Fisheries Service 2011b). Due to their preference for nearshore areas, hawksbills are particularly susceptible to nearshore fisheries gear such as drift nets, entanglement in gill nets, and capture on fish hooks of fishermen (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993).

3.5.2.6 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

3.5.2.6.1 Status and Management

The Kemp's ridley sea turtle is listed as a single population and is classified as endangered under the ESA (FR 35 (233): 18319-18322, December 2, 1970). The National Marine Fisheries Service and the U.S. Fish and Wildlife Service are currently reviewing a petition to designate critical habitat for Kemp's ridley sea turtles for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean (WildEarth Guardians 2010); however, there is no critical habitat currently designated for this species. The Kemp's ridley turtle has received protection in Mexico since the 1960s and in the United States since 1970. Harvesting of eggs and turtles, and death from trawl fisheries in the Gulf of Mexico, resulted in a worldwide population decline, from tens of thousands of nesting females in the late 1940s to about 300 nesting females in 1985 (Turtle Expert Working Group 2000). The dramatic decline in this population led to intensive management efforts by both Mexican and U.S. environmental agencies. These efforts included protecting nesting beaches from human and animal predators, hatchery programs, and fishing regulations, particularly the requirement of the shrimp industry to use turtle excluder devices.

3.5.2.6.2 Habitat and Geographic Range

Habitats frequently used by Kemp's ridley sea turtles in U.S. waters are warm-temperate to subtropical sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters, where their preferred food, the blue crab, is abundant (Lutcavage and Musick 1985; Seney and Musick 2005). Prolonged exposure to water at 50°F (10°C) or lower can cause Kemp's ridleys to become cold-stunned (sluggish behavior and reduced activity due to exposure to cold water) (Burke et al. 1991). Adult female Kemp's ridley sea turtles take part in mass synchronized nesting emergences known as "arribadas" on only a few nesting beaches; this nesting strategy is unique to *Lepidochelys* spp. Kemp's ridley turtles may also be solitary nesters, but this is less common and generally occurs outside of the main nesting areas in Mexico. In recent years, nesting females have been seen as far north as Georgia and North Carolina, and in 2012, a single nest was laid in Virginia (Back Bay Restoration Foundation 2012). At this time it cannot be determined if these nests represent a permanent range expansion/shift, or if they simply represent seasonal variation or eccentric individuals. Also unlike other species, Kemp's ridley turtles nest primarily during daylight hours (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). The nesting season in the Study Area occurs from April through July.

Evidence suggests that post-hatchling and small juvenile Kemp's ridley sea turtles, similar to loggerhead and green sea turtles of the same region, forage and develop in floating *Sargassum* habitats of the North Atlantic Ocean. Juveniles migrate to habitats along the U.S. Atlantic continental shelf from Florida to New England (Morreale and Standora 1998; Peña 2006) at around 2 years of age. Migrating juvenile Kemp's ridleys travel along coastal corridors generally shallower than 164 ft. (50 m) in bottom depth (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). Suitable developmental habitats are seagrass beds and mud bottoms in waters of less than 33 ft. (10 m) bottom depth and with sea surface temperatures between 72°F and 90°F (22°C and 32°C) (Coyne et al. 2000).

Gulf Stream and North Atlantic Gyre Open Ocean Areas. Recent analysis of sightings and strandings from the eastern Atlantic Ocean may indicate that as the population increases, the range of Kemp's ridley sea turtles may be expanding into the eastern Atlantic Ocean and Mediterranean Sea (Witt et al. 2007).

Northeast U.S. Continental Shelf Large Marine Ecosystem. In the spring, Kemp's ridleys in south Florida begin to migrate northward. With each passing month, the waters to the north become warmer and turtles migrate ever farther north until some appear off Long Island Sound and even Nova Scotia in late summer (Bleakney 1955). In the winter, the migration is reversed as turtles move southward in response to local water temperatures; the turtles in the northernmost areas begin their southward movement earliest, joining up with turtles to the south that begin their migration weeks or months later until each reaches its chosen overwintering site. By early November, turtles from New York and New Jersey merge with turtles from the Chesapeake Bay (Byles 1988; Keinath 1993; Lutcavage and Musick 1985; Renaud 1995) and North Carolina inshore waters (Epperly et al. 1995a), where large clusters of migrating turtles have been reported during winter (Epperly et al. 1995b; Musick et al. 1994).

Southeast U.S. Continental Shelf Large Marine Ecosystem. Satellite telemetry data suggest that turtles migrate south in October and November within the Southeast U.S. Continental Shelf Large Marine Ecosystem—from Georgia and northern Florida to the waters south of Cape Canaveral—and return to their summer foraging grounds in March and April. Therefore, higher densities of Kemp's ridleys in Florida are likely found in winter. The offshore waters south of Cape Canaveral are identified as an important overwintering area for turtles foraging in Atlantic coastal waters (Henwood and Ogren 1987; Schmid 1995). Waters off central North Carolina, which are relatively warm because of the nearby Gulf Stream, are a potentially important overwintering area (Morreale and Standora 1998).

Gulf of Mexico Large Marine Ecosystem. The Kemp's ridley occurs year-round in the coastal waters of the Gulf of Mexico Large Marine Ecosystem from the Yucatán peninsula to south Florida (Lazell 1980; Morreale et al. 1992). The entire population nests in the Gulf of Mexico, along a stretch of beaches from southern Texas to the Yucatán peninsula. The primary nesting beach for Kemp's ridley turtles is near Rancho Nuevo in Tamaulipas, Mexico, with a smaller nesting population in Veracruz, Mexico. Padre Island National Seashore near Galveston, Texas, supports the largest U.S. nesting aggregation, hosting between 100 and 200 nests annually (Shaver and Caillouet Jr. 1998). Low nesting levels have also been reported elsewhere in Texas, and along the coasts of Alabama and Florida, typically with fewer than 10 nest per year in each area (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). Key foraging sites on the west coast of Florida include Charlotte Harbor and Gullivan Bay (Witzell and Schmid 2005).

Post-hatchlings in the Gulf of Mexico appear to transition into the nearshore waters along the northern and eastern shorelines of the Gulf. This transition, as well as post-settlement migration, seems to be seasonal (Renaud and Williams 2005). During spring and summer, juvenile Kemp's ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp's ridleys migrate to deeper or more southern warmer waters and remain there through the winter (Schmid 1998). Key foraging sites in the northern Gulf of Mexico Large Marine Ecosystem include Sabine Pass, Texas; Caillou Bay and Calcasieu Pass, Louisiana (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011); Big Gulley, Alabama; and Apalachicola, Apalachee, Deadman, and Waccasassa Bays, Florida (Schmid et al. 2002).

Satellite tagging studies have shed light on seasonal migration patterns of juvenile turtles in Waccasassa Bay. These turtles migrate in November from the cold shallow waters of Waccasassa Bay either to deeper waters offshore or as far south as Sanibel Island, 185 miles (mi.) (300 kilometers [km]) from their summer foraging grounds. All tracked turtles eventually return to Waccasassa Bay by late March (Renaud and Williams 2005). Recaptured tagged turtles indicate some return to the same summer foraging areas in subsequent years (Schmid 1998), while others occupy relatively confined foraging

areas (1.5–18.5 square miles [mi.^{2}] [4–48 square kilometers {km^2}]). These studies reveal that both the nearshore foraging grounds and offshore overwintering areas in the Gulf of Mexico are important to the conservation and recovery of the species (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011).

Important year-round developmental habitats in the northern Gulf of Mexico include the western coast of Florida (particularly the Cedar Keys area), the eastern coast of Alabama, and the mouth of the Mississippi River (Lazell 1980; Lutcavage and Musick 1985; Marquez-M. 1994; Márquez-M. 1990; National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992b; Schmid et al. 2002; Weber 1995). Coastal waters off western Louisiana and eastern Texas also provide adequate habitats for bottom feeding.

As adults, many turtles remain in the Gulf of Mexico Large Marine Ecosystem, with only occasional occurrence in the Atlantic Ocean (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). While the understanding of adult males' distribution and habitat usage is limited, satellite telemetry of males caught near Padre Island, Texas, indicates that they do not migrate, remaining year-round in nearshore waters of less than 165 ft. (less than 50 m) (Shaver et al. 2005). Many of the post-nesting females from Rancho Nuevo migrate north to areas offshore of Texas and Louisiana (Marquez-M. 1994). Farther south, some post-nesting females migrate from Rancho Nuevo to the northern and western Yucatán Peninsula in the Southern Gulf of Mexico, which contains important seasonal foraging sites for adult females—specifically the Bay of Campeche (Marquez-M. 1994; Márquez-M. 1990; Pritchard and Marquez 1973).

3.5.2.6.3 Population and Abundance

Based on the number of nests monitored between 2005 and 2009, an estimated 5,500 females nest each season in the Gulf of Mexico (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). Given the current population growth rate, the population could increase to 10,000 nesting females by 2015 (Heppell et al. 2005). The main nesting beach of Kemp's ridley sea turtles is at Rancho Nuevo, Mexico. Since the mid-1980s, the number of nests observed at Rancho Nuevo and nearby beaches increased 14 to 16 percent per year and is expected to continue to grow 12 to 16 percent per year, provided that nest protection and other management measures continue (Heppell et al. 2005). More than 20,000 nests were recorded in 2009 at Rancho Nuevo and adjacent camps (Shaver and Caillouet Jr. 1998). The same year, a record 127 nests were recorded in Texas, 73 of which were documented at Padre Island National Seashore (National Park Service 2011).

3.5.2.6.4 Predator and Prey Interactions

Kemp's ridley sea turtles feed primarily on crabs but are also known to prey on molluscs, shrimp, fish, jellyfish, and plant material (Frick et al. 1999; Marquez-M. 1994). Blue crabs and spider crabs are important prey species for the Kemp's ridley (Keinath et al. 1987; Lutcavage and Musick 1985; Seney and Musick 2005). They may also feed on shrimp fishery bycatch (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993). As with other sea turtle species, the Kemp's ridley esophagus is lined with papillae (spiny projections) that trap food before swallowing.

Major predators of Kemp's ridley sea turtle eggs and hatchlings on nesting beaches include raccoons, dogs, pigs, skunks, badgers, and fire ants. Predatory fishes such as jackfish and redfish may feed on hatchlings at sea. Sharks are the primary predator of juvenile and adult Kemp's ridley sea turtles (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011).

3.5.2.6.5 Species-Specific Threats

In addition to the general threats described in Section 3.5.2.3 (General Threats), oil and gas exploration and development in the Gulf of Mexico are a particular threat to Kemp's ridley sea turtles because most of the population occurs there (Shaver and Rubio 2008; Shaver et al. 2005). Kemp's ridley sea turtles periodically strand on beaches in Mexico covered in crude oil, and most of the turtles found injured and dead following the *Deepwater Horizon* oil spill were Kemp's ridley sea turtles (National Marine Fisheries Service 2011a; National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). Shrimp trawling in the southeastern U.S. Atlantic and Gulf of Mexico was once a significant threat to Kemp's ridleys; however, the use of turtle excluder devices and general decline of shrimp fishing in recent years have greatly reduced mortality levels (Caillouet Jr. et al. 2008; Nance et al. 2012). Vehicle activity on sea turtle nesting beaches can also disrupt the nesting process, crush nests, and create ruts and ridges in the sand that pose obstacles to turtles (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2011). Beach vehicular driving is permitted on most beaches in Texas, where adult turtles and hatchlings have been crushed by passing vehicles, as well as on some beaches in Mexico.

3.5.2.7 Loggerhead Sea Turtle (*Caretta caretta*)

3.5.2.7.1 Status and Management

In 2009, a status review conducted for the loggerhead (the first turtle species subjected to a complete stock analysis) identified nine distinct population segments within the global population (Conant et al. 2009). In a September 2011 rulemaking, the NMFS and U.S. Fish and Wildlife Service listed five of these distinct population segments as endangered and kept four as threatened under the ESA, effective as of 24 October 2011 (FR 76 (184): 58868-58952, September 22, 2011). The North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea distinct population segments of the loggerhead sea turtle are classified as endangered under the ESA, and the Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, and South Atlantic Ocean distinct population segments are classified as threatened. The Northwest Atlantic Ocean distinct population segment is the only one that occurs entirely within the Study Area, with geographic boundaries between latitude 60° N and the equator, and stretching to longitude 40° W. However, loggerheads from other distinct population segments may occur within the Study Area. This population is likely to decline in the foreseeable future, primarily as a result of fishery bycatch (FR 69 (128): 40734-40758, July 6, 2004).

At the time of listing loggerhead sea turtle distinct population segments, the U.S. Fish and Wildlife Service and NMFS determined that they lacked the comprehensive data and information necessary to identify and propose critical habitat, and stated that critical habitat would be proposed in a separate rulemaking (FR 76 (184): 58868-58952, September 22, 2011).

On 25 March 2013, the U.S. Fish and Wildlife Service proposed to designate 739.3 mi. (1,189.9 km) of loggerhead sea turtle nesting beaches as critical habitat for the Northwest Atlantic Ocean Distinct Population Segment in coastal counties in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi. This accounts for 48 percent of an estimated 1,531 mi. (2,464 km) of coastal beach shoreline, and approximately 84 percent of the documented numbers of nests within these six states (FR 78 (57): 1800-18082, March 25, 2013). None of this proposed critical habitat includes DoD areas of Marine Corps Base Camp Lejeune (Onslow Beach), Cape Canaveral Air Force Station, Patrick Air Force Base, and Eglin Air Force Base, which are exempt from critical habitat designation because their Integrated Natural Resources Management Plans incorporate measures that provide a benefit for the

conservation of the loggerhead sea turtle. There fore, no U.S. Fish and Wildlife Service designated critical habitat for loggerhead sea turtles occurs in the Study Area.

Critical habitat for loggerhead turtles was not designated in the Study Area when the Navy initiated ESA consultation with the NMFS. On 18 July 2013 NMFS issued a proposed rule for the designation of loggerhead turtle critical habitat. Prior to the release of the proposed rule, NMFS provided the Navy with information on areas where loggerhead turtle critical habitat would be proposed. NMFS also provided to the Navy the primary biological features and primary constituent elements being considered in the proposed designation. Discussions between the Navy and NMFS indicated that there is overlap between the areas being evaluated for critical habitat and Navy activities. However, both the Navy and NMFS determined that these Navy activities, as currently conducted, are not the types of activities that may affect or adversely modify critical habitat for the loggerhead sea turtle or its primary biological features and primary constituent elements. The Navy will continue to monitor the designation of loggerhead critical habitat and revisit this determination if new information arises or areas proposed for designation are modified.

3.5.2.7.2 Habitat and Geographic Range

Loggerhead sea turtles occur in U.S. waters in habitats ranging from coastal estuaries to waters far beyond the continental shelf (Dodd 1988). Loggerheads typically nest on beaches close to reef formations and next to warm currents (Dodd 1988), preferring beaches facing the ocean or along narrow bays (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998b). Nesting in the Study Area occurs from April through September, with a peak in June and July (Dodd 1988; Weishampel et al. 2006; Williams-Walls et al. 1983). Large nesting colonies exist in Florida, with more limited nesting along the gulf coast and north through Virginia. At emergence, hatchlings swim to offshore currents and remain in the open ocean, often associating with floating mats of *Sargassum* (Carr 1986, 1987; Witherington and Hirama 2006). Migration between oceanic and nearshore habitats occurs during the juvenile stage as turtles move seasonally from open-ocean current systems to nearshore foraging areas (Bolten 2003; Mansfield 2006). Once adults, loggerheads continue to migrate seasonally from feeding areas to mating and, for females, nesting areas (Bolten 2003). After reaching sexual maturity, adult turtles settle in nearshore foraging habitats (Godley et al. 2003; Musick and Limpus 1997).

Gulf Stream and North Atlantic Gyre Open Ocean Areas. Post-hatchling Northwest Atlantic loggerhead sea turtles migrate offshore into *Sargassum* habitats in northeast Atlantic open-ocean waters. Their open-ocean range reaches beyond the eastern boundary of the Study Area to waters surrounding the Azores and Madeira and the Mediterranean Sea (Bowen et al. 2004; Conant et al. 2009). Genetic evidence shows that open-ocean loggerhead sea turtles found near the Azores are often derived from the nesting populations in the southeastern United States (Bolten et al. 1994; Bolten et al. 1998). After reaching a length of 16 in. (40 cm) (Carr 1987), early juvenile loggerheads make a transoceanic crossing, swimming back to nearshore feeding grounds near their beach of origin in the western Atlantic Ocean (Bowen et al. 2004; Musick and Limpus 1997). Based on growth rate estimates, the duration of the open-ocean juvenile stage for North Atlantic loggerhead sea turtles is estimated to be 8.2 years (Bjorndal et al. 2000).

Juvenile loggerhead sea turtles inhabit offshore waters in the North Atlantic Ocean, where they are often associated with natural and artificial reefs (Fritts et al. 1983). These offshore habitats provide juveniles with an abundance of prey and sheltered locations where they can rest (Rosman et al. 1987). Subadult and adult loggerhead turtles tend to inhabit deeper offshore feeding areas along the western Atlantic coast, from mid-Florida to New Jersey (Hopkins-Murphy et al. 2003; Roberts et al. 2005).

Juveniles also use the strong current of the North Atlantic Gyre to move from developmental nursery habitats to later developmental habitats, and to and from adult foraging, nesting, and breeding habitats (Bolten et al. 1998; Musick and Limpus 1997).

Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems. Loggerheads are generally observed in the northern extent of their range during the summer, in shallow water habitats with large expanses of open-ocean access. This summer distribution likely extends into the Gulf of Maine and waters over the Scotian Shelf, with some individuals venturing as far north as Newfoundland (Bolten et al. 1992).

Northeast U.S. Continental Shelf Large Marine Ecosystem. Shoop and Kenney (1992) estimated that a minimum of 8,000–11,000 loggerheads are present in the Northeast U.S. Continental Shelf Large Marine Ecosystem waters each summer, with the highest summer occurrence in waters over the mid-continental shelf, roughly from Delaware Bay to Hudson Canyon. Small bottom-feeding juveniles in Delaware Bay are the predominant loggerhead size class found along the northeast and mid-Atlantic U.S. coast (Turtle Expert Working Group 1998), while adults inhabit the entire continental shelf area (Hopkins-Murphy et al. 2003). Juveniles are frequently observed in developmental habitats, including coastal inlets, sounds, bays, estuaries, and lagoons with depths less than 100 m (Hopkins-Murphy et al. 2003; Turtle Expert Working Group 1998). Long Island Sound, Cape Cod Bay, and Chesapeake Bay are the most frequently used juvenile developmental habitats along the Northeast U.S. Continental Shelf Large Marine Ecosystem (Burke et al. 1991; Mansfield 2006; Prescott 2000; University of Delaware Sea Grant 2000). Core Sound and Pamlico Sound, North Carolina, on the border between the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, represent important developmental habitat for juvenile loggerheads (Epperly et al. 1995a). Although these habitats are also used by greens and Kemp's ridleys, loggerheads are the most abundant sea turtle species within the summer developmental habitats of North Carolina (Epperly et al. 1995c).

Southeast U.S. Continental Shelf Large Marine Ecosystem. As later juveniles and adults, loggerhead sea turtles most often occur on the continental shelf and along the shelf break of the U.S. Atlantic and gulf coasts, as well as in coastal estuaries and bays (Cetacean and Turtle Assessment Program and University of Rhode Island 1982; Shoop and Kenney 1992). In a sampling study from 2004 to 2007, juveniles were the most abundant age group among loggerheads found in the Charleston, South Carolina, shipping channel between May and August (Arendt et al. 2012). Immature loggerhead sea turtles may occupy coastal feeding grounds for 20 years before their first reproductive migration (Bjorndal et al. 2001). Hawkes et al. (2006) found that adult females forage predominantly in shallow coastal waters along the U.S. Atlantic coast less than 328 ft. (100 m) deep, likely exploiting bottom-dwelling prey.

Coles and Musick (2000) identified preferred sea surface water temperatures to be between 56°F and 82°F (13.3°C and 28°C) for loggerhead turtles off North Carolina. Loggerheads become lethargic at about 56°F (13°C), becoming cold-stunned (sluggish behavior and reduced activity due to exposure to cold water) in water around 50°F (10°C) (Mrosovsky 1980). As water temperatures drop from October to December, most loggerheads emigrate from their summer developmental habitats and eventually return to warmer waters south of Cape Hatteras, where they spend the winter (Morreale and Standora 1998). Cold-stunned loggerheads are often found between December and February offshore of Cape Lookout, North Carolina (Schwartz 1989). The nesting population of the Northwest Atlantic Ocean loggerhead sea turtle distinct population segment is concentrated along the U.S. east coast and Gulf of Mexico from southern Virginia to Alabama (Conant et al. 2009). The southern Florida nesting population produces from 49,000 to 83,000 nests per year. The greatest proportion of that nesting occurs on the

Florida Atlantic coast, below latitude 29° N (Ehrhart et al. 2003). The Navy conducted surveys to assess loggerhead abundance within its ranges as part of Atlantic Fleet Active Sonar Training monitoring requirements and to collect baseline data in support of the Undersea Warfare Training Range Environmental Impact Statement (EIS), which provided the following site-specific data. Monthly aerial surveys conducted from January to August 2009 sighted 193 loggerhead turtles off the coast of Jacksonville, Florida, while line-transect surveys off North Carolina during the same period sighted 41 loggerhead sea turtles (U.S. Department of the Navy 2009). Aerial observations in Onslow Bay from 2 August 2009 through 1 August 2010 sighted 495 loggerhead sea turtles, while vessel surveys during the same period sighted 47 loggerhead sea turtles (U.S. Department of the Navy 2010). Aerial surveys conducted between 2 August 2009 and 1 August 2010 off Jacksonville, Florida, sighted 716 loggerhead sea turtles, while vessel surveys during the same period sighted 47 loggerhead sea turtles (U.S. Department of the Navy 2010). The prevalence for the high number of loggerhead sea turtle sightings is partly because of the location of the surveys, which correlates with their primary habitat, and also because loggerheads are one of the more easily recognizable sea turtle species (other than the leatherback) due to their size and distinctive head.

Caribbean Sea Large Marine Ecosystem. Nesting beaches for the Northwest Atlantic Ocean loggerhead sea turtle distinct population segment are found in the eastern Bahamas, southwestern Cuba, and the eastern Caribbean Islands. After leaving open-ocean habitats, some juveniles migrate to the Bahamas and Cuba (Conant et al. 2009). Juveniles may also use small-scale surface currents for transportation, migrating counter to North Atlantic prevailing currents (Conant et al. 2009).

Gulf of Mexico Large Marine Ecosystem. Loggerhead sea turtles can be found during all seasons in both continental shelf and slope waters of the Gulf of Mexico, with a much higher abundance in the northeastern Gulf than in the northwestern Gulf (Davis et al. 2000; Fritts et al. 1983). Based on aerial survey data, an estimated 12 percent of all western North Atlantic Ocean loggerhead sea turtles reside in the eastern Gulf of Mexico, and the vast majority occur in western Florida waters (Davis et al. 2000; Turtle Expert Working Group 1998). Nesting is infrequent in this region, and juvenile loggerheads appear to primarily use the developmental habitats found in the northwestern Gulf (Bolten 2003; Bowen et al. 1995; Musick and Limpus 1997; Pitman 1990; Zug et al. 1995). Coastal juveniles and adult loggerhead sea turtles may be attached to high prey concentrations around offshore oil platforms in the Gulf (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009) but are more often documented in association with natural and artificial reefs off Florida (Davis et al. 2000; Rosman et al. 1987). The occurrence of loggerhead sea turtles during winter is likely concentrated in the northeastern Gulf, in Alabama and Florida panhandle shelf waters, and in the deeper off-shelf waters from Texas to Florida, although not as abundantly as in shelf waters. The high number of strandings along the central and southern Florida coasts, as well as the numerous sighting records from the Florida Keys, indicates that loggerheads are likely just as common in waters off southern Florida as they are off Alabama and the Florida panhandle during winter.

3.5.2.7.3 Population and Abundance

There are at least five demographically independent loggerhead sea turtle nesting groups or subpopulations of the Northwest Atlantic Ocean: (1) the Northern Recovery Unit, from the Florida-Georgia border to southern Virginia; (2) the Peninsular Florida Recovery Unit, along Florida's Atlantic coast to Key West; (3) the Dry Tortugas Recovery Unit, encompassing all islands west of Key West; (4) the Northern Gulf of Mexico Recovery Unit, from the Florida panhandle through Texas; and (5) the Greater Caribbean Recovery Unit, from Mexico through French Guiana, the Bahamas, and the Lesser and Greater Antilles (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009). Annual

nesting totals of loggerheads on the U.S. Atlantic and gulf coasts fluctuated between 47,000 and 90,000 nests, with an average of 70,880 nests from 1989 to 2007 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009).

The South Florida nesting subpopulation is the largest known loggerhead sea turtle nesting assemblage in the Atlantic Ocean, with an average of 64,513 nests from 1989 to 2007, and is the second largest in the world (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009). Between 1989 and 1998, loggerhead nest counts on Florida beaches increased. However, since 1998, nest counts have declined by 41 percent with a net decrease over the 18-year period (Witherington et al. 2009). The Northern Recovery Unit is the second largest of these five units, with an average of 5,215 nests laid per year. This unit has experienced a long-term decline since at least 1983. The Northern Gulf of Mexico Recovery Unit subpopulation appears to be the third largest of the U.S. nesting subpopulations, with an average of 906 nests from 1995 to 2007 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009). This subpopulation is also in decline. Data for the Greater Caribbean Recovery Unit are not sufficiently complete to determine the overall size of this subpopulation, nor are trends available at this time.

3.5.2.7.4 Predator and Prey Interactions

The diet of a loggerhead sea turtle varies by age class (Godley et al. 1998). The gut contents of post-hatchlings found in masses of *Sargassum* contained parts of *Sargassum*, zooplankton, jellyfish, larval shrimp and crabs, and gastropods (Carr and Meylan 1980; Richardson and McGillivary 1991; Witherington 1994). Juvenile and subadult loggerhead turtles are omnivorous, foraging on crabs, molluscs, jellyfish, and vegetation captured at or near the surface (Dodd 1988). Adult loggerhead sea turtles are generalized carnivores that forage on nearshore bottom-dwelling invertebrates (molluscs, crustaceans, and anemones) and sometimes fish (Dodd 1988). During migration through the open sea, they eat jellyfish, sea slugs, floating molluscs, floating egg clusters, fish, and squid. As with other sea turtle species, the loggerhead's esophagus is lined with papillae (spiny projections) that trap food before swallowing.

Common predators of eggs and hatchlings on nesting beaches are ghost crabs, raccoons, feral pigs, foxes, coyotes, armadillos, and fire ants (Dodd 1988). In the water, hatchlings are susceptible to predation by birds and fish. Sharks are the primary predator of juvenile and adult loggerhead sea turtles (Fergusson et al. 2000; Simpfendorfer et al. 2001).

3.5.2.7.5 Species-Specific Threats

In addition to the general threats described in Section 3.5.2.3 (General Threats), mortality associated with shrimp trawls has been a substantial threat to juvenile loggerheads because these trawls operate in the nearshore habitats commonly used by this species. Although shrimping nets have been modified with turtle excluder devices to allow sea turtles to escape, the overall effectiveness of these devices has been difficult to assess (Bugoni et al. 2008). Shrimp trawl fisheries account for the highest number of loggerhead sea turtle fishery mortalities; however, loggerheads are also captured and killed in trawls, traps and pots, longlines, and dredges. Along the Atlantic coast of the United States, NMFS estimated that almost 163,000 loggerhead sea turtles are captured in shrimp trawl fisheries each year in the Gulf of Mexico, with 3,948 of those sea turtles dying as a result of their capture. Each year, several hundred loggerhead sea turtles are also captured in herring, mackerel, squid, butterfish, and monkfish fisheries; pound net fisheries, summer flounder and scup fisheries; Atlantic pelagic longline fisheries; and gillnet fisheries in Pamlico Sound. Combined, these fisheries capture about 2,000 loggerhead sea turtles each

year. Although most are released alive, about 700 turtles are killed annually (National Marine Fisheries Service 2011b).

Vehicle use on sea turtle nesting beaches is also an issue for loggerheads. Vehicles are allowed on some beaches in Florida, Georgia, North Carolina, Virginia, and Texas. Vehicles can run over and kill hatchlings or nesting adult turtles on the beach, disrupt the nesting process, create ruts in the sand that impede turtle movement, and crush nests (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2009).

3.5.2.8 Leatherback Sea Turtle (*Dermochelys coriacea*)

3.5.2.8.1 Status and Management

The leatherback sea turtle is listed as a single population and is classified as endangered under the ESA (FR 35 (106): 8491-8498, June 2, 1970). Although the U.S. Fish and Wildlife Service and NMFS believe the current listing is valid, preliminary information indicates an analysis and review of the species should be conducted under the distinct population segment policy (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c). Recent information on population structure (through genetic studies) and distribution (through telemetry, tagging, and genetic studies) have led to an increased understanding and refinement of the global stock structure. Based on this research, the Turtle Expert Working Group (under the National Oceanic and Atmospheric Administration's Southeast Fisheries Science Center) (Turtle Expert Working Group 2007) recommends that seven Atlantic Ocean stocks be considered: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guyana Shield/Trinidad, West Africa, South Africa, and Brazil. Leatherback sea turtles from all nesting stocks have the potential to be within the off-shore portions of the Study Area, but only two of these—the Florida stock and the Northern Caribbean stock—nest on beaches in the jurisdiction of the United States.

One of the most globally important stocks of leatherback turtles, the Southern Caribbean Stock, nests in French Guiana, Guyana, Suriname, and Trinidad but migrates and forages throughout the North Atlantic. The Western Caribbean stock of the Central American coast also migrates through the Study Area en route to North Atlantic foraging grounds. Nesting populations in southern Florida, Culebra, Puerto Rico, and the U.S. Virgin Islands are believed to be increasing due to heightened protection and monitoring of the nesting habitat over the past 30 years (Turtle Expert Working Group 2007). Critical habitat was designated for the leatherback's terrestrial environment on St. Croix in 1978; this area is a strip of land 0.2 mi. (0.3 km) wide (mean high tide inland) at Sandy Point Beach (FR 43 (187): 43688-43689, September 26, 1978). The essential physical and biological feature of this critical habitat is its function as an important nesting beach (FR 43 (187): 43688-43689, September 26, 1978). In 1979, critical habitat was designated for the waters next to Sandy Point, St. Croix, up to and including the waters from the 100-fathom curve shoreward to the mean high tide line, as shown in Figure 3.5-3 (FR 44 (58): 17710-17712, March 23, 1979). The essential physical and biological feature of this critical habitat is its function as an important courtship and mating area adjacent to the nesting beach (FR 44 (58): 17710-17712, March 23, 1979).

NMFS and U.S. Fish and Wildlife Service were petitioned on 2 November 2010 by the Sierra Club to revise the critical habitat designated for Atlantic leatherbacks to include the coastline and offshore waters of the Northeast Ecological Corridor of Puerto Rico, extending at least to the 100 fathom contour, or 9 nm offshore, whichever is further (The Sierra Club 2010). On 5 May 2011, NMFS announced their 90-day finding on the petition, which stated that the petition presented substantial scientific information indicating that the requested revision may be warranted (FR 76 (87): 25660-25662, May 5, 2011). The U.S. Fish and Wildlife Service issued a similar 90-day finding and 12-month

determination on the petition on 4 August 2011, which stated their intent to assess critical habitat during the future planned status review for the leatherback sea turtle (FR 76 (150): 47133-47139, August 4, 2011). In January 2012, NMFS designated critical habitat for the leatherback in the Pacific Ocean (outside of the Study Area). The designation includes 16,910 $mi.^2$ (43,798 km^2) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 m depth contour; and 25,004 $mi.^2$ (64,760 km^2) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour (FR 77 (17): 4170-4201, January 26, 2012).

3.5.2.8.2 Habitat and Geographic Range

Limited information is available on the habitats used by post-hatchling and early juvenile leatherback sea turtles because these age classes are entirely oceanic (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992a). These life stages are restricted to waters warmer than 79°F (26°C); consequently, much time is spent in the tropics (Eckert 2002). They are not considered to associate with *Sargassum* or other flotsam, as is the case for all other sea turtle species (Horrocks 1987; Johnson 1989). Upwelling areas, such as equatorial convergence zones, serve as nursery grounds for post-hatchling and early juvenile leatherback sea turtles because these areas provide a high biomass of prey (Musick and Limpus 1997).

Late juvenile and adult leatherback sea turtles are known to range from mid-ocean to the continental shelf and nearshore waters (Grant and Ferrell 1993; Schroeder and Thompson 1987; Shoop and Kenney 1992). Juvenile and adult foraging habitats include both coastal and offshore feeding areas in temperate waters and offshore feeding areas in tropical waters (Frazier 2001). The movements of adult leatherback sea turtles appear to be linked to the seasonal availability of their prey and the requirements of their reproductive cycles (Collard 1990; Davenport and Balazs 1991). Leatherback sea turtles mate in waters adjacent to nesting beaches and along migratory corridors. They prefer adjacent waters to be deep, clean, and high energy, with either a deep-water oceanic approach or a shallow-water approach (Turtle Expert Working Group 2007). In the Study Area, nesting begins around March in the more northern nesting habitats and continues through July or August in Puerto Rico. Leatherback nesting season begins and ends a few months earlier than that of the other sea turtle species that nest in the Study Area. Females remain in the general vicinity of the nesting habitat between nestings, with total residence in the nesting and inter-nesting habitat lasting up to 4 months (Eckert et al. 1989a; Keinath 1993). After nesting, female leatherbacks migrate from tropical waters to more temperate latitudes, which support high densities of jellyfish prey in the summer.

Gulf Stream and North Atlantic Gyre Open Ocean Areas. The leatherback sea turtle is the most oceanic and wide-ranging of the sea turtles, undertaking extensive migrations in open-ocean waters (Hughes et al. 1998; Morreale et al. 1996). Leatherback sea turtles generally associate with oceanic front systems such as shelf breaks and the edges of oceanic gyre systems where prey is concentrated (Eckert 1993). In the Atlantic Ocean, female leatherback sea turtles have been tracked traveling from nesting beaches in the southern Caribbean due north to waters off Cape Breton Island, Nova Scotia, where they forage for many months (James et al. 2005c). Turtles tagged off Nova Scotia during the summer remained in eastern Canada and northeastern U.S. waters until fall. Most turtles left during October and all migrated south. Some turtles moved to waters near nesting beaches in Central and South America, while others migrated to open-ocean waters between 5° N and 23° N, or to continental shelf waters off the southeastern United States. In February and March, these turtles migrated back to the North Atlantic Ocean, typically arriving in June (James et al. 2005c).

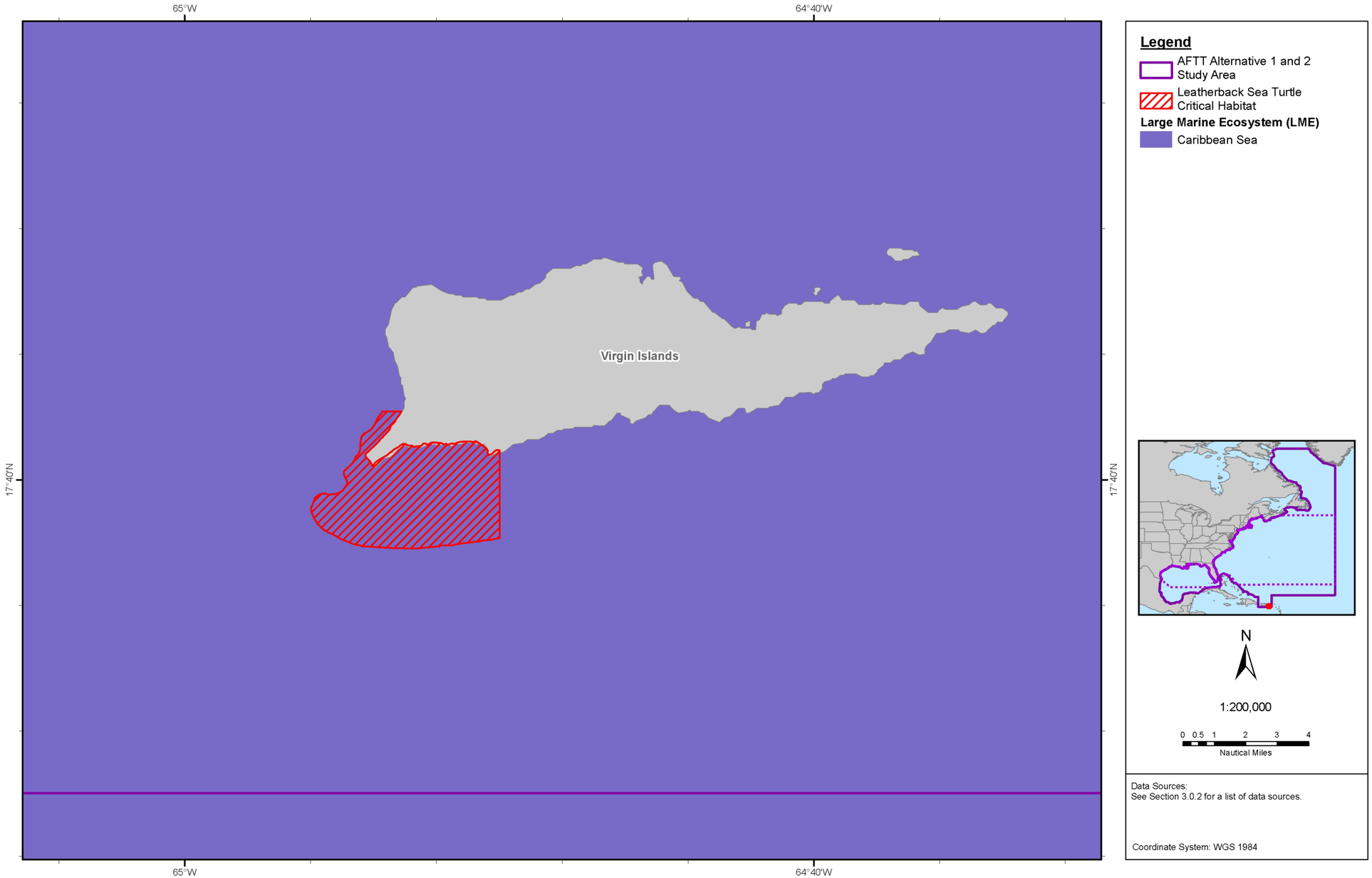

Figure 3.5-3: Critical Habitat Areas for Leatherback Sea Turtles in the Study Area
(the area to the north of purple line shown in this extent of this map)
AFTT: Atlantic Fleet Training and Testing

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Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems. Leatherback sea turtles from Western Atlantic stocks are seasonal visitors to the waters of the Scotian Shelf and Gulf of St. Lawrence, occupying shelf and slope waters off Canada and the United States during summer and fall (James et al. 2005c). Sightings and strandings in the Scotian Shelf Large Marine Ecosystem peak in early August, ranking this region as one of the highest in summer and fall densities of leatherbacks in the North Atlantic due to the abundance of jellyfish prey (James et al. 2006).

Northeast U.S. Continental Shelf Large Marine Ecosystem. Aerial surveys off the United States and Nova Scotia coasts sighted a few leatherback sea turtles beyond the 6,560 ft. (2,000 m) isobath, but most were found much nearer to the coast. Turtles were not observed in the winter, while densities increased southward in summer, with the highest concentrations in the coastal waters of Long Island Sound.

Southeast U.S. Continental Shelf Large Marine Ecosystem. Aerial surveys off the southeastern U.S. coast indicate that leatherback sea turtles occur in these waters throughout the year, with peak abundance in summer (Turtle Expert Working Group 2007). In spring, leatherback sea turtles appear to be concentrated near the coast, while other times of the year they are spread out as far as the Gulf Stream. Aerial surveys were conducted by the Navy from 2 August 2009 through 1 August 2010 off Jacksonville, Florida, to assess population abundance within their ranges as part of Atlantic Fleet Active Sonar Training monitoring requirements and to collect baseline data in support of the Undersea Warfare Training Range EIS. These surveys sighted 48 leatherback sea turtles, while simultaneous vessel surveys sighted four leatherback sea turtles (U.S. Department of the Navy 2010). Leatherbacks nest along the east coast of Florida from March through June, from Brevard County south to Palm Beach County in the Southeast U.S. Continental Shelf Large Marine Ecosystem (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c).

Caribbean Sea Large Marine Ecosystem. In the Caribbean, nesting occurs on beaches in Puerto Rico, the U.S. Virgin Islands, and the British Virgin Islands, as well as other islands in the Caribbean Sea Large Marine Ecosystem such as the Dominican Republic and Grenada (The State of the World's Sea Turtles Team 2006). Between 100 and 500 nests are estimated per year in Grenada, St. Kitts, Nevis, St. Lucia, St. Vincent, and the Grenadines (Eckert and Bjorkland 2004).

Gulf of Mexico Large Marine Ecosystem. Leatherback sea turtles occur regularly in the northern Gulf of Mexico, inhabiting deep off-shore waters in the vicinity of DeSoto Canyon for feeding, resting, and migrating (Davis et al. 2000; Landry and Costa 1999). Leatherback sea turtles may also occur in shallow waters on the continental shelf and have been observed feeding on dense aggregations of jellyfish in nearshore waters off the Florida panhandle, the Mississippi River Delta, and the Texas coast (Collard 1990).

3.5.2.8.3 Population and Abundance

Worldwide estimates of leatherback sea turtle populations have varied dramatically over the years as a result of both significant declines in the population and the discovery of new nesting colonies, particularly a colony in Gabon, Africa. Pritchard (1982) estimated 115,000 females worldwide with 60 percent nesting along the Pacific coast of Mexico. However, in 1995, a revised estimate incorporating information from 28 nesting beaches throughout the world yielded about 34,500 females, with a lower limit of about 26,200 and an upper limit of about 42,900 (Spotila et al. 1996). According to the International Union for Conservation of Nature, analysis of published estimates of global population sizes (Pritchard 1982; Spotila et al. 1996) suggest a reduction of greater than 70 percent of the global

population of adult females in less than one generation. The populations in the Pacific Ocean have declined drastically in the last decade, with current annual nesting female mortalities estimated at around 30 percent (Sarti Martinez 2000). The most recent population estimate for the North Atlantic alone is a range of 34,000 to 94,000 adult leatherbacks (Turtle Expert Working Group 2007). This wide range indicates the uncertainties in nest numbers and their extrapolation to adult population numbers.

Since 1989, there has been a substantial increase in the nesting population along the east coast of Florida (Turtle Expert Working Group 2007). This increase has coincided with an upsurge in the Caribbean population. Sporadic nesting also occurs in Georgia, South Carolina, as far north as North Carolina (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992a; Rabon et al. 2003; Schwartz 1989), and in the Gulf of Mexico on the Florida panhandle (Meylan et al. 1995).

Leatherback sea turtles from two of the stocks, the Florida and the Northern Caribbean stocks, nest on beaches in the jurisdiction of the United States. Only the following territories from the Northern Caribbean stock—Puerto Rico, the U.S. Virgin Islands, and the British Virgin Islands—fall within the boundaries of the Study Area. The greatest number of nests recorded within the Caribbean portion of the Study Area is from the Northern Caribbean Stock and occurred on the main island of Puerto Rico at Fajardo, with additional important nesting on the island of Culebra. Nesting increased considerably from 1978, when only nine nests were reported, to the period between 1997 and 2005, which averaged more than 600 nests annually. Increases in nesting similar to those observed in Puerto Rico have occurred at St. Croix since 1978. Nesting in Puerto Rico and the British Virgin Islands (Tortola) peaked in 2003 with 882 and 65 nests, respectively. Nesting in the U.S. Virgin Islands peaked in 2001, when 1,008 total nests were recorded, with 186 individual nesting females in St. Croix. The total number of nests for the Northern Caribbean stock was estimated at 1,600–3,400 for 2005, indicating that between 250 and 1,600 females nest annually, with a point estimate of 640 females. Overall, nesting populations have increased between 4 and 20 percent annually at these three locations (Turtle Expert Working Group 2007). Nesting also peaked for the Florida stock in 2001 with 935 nests. Nesting females from this stock lay between two and eight nests per season, with an average of just under five.

3.5.2.8.4 Predator and Prey Interactions

Leatherbacks lack the crushing chewing plates characteristic of hard-shelled sea turtles that feed on hard-bodied prey (National Marine Fisheries Service 2010). Instead, they have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied open-ocean prey such as jellyfish and salps (Aki et al. 1994; Bjorndal 1997; James and Herman 2001; Salmon et al. 2004). As with other sea turtle species, the leatherback's esophagus is lined with papillae (spiny projections) that trap food before swallowing. Leatherback sea turtles feed throughout the water column (Davenport 1988; Eckert et al. 1989b; Eisenberg and Frazier 1983; Grant and Ferrell 1993; James et al. 2005b; Salmon et al. 2004). Leatherback prey is predominantly jellyfish (Aki et al. 1994; Bjorndal 1997; James and Herman 2001; Salmon et al. 2004). In Atlantic Canada, leatherbacks feed on jellyfish of *Cyanea* spp. and *Aurelia* spp. (James and Herman 2001). In North Carolina and Georgia, turtles feed on cannonball jellies (*Stomolophus meleagris*) (Frick et al. 1999; Grant and Ferrell 1993). Patterns in feeding behavior off St. Croix, U.S. Virgin Islands, over a 24-hour period suggest an interaction between leatherback diving and vertical movements of the deep scattering layer (a horizontal zone of planktonic organisms), with more frequent and shallower dives at night compared with fewer and deeper day dives (Eckert et al. 1989b). Research in the feeding grounds of Georgia (Frick et al. 1999), North Carolina (Grant and Ferrell 1993), and Atlantic Canada (James and Herman 2001) has documented leatherbacks foraging on jellyfish at the surface.

Predators of leatherback sea turtles eggs include feral pigs, dogs, raccoons, ghost crabs, and fire ants. As with other sea turtle species, leatherback hatchlings are preyed on by birds and large fish such as tarpon and snapper. Sharks and killer whales are predators of adult leatherbacks (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c).

3.5.2.8.5 Species-Specific Threats

In addition to the general threats described in Section 3.5.2.3 (General Threats), bycatch in commercial fisheries is a particular threat to leatherback sea turtles. Incidental capture in longline and coastal gillnet fisheries has caused a substantial number of leatherback sea turtle deaths, likely because leatherback sea turtles dive to depths targeted by longline fishermen and are less maneuverable than other sea turtle species (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c). Shrimp trawls in the Gulf of Mexico have been estimated to capture about 3,000 leatherback sea turtles, with 80 of those sea turtles dying as a result. Along the Atlantic Ocean coast of the United States, NMFS estimated that about 800 leatherback sea turtles are captured in pelagic longline fisheries, bottom longline, and drift gillnet fisheries for sharks as well as lobster, deep-sea red crab, Jonah crab, dolphin fish and wahoo, and Pamlico Sound gillnet fisheries. Although most of these turtles are released alive, these fisheries kill about 300 leatherback sea turtles each year (National Marine Fisheries Service 2011b). Harvest of leatherback sea turtle eggs and adult turtles continues to be a threat in many parts of the world. Lastly, because leatherback sea turtle distribution is so closely associated jellyfish aggregations, any changes in jellyfish distribution or abundance may also be a threat to this species.

3.5.2.9 American Crocodile (*Crocodylus acutus*)

3.5.2.9.1 Status and Management

The American crocodile occurs within the jurisdictional boundaries of many different countries and ranges primarily in coastal waters throughout the Caribbean Sea and on the Pacific coast of Central and South America from Mexico to Ecuador. Population declines have been attributed to loss of habitat and extensive poaching for their hides. The American crocodile was listed as endangered under the ESA throughout its range in the year 1979 (FR 44 (58): 17710-17712, March 23, 1979). In 2007, the Florida population of American crocodiles was reclassified as a distinct population segment and was designated as threatened under the ESA (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c); the population outside of Florida remains listed as endangered under the ESA. Critical habitat (Figure 3.5-4) was designated for the Florida population in 1976 and was slightly modified in 1977 to include a more accurate map of the habitat (FR 41 (187): 41914-41916, September 24, 1976; FR 44 (244): 75074-75076, December 18, 1979). The essential physical and biological feature of this critical habitat is Florida Bay and its associated brackish marshes, swamps, creeks, and canals because the crocodile population is concentrated in these waters, and all known breeding females inhabit and nest here (FR 41 (187): 41914-41916, September 24, 1976).

3.5.2.9.2 Habitat and Geographic Range

The American crocodile lives primarily in sheltered, fresh, or brackish waters of mangrove-lined bays, mangrove swamps, tidal estuaries, creeks, and inland swamps (FR 41 (187): 41914-41916, September 24, 1976) but also occurs in rivers, lakes, and reservoirs. Crocodiles retreat farther inland during fall and winter. American crocodiles generally occur in water with salinities less than 20 parts per thousand; however they possess salt glands allowing them to excrete excess salt (U.S. Fish and Wildlife Service 1999) and occasionally inhabit more saline environments (e.g., Florida Bay) (Wheatley et al. 2012). Most crocodile sightings in more saline water are females attending nest sites, hatchlings at nest sites, or juveniles presumably avoiding adults (Mazzotti et al. 2007). Females construct nests on elevated, well-

drained sites near the water such as ditch banks and beaches. In the United States, artificial nests within berms along canal banks provide nearly ideal nesting conditions because they are elevated, well-drained, and near relatively deep, low-to-intermediate salinity water (Mazzotti et al. 2007). These artificial nesting habitats appear to be compensating for natural habitat elsewhere in Florida and account for much of the increase in nesting documented since 1975.

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystem. Within the United States, distribution is limited to the southern tip of mainland Florida and the Florida Keys (FR 70 (56): 15052-15063, March 24, 2005), which represents the northern extent of its range. Regular nesting occurs within Biscayne Bay on Florida's east coast, on the border between the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, and there is evidence that the species is expanding its range back into the Florida Keys (Mazzotti et al. 2007).

Most nesting occurs in the Everglades National Park, the cooling water discharge canal of the Turkey Point Power Plant (Homestead, Florida), and Crocodile Lake National Wildlife Refuge in the Gulf of Mexico Large Marine Ecosystem (Mazzotti et al. 2007). Currently, few crocodiles are found north of Biscayne Bay on the Atlantic Coast of Florida, or north of Sanibel Island on Florida's gulf coast (Florida Fish and Wildlife Conservation Commission nd). However, sightings have occurred in the coastal counties of mainland Florida from as far north as Indian River County on the east coast (FR 72 (53): 13027-13040, March 20, 2007) and Lee County on the west coast (U.S. Fish and Wildlife Service 1999).

The American crocodile is known to inhabit inshore marine waters and "are not predisposed to travel across the open ocean" (FR 72 (53): 13027-13040, March 20, 2007). Instead, they prefer calm warm waters with minimal wave action, and most frequently occur in sheltered, mangrove-lined estuaries (Mazzotti 1983). No available evidence suggests that crocodiles cross the Florida Straits (FR 72 (53): 13027-13040, March 20, 2007). Therefore, this species is not expected to occur in offshore areas within the Study Area.

3.5.2.9.3 Population and Abundance

In 1976, the American crocodile population in Florida was estimated to be between 200 and 300 (FR 40 (242): 58308-58312, December 16, 1975), with only 10 to 20 breeding females estimated in 1975 (FR 40 (242): 58308-58312, December 16, 1975). An estimated 20 nests were laid in Florida in 1975. As a result of conservation measures, including habitat protection, the number of nests increased to 85 in 2004 (Mazzotti et al. 2007). In 2007, the population was estimated to be between 1,400 and 2,000, not including hatchlings (FR 72 (53): 13027-13040, March 20, 2007). The species is gradually recovering in the United States, but survey data from Central and South America are relatively poor.

3.5.2.9.4 Predator and Prey Interactions

The American crocodile typically forages from shortly before sunset to shortly after sunrise (U.S. Fish and Wildlife Service 1999). During these times, crocodiles feed on any prey items that can be caught and overpowered (Mazzotti et al. 2007). Adults feed on fish, crabs, birds, turtles, snakes, and small mammals, while young feed on aquatic invertebrates and small fish.

Fire ants are predators of crocodile eggs. Crocodile hatchlings may be preyed on by large fish, birds, other large reptiles and amphibians, or even other crocodiles. Larger juvenile and adult crocodiles have no known predators (Mazzotti et al. 2007).

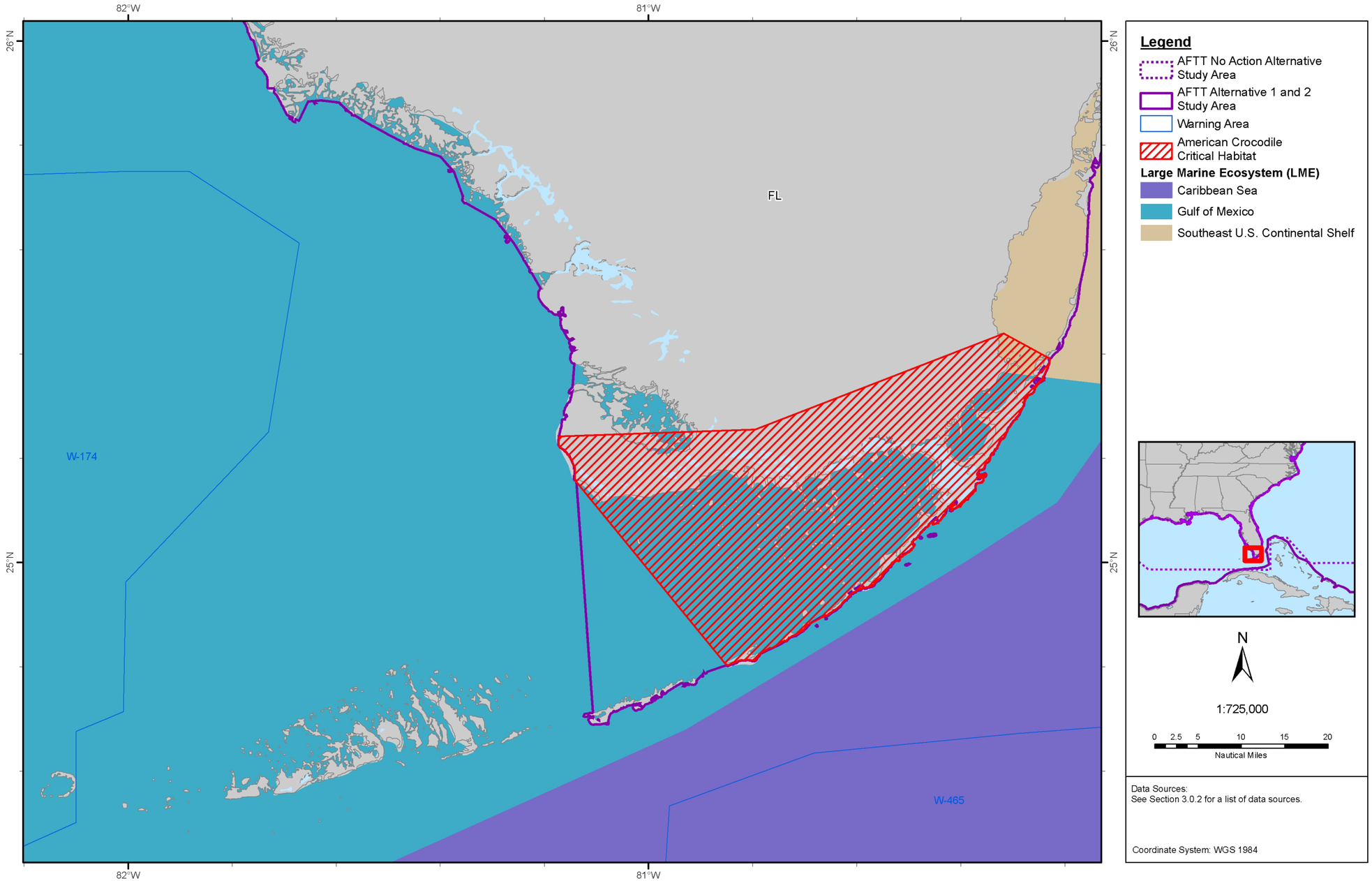

Figure 3.5-4: Critical Habitat Areas for American Crocodiles in the Study Area
AFTT: Atlantic Fleet Training and Testing

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3.5.2.9.5 Species-Specific Threats

Habitat loss is a primary threat to the American crocodile. Development in coastal areas of Florida diminishes American crocodile habitat and restricts the species' breeding range. Erosion or sea level rise may further increase vulnerability of nesting sites. In addition to direct habitat loss, alteration of habitat is a concern. Development restricts freshwater flow into swamps and estuaries, which may limit crocodile growth, survival, and abundance (Mazzotti et al. 2007). Collisions with automobiles are also a documented cause of mortality in Florida's southernmost Miami-Dade and Monroe Counties (Mazzotti et al. 2007).

3.5.2.10 American Alligator (*Alligator mississippiensis*)

3.5.2.10.1 Status and Management

American alligator populations began to decline in the late 1800s, when unregulated hunting for the hides became prevalent, with population numbers close to extinction in some areas (Savannah River Ecology Laboratory 2012a). A hunting ban in the 1950s and other recovery efforts allowed the species to rebound (FR 52 (107): 21059-21064, June 4, 1987). American alligators were listed as an endangered species in 1967 under a law that preceded the ESA of 1973 (National Park Service 2012).

In 1987, the alligator was declared, "no longer biologically threatened or endangered" (FR 52 (107): 21059-21064, June 4, 1987). However, to ensure protections to the American crocodile and other endangered crocodilians, the American alligator is listed under the ESA classification of, "threatened due to similarity of appearance," to the American crocodile (FR 52 (107): 21059-21064, June 4, 1987). Hunting and trade of the American alligator are now permitted and regulated by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2008).

3.5.2.10.2 Habitat and Geographic Range

The American alligator's primary habitats are freshwater swamps and marshes but may also include lakes and rivers. Alligators lack lingual salt glands permitting this species a limited capacity to tolerate highly saline environments (Mazzotti and Dunson 1989). In coastal areas, alligators move between freshwater and estuarine waters. Size and sex influences the habitat that alligators reside in; adult males generally prefer deep, open water within coastal water bodies, while adult females prefer coastal open water habitats only during the spring breeding season. After the breeding season, adult females prefer to move to lake and marsh edges during nesting and hatching seasons (Savannah River Ecology Laboratory 2012b). After juveniles have hatched, they remain with the female for up to a year or more for protection during this vulnerable life stage (National Park Service 2012; Savannah River Ecology Laboratory 2012b). Smaller alligators prefer wetlands with dense vegetation for protection and prey advantage (Savannah River Ecology Laboratory 2012a).

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. The American alligator resides along the southeastern coast of the United States from North Carolina south through Florida and westward to the Texas coast (Elsey and Woodward 2010).

3.5.2.10.3 Population and Abundance

Following federal legislation, including an ESA listing (FR 52 (107): 21059-21064, June 4, 1987) and the Lacey Act of 1981, alligator populations have rebounded to an estimated total in the millions of individuals (FR 52 (107): 21059-21064, June 4, 1987; (Savannah River Ecology Laboratory 2012b).

3.5.2.10.4 Predator and Prey Interactions

American alligators are opportunistic carnivores. Adults eat a variety of animals, including large fish, turtles, snakes, birds, and small mammals. Hatchlings and smaller alligators eat insects, crayfish, snails and other invertebrates, small fish, and amphibians (Savannah River Ecology Laboratory 2012a).

Alligator eggs are often preyed upon by raccoons, opossums, skunks, pigs, and other terrestrial nest predators. Similarly, young alligators are preyed upon by raccoons, crabs, large snakes, turtles, birds, and even fish (Savannah River Ecology Laboratory 2012b).

3.5.2.10.5 Species-Specific Threats

As described in Section 3.5.2.10.1 (Status and Management), the American alligator population has rebounded after a hunting ban and other recovery efforts. Continuing threats to the American alligator are the same as those described in Section 3.5.2.3.2 (Crocodilians).

3.5.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially could impact sea turtles and other marine reptiles known to occur within the Study Area. Tables 2.8-1 through 2.8-3 present the training and testing activity locations for the No Action Alternative, Alternative 1, and the Preferred Alternative, Alternative 2 (including number of activities and ordnance expended). General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Table F-1 in Appendix F shows all warfare areas and associated stressors that were considered for analysis of all biological resources. Stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to sea turtles and other marine reptiles discussed in Section 3.5.2 (Affected Environment), the stressors applicable to sea turtles in the Study Area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources, explosives, pile driving, swimmer defense airguns, weapons firing, launch, and impact noise, vessel noise, aircraft noise)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables, guidance wires, and parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary stressors

As described in Section 3.0.3 (Ecological Characterization of the Study Area), the Study Area does not extend above the mean high tide line; therefore, land-based stressors and potential impacts on nesting habitats are not discussed in this document. Because the American crocodile and the American alligator are primarily freshwater and estuarine species, they are unlikely to be exposed to many of the stressors associated with Navy training and testing activities which occur in the marine environment in the nearshore and offshore waters of the Northwestern Atlantic Ocean and Gulf of Mexico. The Navy determined through a screening process that, based on the geographic overlap between training and testing activities and the American crocodile and American alligator, only acoustic stressors are applicable and will be analyzed below. All other stressors would not overlap with American crocodile or American alligator habitat and therefore have been excluded from further analysis.

Each of these components is carefully analyzed for potential impacts on sea turtles and other marine reptiles contained in this section. The specific analysis of the training and testing activities considers the components used, the context of geographic location, and overlap of the species. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.5.3.1 Acoustic Stressors

3.5.3.1.1 Sound Producing and Explosive Activities

Assessing whether sounds may disturb or injure an animal involves understanding the characteristics of the acoustic sources, the animals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals.

The methods used to predict acoustic effects on sea turtles and crocodilians builds upon the Conceptual Framework for Assessing Effects from Sound Producing Activities (Section 3.0.5.7.1). Additional research specific to sea turtles and crocodilians is presented where available; however, research regarding the impacts of acoustic stressors on crocodilians is limited.

3.5.3.1.2 Analysis Background and Framework

A range of impacts could occur to a marine reptile depending on the sound source. The impacts of exposure to non-explosive, sound-producing activities or to sounds produced by an explosive detonation could include permanent or temporary hearing loss, changes in behavior, and physiological stress. In addition, potential impacts from an explosive impulse can range from physical discomfort to nonlethal and lethal injuries. Immediate nonlethal injury includes slight injury to internal organs and injury to the auditory system, which could reduce long-term fitness. Immediate lethal injury would result from massive combined trauma to internal organs as a direct result of proximity to the point of detonation.

3.5.3.1.2.1 Direct Injury

Potential direct injury from non-impulsive sound sources, such as sonar, is unlikely due to relatively lower peak pressures and slower rise times than potentially injurious sources such as explosives and impact pile driving. Non-impulsive sources also lack the strong shock waves that are associated with explosions. Therefore, primary blast injury and barotrauma would not occur due to exposure to non-impulsive sources such as sonar and are only considered for explosive detonations.

The potential for trauma in sea turtles exposed to impulsive sources (e.g., explosions) has been inferred from tests of submerged terrestrial mammals exposed to underwater explosions (Ketten et al. 1993; Richmond et al. 1973; Yelverton et al. 1973). The effects of an underwater explosion on a sea turtle depend on multiple factors, including size, type, and depth of both the animal and the explosive; depth of the water column; and distance from the charge to the animal. Smaller animals would generally be more susceptible to injury. The compression of blast-sensitive, gas-containing organs when an animal increases depth reduces likelihood of injury to these organs. The location of the explosion in the water column and the underwater environment determines whether most energy is released into the water or the air and influences the propagation of the blast wave. The potential for trauma to crocodilians due to explosions is not evaluated because no use of explosives is proposed in crocodilian habitats.

Primary Blast Injury and Barotrauma

The greatest potential for direct, nonauditory tissue impacts is primary blast injury and barotrauma after exposure to the shock waves of high-amplitude impulsive sources, such as explosions. Primary blast injury refers to those injuries that result from the initial compression of a body exposed to the high pressure of a blast or shock wave. Primary blast injury is usually limited to gas-containing structures (e.g., lung and gut) and the pressure-sensitive components of the auditory system (discussed below) (Craig and Hearn 1998; Craig Jr. 2001; Phillips and Richmond 1990), although additional injuries could include concussive brain damage and cranial, skeletal, or shell fractures (Ketten 1995). Barotrauma refers to injuries caused when large pressure changes occur across tissue interfaces, normally at the boundaries of air-filled tissues such as the lungs. Primary blast injury to the respiratory system, as measured in terrestrial mammals, may consist of lung bruising, collapsed lung, traumatic lung cysts, or air in the chest cavity or other tissues (Phillips and Richmond 1990). These injuries may be fatal, depending on the severity of the trauma. Rupture of the lung may introduce air into the vascular system, possibly producing air blockage that can cause a stroke or heart attack by restricting oxygen delivery to these organs. Although often secondary in life-threatening severity to pulmonary blast trauma, the gastrointestinal tract can also suffer bruising and tearing from blast exposure, particularly in air-containing regions of the tract. Potential traumas include internal bleeding, bowel perforation, tissue tears, and ruptures of the hollow abdominal organs. Although hemorrhage of solid organs (e.g., liver, spleen, and kidney) from blast exposure is possible, rupture of these organs is rarely encountered. Nonlethal injuries could increase a sea turtle's risk of predation, disease, or infection.

Auditory Trauma

Components of the auditory system that detect smaller or more gradual pressure changes can also be damaged when overloaded at high pressures with rapid rise times. Rupture of the eardrum, while not necessarily a serious or life-threatening injury, may lead to permanent hearing loss (Ketten 1995, 1998). No data exist to correlate the sensitivity of the sea turtle eardrum and middle and inner ear to trauma from shock waves associated with underwater explosions (Viada et al. 2008).

The specific impacts of bulk cavitation on sea turtles are unknown. Section 3.0.5.3.1.2 (Explosives) explains cavitation following an explosive detonation. The presence of a sea turtle within the cavitation region created by the detonation of small charges could annoy, injure, or increase the severity of the injuries caused by the shock wave, including injuries to the auditory system or lungs. Presence within the area of cavitation from a large charge, such as those used in ship shock trials, is expected to be an area of almost complete total physical trauma for smaller animals (Craig and Rye 2008). An animal at (or near) the cavitation closure depth would be subjected to a short-duration ("water hammer") pressure pulse; however, direct shock wave impacts alone would be expected to cause auditory system injuries and could cause internal organ injuries.

3.5.3.1.2.2 Hearing Loss

Hearing loss could effectively reduce the distance over which marine reptiles can detect biologically relevant sounds. Both auditory trauma (a direct injury discussed above) and auditory fatigue may result in hearing loss, but the mechanisms responsible for auditory fatigue differ from auditory trauma. Hearing loss due to auditory fatigue does not equate to "deafness" or total hearing loss. Hearing loss due to auditory fatigue is also known as threshold shift, a reduction in hearing sensitivity at certain frequencies. Threshold shift is the difference between hearing thresholds measured before and after an intense, fatiguing sound exposure. Threshold shift occurs when hair cells in the ear fatigue, causing them to become less sensitive over a small range of frequencies related to the sound source to which an animal was exposed. The amount of threshold shift depends on the amplitude, duration, frequency, and

temporal pattern of the sound exposure. No studies are published on inducing threshold shift in sea turtles; therefore, the potential for the impact on sea turtles or crocodilians must be inferred from studies of threshold shift in other animals.

Temporary threshold shift (TTS) is a hearing loss that recovers to the original hearing threshold over time. An animal may not even be aware of a TTS. It does not become deaf, but requires a louder sound stimulus (related to the amount of TTS) to detect a sound within the affected frequencies. TTS may last several minutes to several days, depending on the intensity and duration of the sound exposure that induced the threshold shift (including multiple exposures).

Permanent threshold shift (PTS) is a permanent hearing loss at a certain frequency range. PTS is nonrecoverable due to the destruction of tissues within the auditory system. The animal does not become deaf but requires a louder sound stimulus (related to the amount of PTS) to detect a sound within the affected frequencies. As the name suggests, the effect is permanent.

3.5.3.1.2.3 Auditory Masking

Auditory masking occurs when a sound prevents or limits the distance over which an animal detects other biologically relevant sounds. When a noise has a sound level above the sound of interest, and in a similar frequency band, auditory masking could occur (Section 3.0.5.7.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities). Any sound above ambient noise levels and within an animal's hearing range may potentially cause masking. The degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to actually cause any substantial masking, whereas a louder noise may mask sounds over a wider frequency range. In addition, a continuous sound would have more potential for masking than a sound with a low duty cycle. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 μPa, especially at lower frequencies (below 100 Hz); inshore, ambient noise levels, especially around busy ports, can exceed 120 dB re 1 μPa.

Unlike auditory fatigue, which always results in a localized stress response, behavioral changes resulting from auditory masking may not be coupled with a stress response. Another important distinction between masking and hearing loss is that masking only occurs in the presence of the sound stimulus, whereas hearing loss can persist after the stimulus is gone.

Little is known about how sea turtles use sound in their environment. Based on knowledge of their sensory biology (Bartol and Ketten 2006; Bartol and Musick 2003; Ketten and Moein-Bartol 2006; Levenson et al. 2004), sea turtles may detect objects within the water column (e.g., vessels, prey, predators) via some combination of auditory and visual cues. However, research examining the ability of sea turtles to avoid collisions with vessels shows they may rely more on their vision than auditory cues (Hazel et al. 2007). Similarly, while sea turtles may rely on acoustic cues to identify nesting beaches, they appear to rely on other nonacoustic cues for navigation, such as magnetic fields (Lohmann 1991; Lohmann and Lohmann 1996b) and light (Avens and Lohmann 2003). Additionally, they are not known to produce sounds underwater for communication. As a result, sound may play a limited role in a sea turtle's environment. Therefore, the potential for masking may be limited.

Crocodilians rely on sound for communication, using a repertoire of aerial contact calls, threat hisses, and bellows typically at the water surface (Vergne et al. 2009). Bellows attract other crocodilians and can stimulate a bellowing chorus. The active space for low-frequency American alligator bellows was estimated to be 169 m in air and 1.5 km in water (Todd 2007). Based on the types of sounds used for

crocodilian communication, the potential for masking may exist if crocodilians are exposed to lower frequency aerial or in-water noise.

3.5.3.1.2.4 Physiological Stress

Marine reptiles may exhibit a behavioral response or combinations of behavioral responses upon exposure to anthropogenic sounds. If a sound is detected, a stress response (i.e., startle or annoyance) or a cueing response (based on a past stressful experience) can occur. Marine reptiles naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur in the absence of human activity.

Immature Kemp's ridley turtles show physiological responses to the acute stress of capture and handling through increased levels of the stress hormone corticosterone, along with biting and rapid flipper movement (Gregory and Schmid 2001). Captive olive ridley hatchlings showed heightened blood glucose levels indicating physiological stress (Rees et al. 2008; Zenteno et al. 2007). Repeated exposure to stressors, including human disturbance such as vessel disturbance and anthropogenic sound, may result in negative consequences to the health and viability of an individual or population (Gregory and Schmid 2001). One factor to consider when predicting a stress or cueing response is whether an animal is naïve or has prior experience with a stressor. Prior experience with a stressor may be of particular importance because repeated experience with a stressor may dull the stress response via acclimation.

3.5.3.1.2.5 Behavioral Reactions

The response of a marine reptile to an anthropogenic sound would likely depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). Distance from the sound source and whether it is perceived as approaching or moving away could also affect the way a marine reptile responds to a sound. Potential behavioral responses to anthropogenic sound could include startle reactions, disruption of feeding, disruption of migration, changes in respiration, alteration of swim speed, alteration of swim direction, and area avoidance.

There are limited studies of sea turtle responses to sounds. A few studies examined sea turtle reactions to airguns, which produce broadband impulsive sound. O'Hara and Wilcox (1990) attempted to create a sound barrier at the end of a canal using seismic airguns. They reported that loggerhead turtles kept in a 984 ft. x 148 ft. (300 m x 45 m) enclosure in a 10 m deep canal maintained a standoff range of 98 ft. (30 m) from airguns fired simultaneously at intervals of 15 seconds (s) with strongest sound components within the 25–1,000 Hz frequency range. McCauley et al. (2000) estimated that the received level at which turtles avoided sound in the O'Hara and Wilcox (1990) experiment was 175–176 dB re 1 µPa root mean square.

Moein Bartol et al. (1995) investigated the use of air guns to repel juvenile loggerhead sea turtles from hopper dredges. Sound frequencies of the airguns ranged from 100 to 1,000 Hz at three levels: 175, 177, and 179 dB re 1 µPa at 1 m. The turtles avoided the airguns during the initial exposures (mean range of 24 m), but additional trials several days afterward did not elicit statistically significant avoidance. They concluded that this was due to either habituation or a temporary shift in the turtles' hearing capability.

McCauley et al. (2000) exposed caged green and loggerhead sea turtles to an approaching-departing single air gun to gauge behavioral responses. The trials showed that above a received level of 166 dB re 1 µPa (root mean square), the turtles noticeably increased their swimming activity compared to nonoperational periods, with swimming time increasing as air gun levels increased during approach. Above 175 dB re 1 µPa (root mean square), behavior became more erratic, possibly indicating the turtles were in an agitated state (McCauley et al. 2000). The authors noted that the point at which the turtles showed the more erratic behavior and exhibited possible agitation would be expected to approximate the point at which active avoidance would occur for unrestrained turtles (McCauley et al. 2000).

No obvious avoidance reactions by free-ranging sea turtles, such as swimming away, were observed during a multi-month seismic survey using airgun arrays, although fewer sea turtles were observed when the seismic airguns were active than when they were inactive (Weir 2007). The author noted that sea state and the time of day affected both airgun operations and sea turtle surface basking behavior, making it difficult to draw conclusions from the data. However, DeRuiter and Doukara (2012) noted several possible startle or avoidance reactions to a seismic airgun array in the Mediterranean by basking loggerhead turtles.

No studies have been performed to examine the response of sea turtles to sonar. However, based on their limited range of hearing, they may respond to sources operating below 2 kHz but are unlikely to sense higher frequency sounds (Section 3.5.2.2, Hearing and Vocalization).

Data regarding crocodilian responses to anthropogenic sound is limited. Based on their hearing range, they may respond to aerial and in-water sounds at lower frequencies (less than two kHz).

3.5.3.1.2.6 Repeated Exposures

Repeated exposures of an individual to multiple sound-producing activities over a season, year, or life stage could cause reactions with energetic costs that can accumulate over time to cause long-term consequences for the individual. Conversely, some sea turtles may habituate to or become tolerant of repeated exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat, such as high levels of ambient noise found in areas of high vessel traffic (Hazel et al. 2007). In an experiment, after initial avoidance reactions, loggerhead sea turtles habituated to repeated exposures to airguns of up to a source level of 179 dB re 1 µPa in an enclosure. The habituation behavior was retained by the sea turtles when exposures were separated by several days (Moein et al. 1994).

3.5.3.1.3 Acoustic and Explosive Thresholds and Criteria

The Navy considers two primary categories of sound sources in its analyses of sound impacts on sea turtles: impulsive sources (e.g., explosives, airguns, weapons firing, and impact pile driving) and non-impulsive sources (e.g., sonar, pingers, and countermeasure devices). General definitions of impulsive and non-impulsive sound sources are provided below. Acoustic impacts criteria and thresholds were developed in cooperation with NMFS for sea turtle exposures to various sound sources. These acoustic impacts criteria are summarized in Table 3.5-2 and Table 3.5-3 and are discussed below. These criteria can be used to estimate the number of sea turtles impacted by testing and training activities that emit sound or explosive energy, as well as the severity of the immediate impacts. These criteria are used to quantify impacts from explosives, swimmer defense airguns, pile driving, sonar, and other active acoustic sources. These criteria are also useful for qualitatively assessing activities that indirectly impart sound to water, such as firing of weapons and aircraft flights.

The criteria presented below are only applicable to sea turtles. Empirical studies and data from which to derive criteria for crocodilians is unavailable; therefore, impacts on the American crocodile and American alligator will be qualitatively discussed based on the limited information available about crocodilian hearing.

Table 3.5-2: Sea Turtle Impact Threshold Criteria for Non-Impulsive Sources

Physiological Thresholds		
Onset[1] PTS	**Onset[1] TTS**	**Injury (Vibratory Pile Driving)**
198 dB SEL (T^2)	178 dB SEL (T^2)	190 dB re 1 μPa SPL root mean square

dB: decibels; μPa: micropascals; PTS: permanent threshold shift; SEL: sound exposure level; SPL: sound pressure level; TTS: temporary threshold shift

[1] When the cetacean criteria were weighted to correlate with Type II frequency weighting, the turtle threshold was inadvertently lowered by 17 dB, even though Type II weighting is not applied to sea turtle hearing. This resulted in an increased number of model-predicted turtle impacts, although the actual impacts are expected to be substantially lower.

[2] (T): Turtle weighting function

Table 3.5-3: Sea Turtle Impact Threshold Criteria for Impulsive Sources

Impulsive Sound Exposure Impact	Threshold Value
Onset Mortality[1] (1% Mortality Based on Extensive Lung Injury)	$= 91.4M^{1/3}\left(1+\frac{D_{Rm}}{10.081}\right)^{1/2} Pa-s$
Onset Slight Lung Injury[1]	$= 39.1M^{1/3}\left(1+\frac{D_{Rm}}{10.081}\right)^{1/2} Pa-s$
Onset Slight Gastrointestinal Tract Injury	237 dB re 1 μPa SPL (104 psi)
Onset PTS[3]	187 dB re 1 μPa^2-s SEL (T^2) or 230 dB re 1 μPa Peak SPL
Onset TTS[3]	172 dB re 1 μPa^2-s SEL (T^2) or 224 dB re 1 μPa Peak SPL
Injury (Impact Pile Driving and Airguns)	190 dB re 1 μPa SPL root mean square[4]

dB: decibels, μPa: micropascals; PTS: permanent threshold shift, SEL: sound exposure level, SPL: sound pressure level TTS: temporary threshold shift

[1] M = mass of animals (kg) as shown for each species in Table 3.5-4, D_{Rm} = depth of animal (m). Impulse calculated over a delivery time that is the lesser of either the initial positive pressure duration or 20% of the natural period of the assumed-spherical lung adjusted for animal size and depth.

[2] Turtle weighting function

[3] When the cetacean criteria were weighted to correlate with Type II frequency weighting, the turtle onset PTS and onset TTS SEL-based thresholds were inadvertently lowered, even though Type II weighting is not applied to sea turtle hearing. This resulted in an increased number of model-predicted turtle impacts, although the actual impacts are expected to be substantially lower.

[4] The time interval for determining the root mean square is that which contains 90% of the total energy within the envelope of the pulse. This windowing procedure for impulse signals removes uncertainty about where to set the exact temporal beginning or end of the signal, which may be obscured by ambient noise.

Table 3.5-4: Species-Specific Masses for Determining Onset of Extensive and Slight Lung Injury Thresholds

Common Name	Juvenile Mass (kg)	Reference
Loggerhead Turtle	8.4	Southwood et al (2007)
Green Turtle	8.7	Wood and Wood (1993)
Hawksbill Turtle	7.4	Okuyama et al. (2010)
Kemp's Ridley Turtle	6.3	McVey and Wibbels (1984) and Caillouet (1986)
Leatherback Turtle	34.8	Jones (2009)

3.5.3.1.3.1 Categories of Sounds as Defined for Thresholds and Criteria

Categories of sound are discussed in Section 3.0.4 (Acoustic and Explosives Primer). Impulsive and non-impulsive sounds are described again below with details specific to assigning acoustic and explosive criteria for predicting impacts on sea turtles.

Impulsive Sounds

Impulsive sounds (including explosions) have a steep pressure rise or rapid pressure oscillation, which is the primary reason the impacts of these sounds are considered separately from non-impulsive sounds. Impulsive sounds usually rapidly decay with only one or two peak oscillations and are of very short duration (usually 0.1 s or shorter). Rapid pressure changes may produce mechanical damage to the ear or other structures that would not occur with slower rise times found in non-impulsive signals. Impulsive sources analyzed in this document include explosives, airguns, sonic booms, weapons firing, and impact pile driving.

Non-Impulsive Sounds

Non-impulsive sounds typically contain multiple pressure oscillations without a rapid rise time, although the total duration of the signal may still be quite short (0.1 s or shorter for some high frequency sources). Such sounds are typically characterized by a root mean square average sound pressure level or energy level over a specified period. Sonar and other active acoustic sources (e.g., pingers) are analyzed as non-impulsive sources in this document.

Intermittent non-impulsive sound sources produce sound for only a small fraction of the time that the source is in use (a few seconds or a fraction of a second, e.g., sonar and pingers), with longer silent periods in between the sound. Continuous sources are those that transmit sound for the majority of the time they are being used, often for many minutes, hours, or days. Vibratory pile driving, vessel noise, and aircraft noise are continuous noise sources analyzed in this document.

3.5.3.1.3.2 Criteria for Mortality and Injury from Explosions

There is a considerable body of laboratory data on actual injuries from impulsive sounds, usually from explosive pulses, obtained from tests with a variety of vertebrate species (Goertner et al. 1994; Richmond et al. 1973; Yelverton et al. 1973). Based on these studies, potential impacts, with decreasing likelihood of serious injury or lethality, include onset of mortality, onset of slight lung injury, and onset of slight gastrointestinal injury.

In the absence of data specific to sea turtles, criteria developed to assess impacts on protected marine mammals are also used to assess impacts on protected sea turtles. These criteria are discussed below.

Criteria for Mortality and Slight Lung Injury

In air or submerged, the most commonly reported internal bodily injury due to explosive detonations is hemorrhaging in the fine structure of the lungs. The likelihood of internal bodily injury is related to the received impulse of the underwater blast (pressure integrated over time), not peak pressure or energy (Richmond et al. 1973; Yelverton and Richmond 1981; Yelverton et al. 1973; Yelverton et al. 1975). Therefore, impulse is used as a metric upon which internal organ injury can be predicted. Onset mortality and onset slight lung injury are defined as the impulse level that would result in 1 percent mortality (most survivors have moderate blast injuries and should survive) and zero percent mortality (recoverable, slight blast injuries) in the exposed population, respectively. Criteria for onset mortality and onset slight lung injury were developed using data from explosive impacts on mammals (Yelverton and Richmond 1981).

The impulse required to cause lung damage is related to the volume of the lungs. The lung volume is related to both the size (mass) of the animal and compression of gas-filled spaces at increasing water depth. Turtles have relatively low lung volume to body mass and a relatively stronger anatomical structure compared to mammals; therefore, application of the criteria derived from studies of impacts of explosives on mammals is conservative.

Table 3.5-4 provides a nominal conservative body mass for each sea turtle species based on juvenile mass. Juvenile body masses were selected for analysis given the early rapid growth of these reptiles (newborn turtles weigh less than 0.5 percent of maximum adult body mass). In addition, small turtles tend to remain at shallow depths in the surface pressure release zone, reducing potential exposure to injurious impulses. Therefore, use of hatchling weight would provide unrealistically low thresholds for estimating injury to sea turtles. The use of juvenile body mass rather than hatchling body mass was chosen to produce reasonably conservative estimates of injury.

The scaling of lung volume to depth is conducted for all species since data come from experiments with terrestrial animals held near the water's surface. The calculation of impulse thresholds consider depth of the animal to account for compression of gas-filled spaces that are most sensitive to impulse injury. The impulse required for a specific level of injury (impulse tolerance) is assumed to increase proportionally to the square root of the ratio of the combined atmospheric and hydrostatic pressures at a specific depth with the atmospheric pressure at the surface (Goertner 1982). Additionally, to reach the threshold for onset slight lung injury or onset mortality, the critical impulse value must be delivered during a time period that is the lesser of either the initial positive pressure duration or 20 percent of the natural period of the assumed-spherical lung adjusted for size and depth of the animal. Therefore, as depth increases or animal size decreases, impulse delivery time decreases (Goertner 1982).

Very little information exists regarding the impacts of underwater detonations on sea turtles. Impacts on sea turtles from explosive removal operations range from noninjurious impacts (e.g., acoustic annoyance, mild tactile detection, or physical discomfort) to varying levels of injury (i.e., nonlethal and lethal injuries) (e.g., Klima et al. 1988; Viada et al. 2008). Often, impacts of explosive events on turtles must be inferred from documented impacts on other vertebrates with lungs or other-gas containing organs, such as mammals and most fishes (Viada et al. 2008). The methods used by Goertner (1982) to develop lung injury criteria for marine mammals may not be directly applicable to sea turtles, as it is not known what degree of protection to internal organs from the shock waves is provided to sea turtles by their shell (Viada et al. 2008). However, the general principles of the Goertner model are applicable and should provide a protective approach to assessing potential impacts on sea turtles. The Goertner method predicts a minimum primary positive impulse value associated with onset of slight lung injury

and onset of mortality, adjusted for assumed lung volume (correlated to animal mass) and depth of the animal. These equations are shown in Table 3.5-3.

Criteria for Onset of Gastrointestinal Tract Injury

Without data specific to sea turtles, data from tests with terrestrial animals are used to predict onset of gastrointestinal tract injury. It is shown that gas-containing internal organs, such as lungs and intestines, were the principle damage sites from shock waves in submerged terrestrial mammals (Clark and Ward 1943; Greaves et al. 1943; Richmond et al. 1973; Yelverton et al. 1973). Furthermore, slight injury to the gastrointestinal tract may be related to the magnitude of the peak shock wave pressure over the hydrostatic pressure and would be independent of the animal's size and mass (Goertner 1982). Slight contusions to the gastrointestinal tract were reported during small charge tests (Richmond et al. 1973), when the peak was 237 dB re 1 µPa. Therefore, this value is used to predict onset of gastrointestinal tract injury in sea turtles exposed to explosions.

3.5.3.1.3.3 Frequency Weighting

Animals generally do not hear equally well across their entire hearing range. Several studies using green, loggerhead, and Kemp's ridley turtles suggest sea turtles are most sensitive to low-frequency sounds, although this sensitivity varies slightly by species and age class (Bartol and Ketten 2006; Bartol et al. 1999; Lenhardt 1994; Ridgway et al. 1969). Sea turtles possess an overall hearing range of about 100 Hz to 1 kHz, with an upper limit of 2 kHz (Bartol and Ketten 2006; Bartol et al. 1999; Lenhardt 1994; Ridgway et al. 1969).

Because hearing thresholds are frequency dependent, an auditory weighting function was developed for sea turtles (turtle-weighting, or T-weighting). The T-weighting function simply defines lower and upper frequency boundaries beyond which sea turtle hearing sensitivity decreases. The single frequency cutoffs at each end of the frequency range where hearing sensitivity begins to decrease are based on the most liberal interpretations of sea turtle hearing abilities (10 Hz and 2 kHz). These boundaries are precautionary and exceed the demonstrated or anatomy-based hypothetical upper and lower limits of sea turtle hearing. Figure 3.5-5 shows the sea turtle auditory weighting function with lower and upper boundaries of 10 Hz and 2 kHz, respectively.

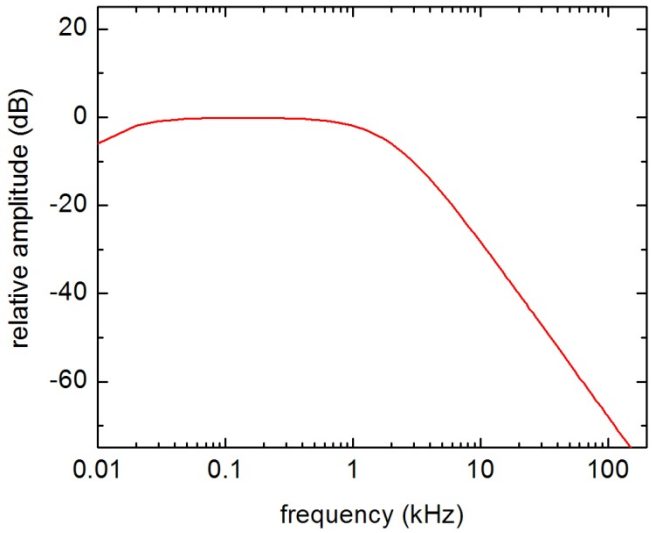

Figure 3.5-5: Auditory Weighting Function for Sea Turtles (T-Weighting)

The T-weighting function adjusts the received sound level based on sensitivity to different frequencies, emphasizing frequencies to which sea turtles are most sensitive and reducing emphasis on frequencies outside of their estimated useful range of hearing. For example, a 160 dB re 1 µPa tone at 10 kHz, far outside sea turtle best range of hearing, is estimated to be perceived by a sea turtle as a 130 dB re 1 µPa sound (i.e., 30 dB lower). Stated another way, a sound outside of the range of best hearing would have to be more intense to have the same impact as a sound within the range of best hearing. Weighting functions are further explained in Section 3.0.4 (Acoustic and Explosives Primer).

3.5.3.1.3.4 Criteria for Hearing Loss – Temporary and Permanent Threshold Shift

Whereas TTS represents a temporary reduction of hearing sensitivity, PTS represents tissue damage that does not recover and permanent reduced sensitivity to sounds over specific frequency ranges (Section 3.5.3.1.2.2, Hearing Loss). To date, no known data are available on potential hearing impairments (i.e., TTS and PTS) in sea turtles. Sea turtles, based on their auditory anatomy (Bartol and Musick 2003; Lenhardt et al. 1985; Wartzok and Ketten 1999; Wever 1978; Wyneken 2001), almost certainly have poorer absolute sensitivity (i.e., higher thresholds) across much of their hearing range than do the mid-frequency cetacean species. Therefore, applying TTS and PTS criteria derived from mid-frequency cetaceans to sea turtles should provide a protective approach to estimating acoustic impacts on sea turtles (PTS and TTS data are not available for low-frequency cetaceans). Criteria for hearing loss due to onset of TTS and PTS are based on sound exposure level (for non-impulsive and impulsive sources) and peak pressure (for impulsive sources only).

To determine the sound exposure level, the turtle weighting function is applied to the acoustic exposure to emphasize only those frequencies within a sea turtle's hearing range. Multiple exposures within any 24-hour period are considered one continuous exposure for the purposes of calculating the received sound exposure level for a given individual. This conservatively assumes no recovery of hearing between exposures during a 24-hour period. The weighted sound exposure level is then compared to weighted threshold values for TTS and PTS. If the weighted exposure level meets or exceeds the weighted threshold, then the physiological impact (TTS or PTS) is assumed to occur. For impacts from exposures to impulsive sources, the metric (peak pressure or sound exposure level) and threshold level that results in the longest range to impact is used to predict impacts. Exposures are not calculated for sound sources with a nominal frequency outside the upper and lower frequency hearing limits for sea turtles.

In addition to being discussed below, thresholds for onset of TTS and PTS for impulsive and non-impulsive sounds are summarized in Tables 3.5-2 and 3.5-3.

Criteria for Non-Impulsive Temporary Threshold Shift

Based on best available science regarding TTS in marine vertebrates (Finneran et al. 2002; Southall et al. 2007) and the lack of information regarding TTS in sea turtles, the total T-weighted sound exposure level of 178 dB re 1 μPa^2-s is used to estimate exposures resulting in TTS for sea turtles. The T-weighting function is used in conjunction with this non-pulse criterion, which effectively provides an upper cutoff of 2 kHz.

The T-weighted non-impulsive TTS threshold of 178 dB re 1 μPa^2-s sound exposure level was inadvertently based on Type II weighted cetacean TTS data rather than Type I weighted cetacean TTS data. This resulted in incorrectly lowering the turtle TTS threshold by 17 dB. The sea turtle non-impulsive TTS threshold, based on mid-frequency cetacean data, should be 17 dB higher than 178 dB re 1 μPa^2-s. Because an incorrectly lowered threshold was used to quantitatively analyze acoustic impacts to sea

turtles in this EIS/OEIS, the quantitative impacts presented herein for non-impulsive TTS are conservative (i.e., over-predicted).

Criteria for Impulsive Temporary Threshold Shift

Based on best available science regarding TTS in marine vertebrates (Finneran et al. 2005; Finneran et al. 2000; Finneran et al. 2002; Nachtigall et al. 2003; Nachtigall et al. 2004; Schlundt et al. 2000) and the lack of information regarding TTS in sea turtles, the respective total T-weighted sound exposure level of 172 dB re 1 μPa^2-s or peak pressure of 224 dB re 1 μPa (23 pounds per square inch [psi]) is used to estimate exposures resulting in TTS for sea turtles. The T-weighting function is applied when using the sound exposure level-based thresholds to predict TTS.

The T-weighted impulsive TTS threshold of 172 dB re 1 μPa^2-s sound exposure level was inadvertently based on Type II weighted cetacean TTS data rather than Type I weighted cetacean TTS data. This resulted in incorrectly lowering the turtle TTS threshold. The sea turtle impulsive TTS threshold, based on Type I mid-frequency cetacean data, should be 183 dB re 1 μPa^2-s. Because an incorrectly lowered threshold was used to quantitatively analyze acoustic impacts to sea turtles in this EIS/OEIS, the quantitative impacts presented herein for impulsive TTS are conservative (i.e., over-predicted).

Criteria for Non-Impulsive Permanent Threshold Shift

Since no studies were designed to intentionally induce PTS in sea turtles, levels for onset of PTS for these animals must be estimated using TTS data and relationships between TTS and PTS established in terrestrial mammals. PTS can be estimated based on the growth rate of a threshold shift and the level of threshold shift required to potentially become nonrecoverable. A variety of terrestrial and marine mammal data sources show that threshold shifts up to 40 to 50 dB may be recoverable, and that 40 dB is a reasonable upper limit of a threshold shift that does not induce PTS (Southall et al. 2007). This analysis assumes that continuous-type exposures producing threshold shifts of 40 dB or more always result in some amount of PTS.

Data from terrestrial mammal testing (Ward et al. 1958; Ward et al. 1959) show temporary threshold shift growth of 1.5 to 1.6 dB for every 1 dB increase in sound exposure level. The difference between minimum measureable TTS onset (6 dB) and the 40 dB upper safe limit of TTS yields a difference of 34 dB. When divided by a TTS growth rate of 1.6 dB TTS per dB sound exposure level, there is an indication that an increase in exposure of a 21.25 dB sound exposure level would result in 40 dB of TTS. For simplicity and conservatism, the number was rounded down to 20 dB sound exposure level.

Therefore, non-impulsive exposures of 20 dB sound exposure level above those producing a TTS may be assumed to produce a PTS. The onset of TTS threshold of 178 dB re 1 μPa^2-s for sea turtles has a corresponding onset of PTS threshold of 198 dB re 1 μPa^2-s. The T-weighting function is applied when using the sound exposure level-based thresholds to predict PTS.

The T-weighted non-impulsive TTS threshold of 178 dB re 1 μPa^2-s sound exposure level was inadvertently based on Type II weighted cetacean TTS data rather than Type I weighted cetacean TTS data. This resulted in incorrectly lowering the turtle TTS threshold by 17 dB; consequently, also incorrectly lowering the sea turtle PTS threshold by 17 dB. The sea turtle non-impulsive PTS threshold, based on mid-frequency cetacean data should be 17 dB higher than 198 dB re 1 μPa^2-s. Because an incorrectly lowered threshold was used to quantitatively analyze acoustic impacts to sea turtles in this EIS/OEIS, the quantitative impacts presented herein for non-impulsive PTS are conservative (i.e., over-predicted).

Criteria for Impulsive Permanent Threshold Shift

Since marine mammal and sea turtle PTS data from impulsive exposures do not exist, onset of PTS levels for these animals are estimated by adding 15 dB to the sound exposure level-based TTS threshold and adding 6 dB to the peak pressure-based thresholds. These relationships were derived by Southall et al. (2007) from impulsive noise TTS growth rates in chinchillas. This results in onset of PTS thresholds of total weighted sound exposure level of 187 dB re 1 μPa^2-s or peak pressure of 230 dB re 1 µPa for sea turtles. The T-weighting function is applied when using the sound exposure level-based thresholds to predict PTS.

The T-weighted impulsive PTS threshold of 187 dB re 1 μPa^2-s sound exposure level was inadvertently based on Type II weighted cetacean TTS data rather than Type I weighted cetacean TTS data. This resulted in incorrectly lowering the turtle TTS threshold. The sea turtle impulsive PTS threshold, based on Type I mid-frequency cetacean data, should be 198 dB re 1 μPa^2-s. Because an incorrectly lowered threshold was used to quantitatively analyze acoustic impacts to sea turtles in this EIS/OEIS, the quantitative impacts presented herein for impulsive TTS are conservative (i.e., over-predicted).

3.5.3.1.3.5 Criteria for Behavioral Responses

A sea turtle's behavioral responses to sound are assumed to be variable and context specific. For instance, a single impulse may cause a brief startle reaction. A sea turtle may swim farther away from the sound source, increase swimming speed, change surfacing time, and decrease foraging if the stressor continues to occur. For each potential behavioral change, the magnitude of the change ultimately would determine the severity of the response. It is assumed that most responses would be short-term avoidance reactions.

A few studies reviewed in section 3.5.3.1.2.5 (Behavioral Reactions) investigated behavioral responses of sea turtles to impulsive sounds emitted by airguns (DeRuiter and Doukara 2012; McCauley et al. 2000; Moein Bartol et al. 1995; O'Hara and Wilcox 1990). There are no studies of sea turtle behavioral responses to sonar. Cumulatively, available airgun studies indicate that perception and a behavioral reaction to a repeated sound may occur with sound pressure levels greater than 166 dB re 1 µPa root mean square, and that more erratic behavior and avoidance may occur at higher thresholds around 175–179 dB re 1 µPa root mean square (McCauley et al. 2000; Moein Bartol et al. 1995; O'Hara and Wilcox 1990). A received level of 175 dB re 1 µPa root mean square is more likely to be the point at which avoidance may occur in unrestrained turtles, with a comparable sound exposure level of 160 dB re 1 μPa^2-s (McCauley et al. 2000). Because information about sea turtle responses to non-impulsive sounds or sounds generated by explosives is limited, the distance from a sound source or explosion within which behavioral responses may occur are estimated using the values associated with sea turtle avoidance of airguns in the above studies. Values for estimating sea turtle responses to pile driving and airguns are discussed in Section 3.5.3.1.3.13 (Criteria for Pile Driving and Swimmer Defense Airguns).

Airgun studies used sources that fired repeatedly over some duration. For single impulses at received levels below threshold shift (hearing loss) levels, the most likely behavioral response is assumed to be a startle response. Since no further sounds follow the initial brief impulse, the biological significance is considered to be minimal.

Based on the limited information regarding significant behavioral reactions of sea turtles to sound, behavioral responses to sounds are qualitatively assessed for sea turtles.

3.5.3.1.3.6 Criteria for Pile Driving and Swimmer Defense Airguns

Existing NMFS risk criteria are applied to sounds generated by pile driving and swimmer defense airguns. The NMFS threshold value for injury to sea turtles due to impact pile driving, vibratory pile driving, and airguns is 190 dB re 1 μPa sound pressure level root mean square.

3.5.3.1.4 Quantitative Analysis

Various computer models and mathematical equations can be used to predict how energy spreads from a sound source (e.g., sonar or underwater detonation) to a receiver (e.g., sea turtle). The Acoustic and Explosives Primer (Section 3.0.4) provides background information about how sound travels through the water. All modeling is an estimation of reality, with simplifications made both to facilitate calculations by focusing on the most important factors and to account for unknowns. For analysis of underwater sound impacts, basic models calculate the overlap of energy and marine life using assumptions that account for the many, variable, and often unknown factors that can greatly influence the result. Assumptions in previous Navy models intentionally erred on the side of overestimation when there were unknowns or when the addition of other variables was not likely to substantively change the final analysis. For example, because the ocean environment is extremely dynamic and information is often limited to a synthesis of data gathered over wide areas requiring many years of research, known information tends to be an average of the wide seasonal or annual variation that is actually present. The Equatorial Pacific El Niño disruption of the ocean-atmosphere system is an example of dynamic change in which unusually warm ocean temperatures are likely to result in the redistribution of marine life and alter the propagation of underwater sound energy. Previous Navy modeling, therefore, made some assumptions indicative of a maximum theoretical propagation for sound energy (such as a perfectly reflective ocean surface and a flat seafloor). More complex computer models build upon basic modeling by factoring in additional variables in an effort to be more accurate by accounting for such things as bathymetry and an animal's likely presence at various depths.

For quantification of estimated marine mammal and sea turtle impacts resulting from sounds produced during Navy activities, the Navy developed a set of data and new software tools. This new approach is the resulting evolution of the basic modeling approaches used by the Navy previously and reflects a much more complex and comprehensive modeling approach as described below.

The quantified results of the sea turtle acoustic impact analysis presented in this Final EIS/OEIS differ from the quantified results presented in the AFTT Draft EIS/OEIS (U.S. Department of the Navy 2012a) due to refinement of training and testing model inputs. The results presented here are well within the framework of the previous National Environmental Policy Act (NEPA) analyses presented in the AFTT Draft EIS/OEIS.

Because limited data is available on crocodilian hearing and because most activities using sonar and explosives would not occur in crocodilian habitat, impacts on crocodilians due to navy training and testing are qualitatively analyzed.

3.5.3.1.5 Navy Acoustic Effects Model

For this analysis of Navy training and testing activities at sea, the Navy developed a set of software tools and compiled data for estimating acoustic impacts. These databases and tools collectively form the Navy Acoustic Effects Model. Details of the Navy Acoustic Effects Model processes and the description and derivation of the inputs are presented in a technical report titled *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact*

Statement/Overseas Environmental Impact Statement (Marine Species Modeling Team 2013). The following paragraphs provide an overview of the Navy Acoustics Effects Model process and its more critical data inputs.

The Navy Acoustic Effects Model improves upon previous modeling efforts in several ways. First, unlike earlier methods that modeled sources individually, the Navy Acoustic Effects Model has the capability to run all sources within a scenario simultaneously, providing a more realistic depiction of the potential effects of an activity. Second, previous models calculated sound received levels within set volumes of water and spread animals uniformly across the volumes; in the Navy Acoustic Effects Model, animats (virtual animals) are distributed nonuniformly based on higher resolution species-specific density, depth distribution, and group size information; and animats serve as dosimeters, recording energy received at their location in the water column. Third, a fully three-dimensional environment is used for calculating sound propagation and animat exposure in the Navy Acoustic Effects Model, rather than a two-dimensional environment where the worst case sound pressure level across the water column is always encountered. Finally, current efforts incorporate site-specific bathymetry, sound speed profiles, wind speed, and bottom properties into the propagation modeling process rather than the flat-bottomed provinces used during earlier modeling (Marine Species Modeling Team 2013). The following paragraphs provide an overview of the Navy Acoustic Effects Model process and its more critical data inputs.

Using the best available information on the estimated density of sea turtles in the area being modeled, the Navy Acoustics Effects Model derives an abundance (total number individuals) and distributes the resulting number of animats into an area bounded by the maximum distance that energy propagates out to a criterion threshold value (energy footprint). These animats are distributed based on density differences across the area and known depth distributions (dive profiles). Animats change depths every four minutes but do not otherwise mimic actual animal behaviors (such as avoidance or attraction to a stimulus).

Schecklman et al. (2011) argue that static distributions underestimate acoustic exposure compared to a model with fully three-dimensionally moving animals. However, their static method is different from the Navy Acoustic Effects Model in several ways. First, they distribute the entire population at depth with respect to the species-typical depth distribution histogram, and those animats remain static at that position throughout the entire simulation. In the Navy Acoustic Effects Model, animats are placed horizontally dependent upon nonuniform density information, and then move up and down over time within the water column by interrogating species-typical depth distribution information. Second, for the static method, Schecklman et al. (2011) calculated acoustic received levels for designated volumes of the ocean and then sum the animats that occur within that volume, rather than using the animats themselves as dosimeters, as in the Navy Acoustic Effects Model. Third, they run 50 iterations of the moving distribution to arrive at an average number of exposures, but because they rely on uniform horizontal density (and static depth density), only a single iteration of the static distribution is realized. In addition to moving the animats vertically, the Navy Acoustic Effects Model overpopulates the animats over a nonuniform density and then resamples the population a number of times to arrive at an average number of exposures as well. Tests comparing fully moving distributions and static distributions with vertical position changes at varying rates were compared during development of the Navy Acoustic Effects Model. For position updates occurring more frequently than every five minutes, the number of estimated exposures was similar between the Navy Acoustic Effects Model and the fully moving distribution; however, computational time was much longer for the fully moving distribution.

Navy Acoustics Effects Model calculates the likely propagation for various levels of energy (sound or pressure) resulting from each non-impulse or impulse source used during a training or testing event. This is done taking into account an event location's actual bathymetry and bottom types (e.g., reflective), and estimated sound speeds and sea surface roughness. Platforms (such as a ship using one or more sound sources) are modeled as moving across an area, the size of which is representative of what would normally occur during a training or testing scenario. The model uses typical platform speeds and event durations. Moving source platforms either travel along a predefined track or move along straight-line tracks from a random initial course, reflecting at the edges of a predefined boundary. Static sound sources are stationary in a fixed location for the duration of a scenario. Modeling locations were chosen based on historical data from ongoing activities and in an effort to include all the environmental variation within the study Area where similar events might occur in the future.

The Navy Acoustics Effects Model then tracks the energy received by each animat within the energy footprint of the event and calculates the number of animats having received levels of energy exposures that fall within defined impact thresholds. Predicted effects on the animats within a scenario are then tallied and the highest-order effect (based on severity of criteria; e.g., PTS over TTS) predicted for a given animat is assumed. Each scenario or each 24-hour period for scenarios lasting greater than 24 hours is independent of all others, and therefore, the same individual marine animal could be impacted during each independent scenario or 24-hour period. In a few instances, although the activities themselves all occur within the Study Area, sound may propagate beyond the boundary of the Study Area. Any exposures occurring outside the boundary of the Study Area are counted as if they occurred within the Study Area boundary.

3.5.3.1.6 Model Assumptions and Limitations

There are limitations to the data used in the Navy Acoustics Effects Model, and results must be interpreted within the context of these assumptions. Output from the Navy Acoustic Effects Model relies heavily on the quality of both the input parameters and impact thresholds and criteria. When there was a lack of definitive data to support an aspect of the modeling (such as lack of well-described diving behavior for all marine species), conservative assumptions believed to overestimate the number of exposures were chosen:

- Animats are modeled as being underwater and facing the source and therefore always predicted to receive the maximum sound level at their position within the water column (e.g., the model does not account for conditions such as body shading or an animal raising its head above water).
- Multiple exposures within any 24-hour period are considered one continuous exposure for the purposes of calculating temporary or permanent hearing loss, because there is insufficient data to estimate a hearing recovery function for the time between exposures.
- Animats do not move horizontally (but change their position vertically within the water column), which may overestimate physiological impacts such as hearing loss, especially for slow-moving or stationary sound sources in the model.
- Animats are stationary horizontally and therefore do not avoid the sound source, unlike in the wild where animals would most often avoid exposures at higher sound levels, especially those exposures that may result in PTS.
- Animats are assumed to receive the full impulse of the initial positive pressure wave due to an explosion, although the impulse-based thresholds (onset mortality and onset slight lung injury) assume an impulse delivery time adjusted for animal size and depth. Therefore, these impacts are overestimated at farther distances and increased depths.

- Mitigation measures implemented during training and testing activities that reduce the likelihood of exposing a sea turtle to higher levels of acoustic energy near the most powerful sound sources (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) were not considered in the model.

3.5.3.1.6.1 Sea Turtle Densities

A quantitative analysis of impacts on a species requires data on the abundance and distribution of the species population in the potentially impacted area. The most appropriate metric for this type of analysis is density, which is the number of animals present per unit area. There is no single source of density data for every area of the world, species, and season because of the fiscal costs, resources, and effort involved in providing survey coverage to sufficiently estimate density. Therefore, to characterize the marine species density for large areas such as the Study Area, the Navy compiled data from several sources. To compile and structure the most appropriate database of marine species density data, the Navy developed a protocol to select the best available data sources based on species, area, and time (season). The resulting Geographic Information System database called the Navy Marine Species Density Database includes seasonal density values for every marine mammal and sea turtle species present within the Study Area (U.S. Department of the Navy 2012a).

In this analysis, sea turtle density data were used as an input in the Navy Acoustic Effects Model in their original temporal and spatial resolution. Seasons are defined as winter (December–February), spring (March–May), summer (June–August), and fall (September–November). The density grid cell spatial resolution varied, depending on the original data source utilized. Where data sources overlap, there might be a sudden increase or decrease in density due to different derivation methods or survey data utilized. This is an artifact of attempting to use the best available data for each geographic region. Density data used for the quantitative analysis of acoustic impacts on sea turtles comes from the Navy OPAREA Density Estimate (NODES) and are primarily based on NMFS aerial survey data collected along the U.S. east coast. The aerial surveys covered only a limited coastal area of the U.S. Exclusive Economic Zone. To estimate density beyond the survey coverage area, the farthest offshore Navy OPAREA Density Estimate (NODES) data were extrapolated to the extent of the U.S. Exclusive Economic Zone. To capture the latitudinal variability in sea turtle abundance, the Navy computed the mean density per each remaining OPAREA region not covered by the aerial surveys. Turtle density was determined for each species. Sightings of unknown hardshell species were combined and counted under the species group name hardshell turtles. Hardshell turtles comprise unknown sea turtle sightings that could be a mix of Kemp's ridley, olive ridley, hawksbill, loggerhead, and green sea turtles. In addition, identified green and hawskbill turtles are considered under the hardshell turtle category because too few sightings of these species are available to generate a separate density estimate. Note that for the hardshell turtle category, green turtle dive profile data were used in the Navy Acoustic Effects Model because green turtles are thought to be the majority of individuals represented. The olive ridley sea turtle will not be analyzed because its occurrence in the Study Area is extralimital. For further explanation, see the Navy Marine Species Density Database technical report (U.S. Department of the Navy 2012a).

All species density distributions matched the expected distributions from published literature and the NMFS stock assessments.

3.5.3.1.7 Impacts from Sonar and Other Active Acoustic Sources

Sonar and other active acoustic sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. These systems are used for anti-submarine warfare, mine warfare, navigation, sensing of oceanographic conditions (e.g., sound speed profile), and communication.

General categories of sonar systems are described in Section 2.3 (Description of Sonar, Ordnance/Munitions, Targets, and Other Systems Employed in Atlantic Fleet Training and Testing Events) and Section 3.0.5.3.1 (Acoustic Stressors).

Potential direct impacts on marine reptiles from exposure to sonar or other non-impulsive underwater active acoustic sources include hearing loss due to threshold shift (permanent or temporary), masking of other biologically relevant sounds, physiological stress, or changes in behavior (Section 3.5.3.1.2.1, Direct Injury). Direct injury and barotrauma from a primary blast would not occur from exposure to these sources due to slower rise times and lower peak pressures. As stated above, a TTS can be mild and recovery can take place within a matter of minutes to days and, therefore, is unlikely to cause long-term consequences to individuals or populations. There is no research to indicate whether sea turtles with PTS would suffer long-term consequences. Sea turtles probably do not rely on their auditory systems as a primary sense, although little is known about how sea turtles use the narrow range of low-frequency sounds they might perceive in their environment (Section 3.5.3.1.2.3, Auditory Masking). It is possible that some individuals that experience some degree of permanent hearing loss may have decreased abilities to find resources such as prey or nesting beaches or detect other relevant sounds such as vessel noise, which may lead to long-term consequences for the individual. Similarly, the effect of masking on sea turtles is difficult to assess.

There is little information regarding marine reptile responses to sound. It is anticipated that the intensity of their behavioral response to a perceived sound could depend on several factors, including species, the animal's age, reproductive condition, past experience with the sound exposure, behavior (foraging or reproductive), the received level from the exposure, the type of sound (impulse or nonimpulse), and duration of the sound (Section 3.0.5.7.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities). Any behavioral responses may be short term (seconds to minutes) and of little immediate consequence for the animal, such as simply orienting to the sound source. Alternatively, there may be a longer-term response over several hours such as moving away from the sound source. However, exposure to loud sounds resulting from Navy training and testing at sea would likely be brief because ships and other participants are constantly moving and the animal would likely be moving as well. Animals that are resident during all or part of the year near Navy ports, piers, and nearshore facilities or on fixed Navy ranges are the most likely to experience multiple or repeated exposures. It is likely that a sea turtle could be exposed to sonar and other active acoustic sources multiple times in its lifetime, although the possibility of habituation is unknown. Most exposures would be intermittent and short term when considered over the duration of a sea turtle's life span. In addition, most sources use frequencies that are higher than the best hearing range of sea turtles. Because alligators and crocodiles are found in inland waters, bays, and estuaries, they are not likely to be exposed to most sonar and active acoustic sources used by the Navy.

Most sonar and other active acoustic sources used during training and testing use frequency ranges that are higher than the estimated hearing range of sea turtles (10 Hz to 2 kHz). Therefore, most of these sources have no impact on sea turtle hearing. The limited information on crocodilian hearing indicates that they also likely only sense lower-frequency sounds and would not be able to detect many of the active acoustic sources used during training and testing. Only sonar with source levels greater than 160 dB re 1 µPa using frequencies within the hearing range of sea turtles were modeled for potential acoustic impacts on sea turtles. Other active acoustic sources with low source level, narrow beam width, downward directed transmission, short pulse lengths, frequencies above known hearing ranges, or some combination of these factors are not anticipated to result in impacts on sea turtles. These sources were not modeled and are addressed qualitatively in this EIS/Overseas Environmental Impact Statement

(OEIS) (Section 2.3.7.2, Source Classes Qualitatively Analyzed). These sources generally have frequencies greater than 200 kHz and source levels less than 160 dB re 1 µPa. The types of sources with source levels less than 160 dB are primarily hand-held sonars, range pingers, transponders, and acoustic communication devices. Acoustic impacts on crocodilians were not modeled because they are not present in most areas where training and testing are conducted, and minimal data exist to predict acoustic impacts on crocodilians.

Within this acoustics analysis, the numbers of animals that may receive some form of hearing loss were predicted using the Navy Acoustic Effects Model (Section 3.5.3.1.5). To quantify the impacts of acoustic exposures to sea turtles, training and testing activities were modeled that employ acoustic sources using frequencies in the hearing range of sea turtles. These activities and the acoustic source classes used are listed in Table 3.5-5. Most sonar and active acoustic sources used during training and testing use frequencies outside the estimated hearing range of turtles.

Table 3.5-5: Activities and Active Acoustic Sources Modeled and Quantitatively Analyzed for Acoustic Impacts on Sea Turtles

Activity	Acoustic Source Class[1]
Training Activities	
ASW for Joint Task Force Exercise	ASW2
ASW for Composite Training Unit Exercise	ASW2
Group Sail	ASW2
TRACKEX/TORPEX-Surface	ASW1, MF12
TRACKEX-Maritime Patrol Aircraft	ASW2
Testing Activities	
ASW Tracking Test: Maritime Patrol Aircraft	ASW2
Surface Combatant Sea Trials: ASW Testing	MF9, MF10
Surface Combatant Sea Trials: Pierside Sonar Testing	MF9, MF10
Submarine Sea Trial: ASW Testing	MF10
Littoral Combat Ship Mission Package Testing: ASW	MF12
Surface Ship Sonar Testing/Maintenance	MF9, MF10
UUV Demonstration (NSWC PCD)	LF4, MF9
Special Warfare Testing (NSWC PCD)	MF9
Stationary Source Testing (NSWC PCD)	LF4, MF8
Towed Equipment Testing (NUWCDIVNPT)	LF4, MF9, SAS1
Unmanned Underwater Vehicle (UUV) Testing (NUWCDIVNPT)	LF5
Semi-stationary Equipment Testing (NUWCDIVNPT)	LF4, LF5, MF9, MF10
UUV Demonstration (NUWCDIVNPT)	LF4, MF9
Signature Analysis Activities (SFOMF)	LF4, ASW2
Surface Testing Activities (SFOMF)	LF5, MF9
UUV Demonstration (SFOMF)	LF4, MF9
Sonobuoy Lot Acceptance Testing	ASW2
Pierside Integrated Swimmer Defense Testing	LF4, MF8
Unmanned Vehicle Development and Payload Testing	MF9
Special Warfare	MF9

ASW: anti-submarine warfare; LF: low frequency; MF: mid frequency; NSWC PCD: Naval Surface Warfare Center, Panama City Division Testing Range; NUWCDIVNPT: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range; TORPEX: torpedo exercise; TRACKEX: tracking exercise; UUV: unmanned underwater vehicle

[1] Characteristics of acoustic source classes are described in Section 2.3.7 (Classification of Acoustic and Explosive Sources)

3.5.3.1.7.1 Model-Predicted Impacts

Table 3.5-6 through Table 3.5-8 show predicted impacts on sea turtles from the Navy Acoustics Effects Model. The exposure estimates for each alternative represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. The predicted acoustic impacts do not take into account mitigation measures, such as establishing shut-down zones for certain sonar systems (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

Table 3.5-6: Annual Total Model-Predicted Impacts on Sea Turtles for Training Activities Using Sonar and Other Active Non-Impulsive Acoustic Sources

Sea Turtle Species or Group	No Action Alternative		Alternative 1		Alternative 2	
	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]
Hardshell Turtles[1]	218	0	12,131	11	12,131	11
Kemp's Ridley Turtle	17	0	263	0	263	0
Loggerhead Turtle	310	0	16,624	16	16,624	16
Leatherback Turtle	401	1	8,806	9	8,806	9

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-7: Annual Total Model-Predicted Impacts on Sea Turtles for Testing Activities Using Sonar and Other Active Non-Impulsive Acoustic Sources

Sea Turtle Species or Group	No Action Alternative		Alternative 1		Alternative 2	
	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]
Hardshell Turtles[1]	62	0	3,647	0	4,021	0
Kemp's Ridley Turtle	3	0	193	0	213	0
Loggerhead Turtle	96	0	4,393	0	4,847	0
Leatherback Turtle	38	0	671	0	741	0

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-8: Model-Predicted Impacts for Unmanned Underwater Vehicle Demonstrations (Testing) Using Sonar (Occurs Once per Five-Year Period at Each Location)

Sea Turtle Species or Group	NSWC Panama City (all Alternatives)		SFOMF (Alternatives 1 and 2 only)		NUWC Newport (all Alternatives)	
	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]
Hardshell Turtles[1]	20	0	921	0	3	0
Kemp's Ridley Turtle	0	0	65	0	0	0
Loggerhead Turtle	139	0	1,142	0	7	0
Leatherback Turtle	21	0	40	0	2	0

NSWC: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; SFOMF: South Florida Ocean Measurement Facility Testing Range

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

As discussed above (Section 3.5.3.1.6, Model Assumptions and Limitations), within the Navy Acoustic Effects Model, animats (virtual animals) do not move horizontally or react in any way to avoid sound at any level. At close ranges and high sound levels approaching those that could cause PTS, avoidance of the area immediately around the sound source is the assumed behavioral response for most cases. Furthermore, cues preceding the commencement of the event (e.g., vessel presence and movement, aircraft overflight) may result in some animals departing the immediate area, even before active sound sources begin transmitting.

Since animal avoidance and mitigation measures are not considered in the Navy Acoustic Effects Model, the model-predicted non-impulsive PTS are adjusted to produce the final quantitative predictions shown below. During the first few pings of an event, or after a pause in sonar operations, if animals are caught unaware and mitigation measures are not yet implemented (e.g., animals are at depth and not visible at the surface) it is possible that they could receive enough acoustic energy to suffer PTS. Therefore, predicted PTS exposures from the Navy Acoustic Effects Model for three to four pings are considered in most activities, with the remainder of the model-predicted PTS considered TTS for this analysis.

3.5.3.1.7.2 No Action Alternative

Training Activities

Training activities under the No Action Alternative include activities that produce non-impulsive noise from the use of sonar and other active acoustic sources that fall within the hearing range of sea turtles. These activities could occur throughout the Study Area but would be concentrated in the Virginia Capes (VACAPES), Navy Cherry Point, and Jacksonville (JAX) Range Complexes. The number of events and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Model-predicted acoustic impacts on sea turtles from exposure to sonar and other active acoustic sources for annually recurring training activities under the No Action Alternative are shown in Table 3.5-6. The results shown are the impacts on sea turtles predicted for one year of training. The

majority of impacts on all sea turtle species would occur due to major training activities (source class ASW2 in Composite Training Unit Exercise and Joint Task Force Exercise) in the JAX Range Complex. These events would occur a limited number of times per year, but each event would last for multiple days. Therefore, some animals may be exposed multiple times over the course of a few days.

Most impacts are predicted to occur in the Southeast U.S. Continental Shelf Large Marine Ecosystem. A smaller, but notable, portion of impacts are also predicted in the Gulf Stream Open Ocean Area. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the Southeast U.S. Continental Shelf Large Marine Ecosystem would typically be foraging adults and juveniles. Because these sound sources would typically be used beyond 12 nm from shore, they are unlikely to impact sea turtles near nesting beaches.

Some sea turtles are predicted to experience TTS, which would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure. One leatherback sea turtle is predicted to experience PTS due to training with sonar and other active acoustic sources, which would permanently reduce perception of sound within a limited frequency range. This long-term consequence could impact an individual turtle's ability to sense biologically important sounds such as predators or prey, reducing that animal's fitness; however, because most sounds are broadband, a reduction in sensitivity over a small portion of hearing range may not interfere with perception of most sounds.

Cues preceding the commencement of the event (e.g., vessel presence and movement, aircraft overflight) may result in some animals departing the immediate area, even before active sound sources begin transmitting. Avoidance behavior could reduce the sound exposure level experienced by a sea turtle and therefore reduce the likelihood and degree of TTS predicted near sound sources. In addition, PTS and TTS threshold criteria for sea turtles are conservatively based on criteria developed for mid-frequency marine mammals. Therefore, actual TTS impacts are expected to be substantially less than the predicted quantities.

Sea turtles may exhibit short-term behavioral reactions, such as swimming away or diving to avoid the immediate area around a source, although studies examining sea turtle behavioral responses to sound have used impulsive sources, not non-impulsive sources. Pronounced reactions to acoustic stimuli could lead to a sea turtle expending energy and missing opportunities to forage or breed. In most cases, acoustic exposures are intermittent, allowing time to recover from an incurred energetic cost, resulting in no long-term consequence.

Because model-predicted impacts are conservative and most impacts would be short-term, potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and are not expected to result in population-level impacts.

Within the Study Area, critical habitat has been designated in the marine environment for the following sea turtle species: green sea turtles (waters out to 3 nm around Culebra Island, Puerto Rico, due to their importance as developmental and foraging habitat [Figure 3.5-1]), hawksbill sea turtles (waters out to 3 nm around Mona and Monito Islands, Puerto Rico, due to their importance as developmental and foraging habitat [Figure 3.5-2]), and leatherback sea turtles (waters inclusive of the 100 fathom curve shoreward off Sand Point, St. Croix, U.S. Virgin Islands, for mating and migratory access of the turtles to and from the nesting beach [Figure 3.5-3]). At the time of these critical habitat designations no primary

constituent elements were listed to define the critical habitat. Sonar and other active acoustic sources within the hearing range of sea turtles are not proposed for use in the nearshore waters in or near these critical habitats. Any use of these sources near these waters would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill sea turtles or mating and nesting activities for the leatherback sea turtle.

The American alligator and the American crocodile are primarily freshwater or estuarine species. Based on limited data on crocodilian hearing, they may be capable of detecting low-frequency and some mid-frequency sounds produced by training with sonar and other active acoustic sources. Training with active acoustic sources would not occur near the swamps and estuaries in southern Florida that are American crocodile habitat; therefore, American crocodiles are not expected to be impacted by these activities. American alligators may be found along the Southeast Atlantic and Gulf coasts and could be exposed to mid-frequency sonar during surface ship and submarine sonar maintenance and navigational activities that occur near shore around naval ports; however, American alligators are not typically present in such saline waters. It is unknown whether an alligator exposed to underwater sound due to these sonar would be able to detect these mid-frequency sources and, if so, whether it would respond. Any impacts on American alligators are expected to be minimal.

Within the Study Area, critical habitat has been designated for the American crocodile in South Florida (Figure 3.5-4). No primary constituent elements were identified during the designation of this habitat. Sonar and other active acoustic sources would not be used in the nearshore shallow waters in or near the critical habitat. Any use of these sources near these waters would not result in the destruction or impairment to the ability of the habitat to support American crocodile populations.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitats.*

Testing Activities

Testing activities under the No Action Alternative include activities that produce non-impulsive noise from the use of sonar and other active acoustic sources that fall within the hearing range of sea turtles. These activities would typically occur in all of the range complexes; at Naval Surface Warfare Center, Panama City Division Testing Range; and at Naval Undersea Warfare Center Division, Newport Testing Range. The number of events and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Model-predicted acoustic impacts on sea turtles from exposure to sonar and other active acoustic sources under the No Action Alternative are shown in Table 3.5-7 for annually recurring testing activities and in Table 3.5-8 for unmanned underwater vehicles demonstrations that do not occur annually. The results shown in Table 3.5-7 are predicted impacts for one year of testing activities.

Although impacts could occur across all of the range complexes and training ranges due to various types of testing involving active acoustic sources, the portion of total predicted impacts are greater for certain activities, either due to the types of sources or the hours of use. For annual testing, the following types of activities at the locations noted produce the majority of predicted impacts: anti-submarine warfare tracking test – Maritime Patrol Aircraft (in the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes), special warfare (Key West Range Complex), unmanned underwater vehicle testing (Naval Surface Warfare Center, Panama City Division Testing Range), and semi-stationary equipment testing (Naval Undersea Warfare Center Division, Newport Testing Range). An unmanned underwater vehicle demonstration event would not occur annually but could occur once at Naval Surface Warfare Center, Panama City Division Testing Range and once at Naval Undersea Warfare Center Division, Newport Testing Range over a five-year period. Testing events using sonar and other active acoustic sources are often multiday events during which active sources are used intermittently; therefore, some animals may be exposed multiple times over the course of a few days.

Predicted impacts due to annual testing are concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem and in the Gulf Stream Open Ocean Area. Smaller, but notable, portions of impacts are also predicted in the Northeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems. While most testing using anti-submarine warfare sonar would occur beyond 12 nm from shore, other testing activities using active acoustic sources may occur closer to shore, specifically at Naval Surface Warfare Center, Panama City Division Testing Range and at Naval Undersea Warfare Center Division, Newport Testing Range. In addition, testing of sonar systems could occur at multiple pierside locations. The addition of an unmanned underwater vehicle demonstration in any given year could increase impacts on sea turtles in nearshore areas in the Gulf of Mexico and Northeast U.S. Continental Shelf Large Marine Ecosystems. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the other Large Marine Ecosystems would typically be adults and juveniles.

Some sea turtles are predicted to experience TTS, which would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure. Cues preceding the commencement of the event (e.g., vessel presence and movement, aircraft overflight) may result in some animals departing the immediate area, even before active sound sources begin transmitting. Avoidance behavior could reduce the sound exposure level experienced by a sea turtle and therefore reduce the likelihood and degree of TTS predicted near sound sources. In addition, PTS and TTS threshold criteria for sea turtles are conservatively based on criteria developed for mid-frequency marine mammals. Therefore, actual TTS impacts are expected to be substantially less than the predicted quantities.

Sea turtles may exhibit short-term behavioral reactions, such as swimming away or diving to avoid the immediate area around a source, although studies examining sea turtle behavioral responses to sound have used impulsive sources, not non-impulsive sources. Pronounced reactions to acoustic stimuli could lead to a sea turtle expending energy and missing opportunities to forage or breed. In nesting season, near nesting beaches (in the Southeast U.S. Continental Shelf, Caribbean, and Gulf of Mexico Large Marine Ecosystems), behavioral disturbances may interfere with nesting beach approach. In most cases, acoustic exposures are intermittent, allowing time to recover from an incurred energetic cost, resulting in no long-term consequence.

Because model-predicted impacts are conservative and most impacts would be short-term, potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual

reproductive success, or lifetime reproductive success (fitness) to most individuals. Therefore, population-level impacts are not expected.

Within the Study Area, critical habitat has been designated in the marine environment for the following sea turtle species: green sea turtles (waters out to 3 nm around Culebra Island, Puerto Rico, due to their importance as developmental and foraging habitat [Figure 3.5-1]), hawksbill sea turtles (waters out to 3 nm around Mona and Monito Islands, Puerto Rico, due to their importance as developmental and foraging habitat [Figure 3.5-2]), and leatherback sea turtles (waters inclusive of the 100 fathom curve shoreward off Sand Point, St. Croix, United States Virgin Islands, for mating and migratory access of the turtles to and from the nesting beach [Figure 3.5-3]). At the time of these critical habitat designations, no primary constituent elements were listed to define the critical habitat. Sonar and other active acoustic sources within the hearing range of sea turtles are not proposed for use in the nearshore waters in or near these critical habitats. Any use of these sources near these waters would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

The American alligator and the American crocodile are primarily freshwater or estuarine species. Based on limited data on crocodilian hearing, they may be capable of detecting low-frequency and some mid-frequency sounds produced by testing with sonar and other active acoustic sources. Testing with active acoustic sources would not occur near the swamps and estuaries in southern Florida that are American crocodile habitat; therefore, American crocodiles are not expected to be impacted by these activities. American alligators may be found along the southeast Atlantic and Gulf coasts and could be exposed mid-frequency sonar during pierside sonar testing; however, American alligators are not typically present in such saline waters. It is unknown whether an alligator exposed to underwater sound due to sonar would be able to detect these mid-frequency sources and, if so, whether it would respond. Any impacts on American alligators are expected to be minimal.

Within the Study Area, critical habitat has been designated for the American crocodile in South Florida (Figure 3.5-4). No primary constituent elements were identified during the designation of this habitat. Sonar and other active acoustic sources would not be used in the nearshore shallow waters in or near the critical habitat. Any use of these sources near these waters would not result in the destruction or impairment of the ability of the habitat to support American crocodile populations.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitats.*

3.5.3.1.7.3 Alternative 1

Training Activities

The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources that fall within the hearing range of sea turtles under Alternative 1 would increase compared to the No Action Alternative. These activities could occur in the VACAPES, Navy

Cherry Point, and JAX Range Complexes. Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Model-predicted acoustic impacts on sea turtles from exposure to sonar and other active acoustic sources for annually recurring training activities under Alternative 1 are shown in Table 3.5-6. The results shown are the impacts on sea turtles predicted for one year of training. The impacts are predicted to increase compared to the No Action Alternative. Similar to the No Action Alternative, impacts could occur throughout the Study Area but would be concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem and in the Gulf Stream Open Ocean Area. The majority of impacts on all sea turtle species would occur due to major training activities (source class ASW2 in Composite Training Unit Exercise and Joint Task Force Exercise) in the JAX Range Complex. Most of the increase in predicted impacts over the No Action Alternative is due to additional anti-submarine warfare training during major training activities. These events would occur a limited number of times per year, but each event would last for multiple days. Therefore, some animals may be exposed multiple times over the course of a few days.

Some sea turtles are predicted to experience TTS, which would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure. Nine leatherback, 16 loggerhead, and 11 hardshell sea turtles are predicted to experience PTS due to training with sonar and other active acoustic sources, which would permanently reduce perception of sound within a limited frequency range. This long-term consequence could impact an individual turtle's ability to sense biologically important sounds, such as predators or prey, reducing that animal's fitness; however, because most sounds are broadband, a reduction in sensitivity over a small portion of hearing range may not interfere with perception of most sounds.

The increase in predicted impacts on sea turtles could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, when compared to the No Action Alternative. However, the expected impacts on any individual sea turtle remain the same. Similarly, the model may over-predict acoustic impacts because the criteria to predict impacts are conservative. For the reasons provided in Section 3.5.3.1.7.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, or lifetime reproductive success (fitness) to most individuals. Although some individuals may experience long-term impacts, population-level impacts are not expected.

The potential impacts on the American alligator and the American crocodile are similar to those under the No Action Alternative in Section 3.5.3.1.7.2 (No Action Alternative). American crocodiles would not be impacted by sonar and other active acoustic sources, but American alligators may be exposed in some nearshore areas. Similar to the No Action Alternative, sea turtle and American crocodile critical habitats would not be impacted by training with sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 1:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on American crocodile and sea turtle critical habitats.*

Testing Activities

Testing activities under Alternative 1 that produce in-water noise from the use of sonar and other active non-impulsive acoustic sources that fall within the hearing range of sea turtles would increase compared to the No Action Alternative. Testing could occur in all of the range complexes; at Naval Surface Warfare Center, Panama City Division Testing Range; at Naval Undersea Warfare Center Division, Newport Testing Range; and at the South Florida Ocean Measurement Facility Testing Range. The number of events and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Model-predicted acoustic impacts on sea turtles from exposure to sonar and other active acoustic sources under the No Action Alternative are shown in Table 3.5-7 for annually recurring testing activities and in Table 3.5-8 for unmanned underwater vehicles demonstrations that do not occur annually. The results shown in Table 3.5-7 are predicted impacts for one year of testing activities. The impacts are predicted to increase compared to the No Action Alternative. The majority of these increases are attributed to the addition of testing activities at the South Florida Ocean Measurement Facility Testing Range, sonobuoy lot testing at the Key West Range Complex, and unmanned vehicle development and payload testing at multiple locations.

Although impacts could occur across all of the range complexes and training ranges due to various types of testing involving active acoustic sources, the portion of total predicted impacts are greater for certain activities, either due to the types of sources or the hours of use. For annual testing, the following types of activities at the locations noted produce the majority of predicted impacts: surface testing activities (South Florida Ocean Measurement Facility Testing Range), unmanned vehicle development and payload testing (Northeast, VACAPES, Navy Cherry Point, JAX, and Gulf of Mexico [GOMEX] Range Complexes), and sonobuoy lot acceptance Testing (Key West Range Complex). An unmanned underwater vehicle demonstration would not occur annually but could occur once at Naval Surface Warfare Center, Panama City Division Testing Range; once at Naval Undersea Warfare Center Division, Newport Testing Range; and once at the South Florida Ocean Measurement Facility Testing Range over a five-year period. Testing events using sonar and other active acoustic sources are often multiday events during which active sources are used intermittently; therefore, some animals may be exposed multiple times over the course of a few days.

Predicted impacts due to annual testing are concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem, the Caribbean Sea Large Marine Ecosystem, and the Gulf Stream Open Ocean Area. While most testing using anti-submarine warfare sonar would occur beyond 12 nm from shore, other testing activities using active acoustic sources may occur closer to shore, specifically at Naval Surface Warfare Center, Panama City Division Testing Range and at Naval Undersea Warfare Center Division, Newport Testing Range. In addition, testing of sonar systems could occur at multiple pierside locations. The addition of an unmanned underwater vehicle demonstration in any given year could increase impacts on sea turtles in nearshore areas in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the other large marine ecosystems would typically be adults and juveniles.

The increase in predicted impacts on sea turtles could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed when compared to the No Action Alternative. However, the expected impacts on any individual sea

turtle remain the same. Similarly, the model may over predict acoustic impacts because the criteria to predict impacts are conservative. For the reasons provided in Section 3.5.3.1.7.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, or lifetime reproductive success (fitness) of most individuals. Although some individuals may experience long-term impacts, population-level impacts are not expected.

The potential impacts on the American alligator and the American crocodile are similar to those under the No Action Alternative in Section 3.5.3.1.7.2 (No Action Alternative). American crocodiles would not be impacted by sonar and other active acoustic sources, but American alligators may be exposed in some nearshore areas. Similar to the No Action Alternative, sea turtle and American crocodile critical habitats would not be impacted by testing with sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 1:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on American crocodile and sea turtle critical habitats.*

3.5.3.1.7.4 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.5.3.1.7.3 (Alternative 1).

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 2:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on American crocodile and sea turtle critical habitats.*

Testing Activities

Testing activities under Alternative 2 that produce in-water noise from the use of sonar and other active non-impulsive acoustic sources that fall within the hearing range of sea turtles would increase compared to the No Action Alternative. Compared to Alternative 1, the activities using sonar and other active acoustic sources would increase by about 10 percent, but the types of testing activities and the locations they occur would be the same as those under Alternative 1. The number of events and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

The increase in predicted impacts on sea turtles could mean an increase in the number of individual animals exposed per year or an increase in the number of times per year some animals are exposed, when compared to the No Action Alternative. However, the expected impacts on any individual sea turtle remain the same. Similarly, the model may over-predict acoustic impacts because the criteria to predict impacts are conservative. For the reasons provided in Section 3.5.3.1.7.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, or lifetime reproductive success (fitness) of most individuals. Although some individuals may experience long-term impacts, population-level impacts are not expected.

The potential impacts on the American alligator and the American crocodile are similar to those under the No Action Alternative in Section 3.5.3.1.7.2 (No Action Alternative). American crocodiles would not be impacted by sonar and other active acoustic sources, but American alligators may be exposed in some nearshore areas. Similar to the No Action Alternative, sea turtle and American crocodile critical habitats would not be impacted by testing with sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 2:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles;*
- *may affect but is not likely to adversely affect ESA-listed American alligators; and*
- *will have no effect on American crocodile and sea turtle critical habitats.*

3.5.3.1.8 Impacts from Explosives

Explosions in the water or near the water's surface can introduce loud, impulsive, broadband sounds into the marine environment. These sounds are likely within the audible range of most sea turtles, but the duration of individual sounds is very short. Energy from explosions is capable of causing mortalities, injuries to the lungs or gastrointestinal tract (Section 3.5.3.1.2.1, Direct Injury), TTS or PTS (Section 3.5.3.1.2.2, Hearing Loss), or behavioral responses (Section 3.5.3.1.2.5, Behavioral Reactions). The impacts on sea turtles from at-sea explosions depend on the net explosive weight of the charge, depth of the charge, the properties of detonations underwater, the animal's distance from the charge, the animal's location in the water column, and environmental factors such as water depth, water temperature, and bottom type. The net explosive weight accounts for the weight and the type of explosive material. Criteria for determining physiological impacts on sea turtles from impulsive sound are discussed in Section 3.5.3.1.3 (Acoustic and Explosive Thresholds and Criteria). The limited information on sea turtle behavioral responses to sounds is discussed in Section 3.5.3.1.2.5 (Behavioral Reactions).

Exposures that result in injuries such as nonlethal trauma and PTS may limit an animal's ability to find or obtain food, communicate with other animals, avoid predators, and interpret the environment around it. Impairment of these abilities can decrease an individual's chance of survival or impact its ability to successfully reproduce. Mortality of an animal will remove the animal entirely from the population as well as eliminate its future reproductive potential.

As discussed in Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift), the thresholds that were used to quantitatively predict onset of TTS and PTS for sea turtles were

incorrectly lowered when developing sea turtle acoustic impact criteria based on cetacean data. Therefore, the predicted impacts are conservative (i.e., over-predicted).

There is some limited information on sea turtle behavioral responses to impulsive noise from airgun studies (Section 3.5.3.1.2.5, Behavioral Reactions) that can be used as a surrogate for explosive impact analysis. Any behavioral response to a single detonation would likely be a short-term startle response, if the animal responds at all. Multiple detonations over a short period may cause an animal to exhibit other behavioral reactions, such as interruption of feeding or avoiding the area.

3.5.3.1.8.1 Model-Predicted Impacts

The average ranges to impacts from explosions of different charge weights for each of the specific criteria (onset mortality, onset slight lung injury, onset slight gastrointestinal tract injury, PTS, and TTS) are shown in Table 3.5-9. Sea turtles within these ranges are predicted by the model to receive the associated impact. Information regarding the ranges to impacts is important not only for predicting acoustic impacts but also for verifying the accuracy of model results against real-world situations and determining adequate mitigation ranges to avoid higher level impacts, especially physiological impacts on sea turtles. Because propagation of the acoustic waves is affected by environmental factors at different locations and because some criteria are partially based on sea turtle mass, the range of impacts for particular criteria will vary.

Table 3.5-9: Ranges to Impacts from In-Water Explosions to Sea Turtles for Representative Sources

Criterion/ Predicted Impact[1]	Impact Predicted to Occur When Sea Turtle is at this Range (m) or Closer to a Detonation					
	Source Class E2 (0.5 lb. NEW)	Source Class E5 (10 lb. NEW)	Source Class E9 (250 lb. NEW)	Source Class E12 (1,000 lb. NEW)	Source Class E16 (14,000 lb. NEW)	Source Class E17 (58,000 lb. NEW)
Onset Mortality (1% Mortality)	12	47	137	204	2,483	3,963
Onset Slight Lung Injury	25	87	240	352	4,372	6,935
Onset Slight GI Tract Injury	25	71	147	274	765	1,249
Permanent Threshold Shift[2,3]	79	222	587	1,602	8,696	12,431
Temporary Threshold Shift[2,3]	178	598	1,711	3,615	19,192	26,992
Avoidance Behavior (for multiple impulses)	344	1,125	2,971	6,709	NA[4]	NA[4]

GI: gastrointestinal; lb.: pound; m: meters, NEW: net explosive weight

Ranges determined using REFMS, Navy's explosive propagation model.

[1] Criteria for impacts are discussed in Section 3.5.3.1.3 (Acoustic and Explosive Thresholds and Criteria).

[2] Modeling for sound exposure level-based impulsive criteria assumed explosive event durations of one second. Actual durations may be less, resulting in smaller ranges to impact.

[3] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

[4] Source classes E16 and E17 are only used during ship shock trials. Each ship shock trial uses up to four detonations that are spaced about one week apart. Therefore, they are considered single impulses.

Based on the estimate of sound exposure level that could induce a sea turtle to exhibit avoidance behavior when exposed to repeated impulsive sounds (Section 3.5.3.1.3.12, Criteria for Behavioral Responses), the distance from an explosion at which a sea turtle may behaviorally react (e.g., avoid by moving farther away) can be estimated. These ranges are also shown in Table 3.5-9. If exposed to a single impulsive sound, a sea turtle is assumed to exhibit a brief startle reaction that would likely be biologically insignificant.

A region of cavitation may occur between a large underwater detonation and the water surface where the reflected shock wave causes a region of water tension. When this region collapses, a change in direction of the pressure wave can be created. During ship shock trial detonations, the cavitation region could extend beyond 1.1 nm at depths less than 30 m from the water surface (Craig and Rye 2008). Animals in this region could be killed or injured. Because the estimated cavitation range is less than the range to onset mortality for explosives used during ship shock trials (source class E16 and E17), any mortalities or injuries due to cavitation are accounted for within the impacts for onset mortality.

Table 3.5-10 through Table 3.5-16 present predicted impacts on sea turtles from explosive detonations estimated by the Navy Acoustic Effects Model, applying the impact threshold criteria shown in Table 3.5-3. The impact estimates for each alternative represent the total number of impacts and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year.

Table 3.5-10: Annual Model-Predicted Impacts on Sea Turtles from Explosions for Training Activities under the No Action Alternative

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury	Mortality
Hardshell Turtles[1]	23	3	0	1	1
Kemp's Ridley Turtle	14	1	0	0	0
Loggerhead Turtle	48	4	0	2	1
Leatherback Turtle	24	3	0	0	0

GI: gastrointestinal

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-11: Annual Model-Predicted Impacts on Sea Turtles from Explosions for Training Activities under Alternatives 1 and 2

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury	Mortality
Hardshell Turtles[1]	85	11	1	3	2
Kemp's Ridley Turtle	39	2	0	1	1
Loggerhead Turtle	188	18	0	7	4
Leatherback Turtle	103	14	0	2	1

GI: gastrointestinal

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-12: Annual Model-Predicted Impacts on Sea Turtles from Explosions for Testing Activities under the No Action Alternative

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury	Mortality
Hardshell Turtles[1]	10	1	0	1	0
Kemp's Ridley Turtle	1	0	0	0	0
Loggerhead Turtle	21	2	0	2	1
Leatherback Turtle	8	1	0	0	0

GI: gastrointestinal

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-13: Annual Model-Predicted Impacts on Sea Turtles from Explosions for Testing Activities under Alternative 1

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury	Mortality
Hardshell Turtles[1]	45	6	0	3	4
Kemp's Ridley Turtle	5	0	0	0	2
Loggerhead Turtle	67	6	0	4	5
Leatherback Turtle	13	2	0	0	0

GI: gastrointestinal

Predicted impacts exclude those from ship shock trials.

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-14: Annual Model-Predicted Impacts on Sea Turtles from Explosions for Testing Activities under Alternative 2

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury	Mortality
Hardshell Turtles[1]	55	7	0	4	5
Kemp's Ridley Turtle	6	0	0	0	2
Loggerhead Turtle	81	7	0	5	5
Leatherback Turtle	17	2	0	1	0

GI: gastrointestinal
Predicted impacts exclude those from ship shock trials.

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.
[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

Table 3.5-15: Model-Predicted Impacts on Sea Turtles from Explosions during Aircraft Carrier Ship Shock Trial under Alternatives 1 and 2

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury[3]	Mortality[3]
Hardshell Turtles[1]	74	2	0	215	40
Kemp's Ridley Turtle	5	0	0	16	2
Loggerhead Turtle	83	5	0	531	67
Leatherback Turtle	120	15	0	126	48

GI: gastrointestinal
Event would occur once per five-year period. Event uses up to four source class E17 charges (14,501–58,000 pounds [lb.] net explosive weight). Detonations are separated by about one week. Predicted impacts are the sum of impacts from the four detonations over one ship shock trial.
[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.
[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).
[3] For larger detonations, such as those that occur during ship shock trials, the range to onset of impacts based on impulse criteria (slight lung injury and mortality) may overtake a portion of the range to pressure and sound exposure level based impacts (temporary threshold shift, permanent threshold shift, and GI tract injury).

Table 3.5-16: Model-Predicted Impacts on Sea Turtles from Explosions during the Guided Missile Destroyer and Littoral Combat Ship Shock Trials Under Alternatives 1 and 2 (Per Single Full Ship Shock Trial Event)

Sea Turtle Species or Group	Temporary Threshold Shift[2]	Permanent Threshold Shift[2]	GI Tract Injury	Slight Lung Injury[3]	Mortality[3]
Hardshell Turtles[1]	38	1	0	23	4
Kemp's Ridley Turtle	3	0	0	1	0
Loggerhead Turtle	49	3	0	42	9
Leatherback Turtle	90	12	0	35	9

GI: gastrointestinal

Guided Missile Destroyer event would occur once per five-year period. Event uses up to four source class E16 charges (7,251–14,500 pound [lb.] net explosive weight). Detonations are separated by about one week. Predicted impacts are the sum of impacts from the four detonations over one ship shock trial.

Littoral Combat Ship event would occur twice per five-year period. Event uses up to four source class E16 charges (7,251–14,500 lb. net explosive weight). Detonations are separated by about one week. Predicted impacts are the sum of impacts from the four detonations over one ship shock trial.

[1] The Hardshell Turtles category includes a combined density estimate for green, hawksbill, and all unidentified hardshell turtles. There is no separate density estimate for green or hawksbill sea turtles.

[2] PTS and TTS impacts are over-estimated due to incorrect threshold weighting; see Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift).

[3] For larger detonations, such as those that occur during ship shock trials, the range to onset of impacts based on impulse criteria (slight lung injury and mortality) may overtake a portion of the range to pressure and sound exposure level based impacts (temporary threshold shift, permanent threshold shift, and GI tract injury).

As discussed in Section 3.5.3.1.3.4 (Criteria for Hearing Loss – Temporary and Permanent Threshold Shift), the thresholds that were used to quantitatively predict onset of TTS and PTS for sea turtles were incorrectly lowered when developing sea turtle acoustic impact criteria based on cetacean data. Therefore, the predicted impacts shown above (PTS and TTS) are conservative (i.e., over-predicted). Additionally, some of the conservative assumptions made for the impact modeling and criteria may cause the impact predictions to be overestimated, as follows:

- Many explosions from munitions such as bombs and missiles actually explode upon impact with above-water targets. For this analysis, sources such as these were modeled as exploding at depths of 1 m, overestimating the amount of explosive and acoustic energy entering the water.
- For predicting TTS and PTS based on sound exposure level, the duration of an explosion is assumed to be one second. Actual detonation durations may be much shorter, so the actual sound exposure level at a particular distance may be lower.
- Mortality and slight lung injury criteria are based on juvenile turtle masses, which substantially increases that range to which these impacts are predicted to occur compared to the ranges that would be predicted using adult turtle masses.
- Animats are assumed to receive the full impulse of the initial positive pressure wave due to an explosion, although the impulse-based thresholds (onset mortality and onset slight lung injury) assume an impulse delivery time adjusted for animal size and depth. Therefore, these impacts are overestimated at farther distances and increased depths.
- The predicted acoustic impacts do not take into account mitigation measures implemented during many training and testing activities, such as exclusion zones around detonations. Smaller hatchling and early juvenile hardshell turtles tend to be near the surface and are often associated with *Sargassum*, which is subject to avoidance mitigation measures (Chapter 5.0, Standard Operating Procedures, Mitigation, and Monitoring).

Most training and testing activities using explosives occur every year. Results for ship shock trial testing activities shown below are presented separately from annual training and testing because these events would not occur annually.

3.5.3.1.8.2 No Action Alternative

Training Activities

Training activities under the No Action Alternative using explosives at or beneath the water surface would expose sea turtles to underwater impulsive sound. The largest source class used during training under the No Action Alternative would be E12 (651–1,000 pounds [lb.] net explosive weight). Explosives at or beneath the water surface would be used in all training range complexes, except typically none would be used in Key West Range Complex. The number of training events using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Model-predicted impacts on sea turtles due to explosives used in annually recurring training activities under the No Action Alternative are shown in Table 3.5-10. The results shown are the impacts on sea turtles predicted for one year of training. Under the No Action Alternative, the majority of predicted impacts are due to bombing exercises (air-to-surface) using source class E12 (651–1,000 lb. net explosive weight), missile exercises (air-to-surface) using source class E6 (11–20 lb. net explosive weight) and E10 (251–500 lb. net explosive weight), tracking exercise/torpedo exercise–Maritime Patrol Aircraft–sonobuoy using source class E4 (2.6–5 lb. net explosive weight), naval surface fire support–at sea using source class E5 (6–10 lb. net explosive weight), and gunnery exercise (air-to-surface)–rocket using source class E5 (6–10 lb. net explosive weight).

Most impacts are predicted to occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem, Southeast U.S. Continental Shelf Large Marine Ecosystem, and Gulf Stream Open Ocean Area. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems would typically be foraging adults and juveniles. Detonations would typically occur beyond about 3 nm from shore, minimizing impacts near nesting beaches. A small number of nearshore (within 3 nm) training events could occur in the Gulf of Mexico Large Marine Ecosystem, potentially exposing some sea turtles approaching nesting beaches to impulsive sounds over a short duration if the training occurred during nesting season.

A small number of sea turtles are predicted to be exposed to impulse levels associated with the onset of mortality (one loggerhead and one hardshell) and slight lung injury (two loggerheads and one hardshell) over any training year. Any injured sea turtles could suffer reduced fitness and long-term survival. Sea turtles that experience PTS (three leatherbacks, four loggerheads, one Kemp's ridley, and three hardshell) would have permanently reduced perception of sound within a limited frequency range. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would have long-term consequences for that individual, as the sea turtle hearing range is already limited. A long-term consequence could be an impact on an individual turtle's ability to sense biologically important sounds, such as predators or prey, reducing that animal's fitness; however, because most sounds are broadband, a reduction in sensitivity over a small portion of hearing range may not interfere with perception of most sounds. One hundred nine sea turtles are predicted to experience TTS, which would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure. PTS and TTS threshold criteria for sea turtles are conservatively

based on criteria developed for mid-frequency marine mammals, so actual PTS and TTS impacts may be less than the predicted quantities.

Some sea turtles beyond the ranges of the above impacts may behaviorally react if they hear a detonation. Events consisting of single detonations, such as bombing and missile exercise, are expected to only elicit short-term startle reactions. If a sea turtle hears multiple detonations in a short period, such as during gunnery, firing, or sonobuoy exercises, it may react by avoiding the area. Any significant behavioral reactions could lead to a sea turtle expending energy and missing opportunities to secure resources. However, because most events would consist of a limited number of detonations and exposures would not occur over long durations, there would be an opportunity to recover from an incurred energetic cost.

Because model-predicted impacts are conservative and most impacts would be short-term, potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

Under the No Action Alternative, training activities involving explosions would not occur in or near the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for green, hawksbill, and leatherback sea turtles. Training activities using explosives also would not occur in inland and nearshore waters used by American crocodiles and American alligators, nor would they occur in or near American crocodile critical habitat.

Pursuant to the ESA, use of explosives during training activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles and ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

Testing Activities

Testing activities under the No Action Alternative using explosives at or beneath the water surface would expose sea turtles to underwater impulsive sound. The largest source class used during testing under the No Action Alternative is E14 (1,741–3,625 lb. net explosive weight). Explosives at or beneath the water surface would be used in all training range complexes, and within the Naval Undersea Warfare Center, Panama City Division Testing Range. The number of testing activities using explosives and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Model-predicted acoustic impacts on sea turtles due to explosions during annually recurring testing activities under the No Action Alternative are shown in Table 3.5-12 and include 1 loggerhead mortality; 2 loggerhead and 1 hardshell slight lung injuries; 1 leatherback, 2 loggerhead, and 1 hardshell PTS; and 40 TTS. The results shown are the impacts on sea turtles predicted for one year of testing. Under the No Action Alternative, the majority of predicted impacts are due to airborne projectile-based mine clearance system using source class E11 (501–650 lb. net explosive weight), anti-submarine warfare

tracking test–Maritime Patrol Aircraft using source classes E3 (0.6–2.5 lb. net explosive weight) and E4 (2.6–5 lb. net explosive weight), and mine countermeasure/neutralization testing using source classes E4 (2.6-5 lb. net explosive weight) and E8 (61–100 lb. net explosive weight).

Most impacts are predicted to occur in Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Caribbean Sea Large Marine Ecosystems. Sea turtles in these areas would typically be adults and juveniles, not post-hatchlings. Although most detonations would occur beyond about 3 nm from shore, some testing activities may occur near shore (within 3 nm) in the Gulf of Mexico Large Marine Ecosystem, potentially exposing some sea turtles approaching nesting beaches to impulsive sounds over a short duration if the testing occurred during nesting season.

A small number of sea turtles are predicted to be exposed to impulse levels associated with the onset of mortality and slight lung injury over any testing year. Any injured sea turtles could suffer reduced fitness and long-term survival. Sea turtles that experience PTS would have permanently reduced perception of sound within a limited frequency range. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would have long-term consequences for that individual, as sea turtle hearing range is already limited. Impacts on an individual turtle's ability to sense biologically important sounds, such as predators or prey, could be a long-term consequence, reducing that animal's fitness; however, because most sounds are broadband, a reduction in sensitivity over a small portion of hearing range may not interfere with perception of most sounds. A larger number are predicted to experience TTS, which would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure. PTS and TTS threshold criteria for sea turtles are conservatively based on criteria developed for mid-frequency marine mammals, so actual PTS and TTS impacts may be less than predicted.

Some sea turtles beyond the ranges of the above impacts may behaviorally react if they hear a detonation. Events consisting of single detonations, such as mine detonation, are expected to only elicit short-term startle reactions. If a sea turtle hears multiple detonations in a short period, such as during gunnery activities, it may react by avoiding the area. Any significant behavioral reactions could lead to a sea turtle expending energy and missing opportunities to secure resources. However, because most events would consist of a limited number of detonations and exposures would not occur over long durations, there would be an opportunity to recover from an incurred energetic cost.

Because model-predicted impacts are conservative and most impacts would be short-term, potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

Under the No Action Alternative, testing activities involving explosions would not occur in or near the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for green, hawksbill, and leatherback sea turtles. Testing activities using explosives also would not occur in inland and nearshore waters used by American crocodiles and American alligators, nor would they occur in or near American crocodile critical habitat.

Pursuant to the ESA, use of explosives during testing activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on American crocodiles or American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

3.5.3.1.8.3 Alternative 1

Training Activities

Under Alternative 1, the number of explosive detonations at or beneath the water surface would increase compared to the No Action Alternative. The largest source class used during training under Alternative 1 would be E12 (651–1,000 lb. net explosive weight). Explosives at or beneath the water surface would be used in all training range complexes. The number of training activities using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Model-predicted impacts on sea turtles due to explosions during annually recurring training activities under Alternative 1 are shown in Table 3.5-11 and include 1 leatherback, 4 loggerhead, 1 Kemp's ridley, and 2 hardshell mortalities; 2 leatherback, 7 loggerhead, 1 Kemp's ridley, and 3 hardshell slight lung injuries; 1 hardshell GI tract injury; 14 leatherback, 18 loggerhead, 2 Kemp's ridley, and 11 hardshell PTS; and 415 TTS. The results shown are the impacts on sea turtles predicted for one year of training. Under Alternative 1, the majority of predicted impacts are due to bombing exercises (air-to-surface) using source class E12 (651–1,000 lb. net explosive weight), missile exercises (air-to-surface) using source class E6 (11–20 lb. net explosive weight) and E10 (251–500 lb. net explosive weight), tracking exercise/torpedo exercise–Maritime Patrol Aircraft–sonobuoy using source class E4 (2.6–5 lb. net explosive weight), mine neutralization-explosive ordnance disposal using source classes E5 through E8 (6–100 lb. net explosive weight), naval surface fire support–at sea using source class E5 (6–10 lb. net explosive weight), and gunnery exercise (air-to-surface)–rocket using source class E5 (6–10 lb. net explosive weight).

Most impacts are predicted to occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem, Southeast U.S. Continental Shelf Large Marine Ecosystem, and Gulf Stream Open Ocean Area. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems would typically be foraging adults and juveniles. Detonations would typically occur beyond about 3 nm from shore, minimizing impacts near nesting beaches. A small number of nearshore (within 3 nm) training events could occur in the Gulf of Mexico Large Marine Ecosystem, potentially exposing some sea turtles approaching nesting beaches to impulsive sounds over a short duration if the training occurred during nesting season.

Although the impacts on sea turtles are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual sea turtle remain the same. For the reasons provided in Section 3.5.3.1.8.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Although a few individuals may experience long-term impacts, population-level impacts are not expected.

Under Alternative 1, training activities involving explosions would not occur in or near the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for green, hawksbill, and leatherback sea turtles. Training activities using explosives also would not occur in inland and nearshore waters used by American crocodiles and American alligators, nor would they occur in or near American crocodile critical habitat.

Pursuant to the ESA, use of explosives during training activities as described under Alternative 1:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

Testing Activities

Under Alternative 1, the number of testing activities that use explosions at or beneath the water surface would increase over the No Action Alternative. The largest source class used during these annually recurring testing events would be E14 (1,741–3,625 lb. net explosive weight). Explosives at or beneath the water surface would be used during annually recurring testing in all training range complexes and within the Naval Surface Warfare Center, Panama City Division Testing Range. The most substantial increase in explosives use would occur during the ship shock trials of three platforms in the VACAPES or JAX Range Complexes: aircraft carrier (one event in five years), destroyer (one event in five years), and Littoral Combat Ship (two events in five years). Aircraft carrier full ship shock trials could use charges up to source class E17 (14,501–58,000 lb. net explosive weight). Destroyer and Littoral Combat Ship full ship shock trials could use charges up to source class E16 (7,251–14,500 lb. net explosive weight). The number of testing activities using explosives and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Model-predicted impacts on sea turtles due to explosions during annually recurring testing activities under Alternative 1 are shown in Table 3.5-13 and include 5 loggerhead, 2 Kemp's ridley, and 4 hardshell mortalities; 4 loggerhead and 3 hardshell slight lung injuries; 2 leatherback, 6 loggerhead, and 6 hardshell PTS; and 130 TTS. The results shown are the impacts on sea turtles predicted for one year of testing. Under Alternative 1, the majority of predicted impacts are due to sonobuoy lot acceptance testing using source classes E3 (0.6–2.5 lb. net explosive weight) and E4 (2.6–5 lb. net explosive weight), airborne projectile-based mine clearance system using source class E11 (501–650 lb. net explosive weight), anti-submarine warfare tracking test–Maritime Patrol Aircraft using source classes E3 (0.6–2.5 lb. net explosive weight) and E4 (2.6–5 lb. net explosive weight), and airborne mine neutralization system testing using source class E11 (501–650 lb. net explosive weight). Model-predicted impacts on sea turtles due to full ship shock trials under Alternative 1 are shown in Table 3.5-15 (Aircraft Carrier) and Table 3.5-16 (Guided Missile Destroyer and Littoral Combat Ship). These impacts are as follows for the aircraft carrier ship shock trial: 48 leatherback, 67 loggerhead, 2 Kemp's ridley, and 40 hardshell mortalities; 126 leatherback, 531 loggerhead, 16 Kemp's ridley, and 215 hardshell slight lung injuries; 15 leatherback, 5 loggerhead, and 2 hardshell PTS; and 282 TTS. These impacts are as follows for each guided missile destroyer or littoral combat ship shock trial: 9 leatherback, 9 loggerhead, and 4 hardshell mortalities; 35 leatherback, 42 loggerhead, 1 Kemp's ridley, and 23 hardshell slight lung injuries; 12 leatherback, 3 loggerhead, and 1 hardshell PTS; and 180 TTS.

Most impacts due to annually recurring testing activities are predicted to occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area. A ship shock trial would introduce substantial impacts in the Southeast U.S. Continental Shelf and the Gulf Stream Open Ocean Area compared to the impacts caused by annual testing alone. Sea turtles in the Gulf Stream Open Ocean Area would typically be post-hatchlings, juveniles, or migrating adults, while sea turtles in the other large marine ecosystems would typically be adults and juveniles. A small number of nearshore (within 3 nm) testing events could occur in the Gulf of Mexico Large Marine Ecosystem, potentially exposing some sea turtles approaching nesting beaches to impulsive sounds over a short duration if the testing occurred during nesting season.

Although the impacts on sea turtles are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual sea turtle remain the same. For the reasons provided in Section 3.5.3.1.8.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Although a few individuals may experience long-term impacts, population-level impacts are not expected.

Under Alternative 1, testing activities involving explosions would not occur in or near the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for green, hawksbill, and leatherback sea turtles. Testing activities using explosives also would not occur in inland and nearshore waters used by American crocodiles and American alligators, nor would they occur in or near American crocodile critical habitat.

Pursuant to the ESA, use of explosives during testing activities as described under Alternative 1:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

3.5.3.1.8.4 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.5.3.1.8.3 (Alternative 1).

Pursuant to the ESA, use of explosives during training activities as described under Alternative 2:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

Testing Activities

The number of annually recurring testing activities that use explosions under Alternative 2 would increase compared to the No Action Alternative. The most substantial increase in explosives use would occur during the ship shock trials of three platforms in the VACAPES or JAX Range Complexes: aircraft

carrier (one event in five years), destroyer (one event in five years), and Littoral Combat Ship (two events in five years). Compared to Alternative 1, the number of detonations during annually recurring testing activities would increase by about 10 percent. The types of testing activities (both annually recurring activities and ship shock trials), source classes, and locations would be the same as those under Alternative 1.

Model-predicted impacts on sea turtles due to explosions during annually recurring testing activities under Alternative 2 are shown in Table 3.5-14. The results shown are the impacts on sea turtles predicted for one year of training, and include 5 loggerhead, 2 Kemp's ridley, and 5 hardshell mortalities; 1 leatherback, 5 loggerhead, and 4 hardshell slight lung injuries; 2 leatherback, 7 loggerhead, and 7 hardshell PTS; and 159 TTS. Model-predicted impacts on sea turtles due to full ship shock trials under Alternative 2 are the same as under Alternative 1 and are shown in Table 3.5-15 (Aircraft Carrier) and Table 3.5-16 (Guided Missile Destroyer and Littoral Combat Ship).

Although the impacts on sea turtles are expected to increase under Alternative 2 compared to the No Action Alternative, the expected impacts on any individual sea turtle remain the same. For the reasons provided in Section 3.5.3.1.8.2 (No Action Alternative), potential impacts are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Although a few individuals may experience long-term impacts, population-level impacts are not expected.

Under Alternative 2, testing activities involving explosions would not occur in or near the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for green, hawksbill, and leatherback sea turtles. Testing activities using explosives also would not occur in inland and nearshore waters used by American crocodiles and American alligators, nor would they occur in or near American crocodile critical habitat.

Pursuant to the ESA, use of explosives during testing activities as described under Alternative 2:

- *may affect and is likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

3.5.3.1.9 Impacts from Pile Driving

Construction of an elevated causeway system, a temporary pier allowing offloading of supply ships, would require pile driving and pile removal during Joint Logistics Over-the-Shore training. A separate environmental assessment has been prepared to address impacts due to all activities that occur during Joint Logistics Over-the-Shore training, with the exception of impacts due to in-water noise generated during construction of the elevated causeway. This EIS/OEIS includes analysis of the impact of underwater noise generated by pile driving during elevated causeway construction to facilitate holistic analysis of impacts due to all underwater noise generated during training and testing in the Study Area.

Pile driving activities could include impact or vibratory pile driving and vibratory pile removal, which would produce impulsive and continuous sounds underwater. Sounds produced during pile driving are described in Section 3.0.5.3.1.3 (Pile Driving). Pile driving would occur only during training under Alternatives 1 and 2 during construction of the elevated causeway system. This activity would involve intermittent impact pile driving of 24-inch, uncapped, steel pipe piles over about two weeks at a rate of

about eight piles per day, one pile at a time, for a total of approximately 100 piles. Each pile takes about 10 minutes to drive. When training events that use the elevated causeway system are complete, the structure would be removed. The piles would be removed using vibratory methods over seven to ten days. Crews can remove about 14 piles per day, each taking about six minutes to remove.

The duration of pile driving during installation and removal of piles is as follows:

Impact pile driving (approximately 100 piles):

- 100 piles/8 piles per day = 12.5 days
- 8 piles x 10 minutes impact driving per pile = 80 minutes per day
- Portion of day impact pile driving noise produced = 6 percent

Vibratory pile removal (approximately 100 piles):

- 100 piles/14 piles per day = 7.1 days
- 14 piles x 6 minutes vibratory removal per pile = 84 minutes per day
- Portion of day impact pile driving noise produced = 6 percent

Underwater noise effects from pile driving were modeled using a conservative estimate of geometric spreading loss of sound in shallow coastal waters. A spreading loss of 15*Log (radius) was used to estimate range (r) to the relevant pile driving criteria. A calculation of sea turtle exposures is then estimated by:

$$\text{Exposure estimate} = (n * (\pi r^2/2)) * \text{days of pile installation/removal}$$

Where:

n = density estimate used for each species/season
r = range to pile driving noise criteria threshold(s)
$\pi \approx 3.1415926$

The exposure estimate was calculated separately for the impact and the vibratory pile driving activities and combined to predict the total number of expected exposures. Three species of sea turtles (loggerhead, Kemp's ridley, and green), as well as a hardshell sea turtle group consisting of unidentified individuals of all hard shell sea turtle species, have density estimates occurring near the coastal pile driving locations.

Based on the calculation as described above, sound pressure levels associated with impact pile driving activities would be above the injury criteria threshold value (190 dB re 1µPa root mean square) only a short distance from the pile (approximately 10 m). Due to the small size of the potential injury zone and the low densities of sea turtles in the proposed project locations, no injurious exposures are predicted to occur due to impact pile driving activities associated with Navy training.

Impulses from an impact hammer are broadband and carry most of their energy in the lower frequencies. The impulses are within the hearing range of most sea turtles and can produce a shock wave that is transmitted to the sediment and water column (Reinhall and Dahl 2011). The impulses produced would be less than a second each, occur at a rate of 30–50 impulses per minute, and have a source level of around 190 dB re 1 µPa root mean square and 203 dB re 1 µPa peak at 10 meters from the pile (California Department of Transportation 2009).

Sound produced from a vibratory hammer is similar in frequency range to that of the impact hammer, except the source levels are much lower than the impact hammer. Since the vibrations typically oscillate at a rate of about 1,700 cycles per minute, the sound source is treated as a continuous sound source. The source level for vibratory removal of the size and type of piles that would be used during Navy training, assuming vibratory removal source levels are similar to vibratory driving source levels, would be around 170 dB re 1 µPa root mean square at 10 meters from the pile(California Department of Transportation 2009), less than the criteria threshold value for injury.

Despite the short duration of driving and removing a single pile, there is potential for auditory masking in sea turtles and some temporary physiological stress. In addition, sea turtles may exhibit behavioral responses to impact or vibratory pile driving, including short-term startle responses or avoidance of the area around the pile driving. Due to the presence of vessels and shore construction activity, sea turtles may avoid the areas around proposed construction before pile driving activities begin, decreasing any potential impacts.

3.5.3.1.9.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative do not include pile driving.

Testing Activities

Testing activities under the No Action Alternative do not include pile driving.

3.5.3.1.9.2 Alternative 1

Training Activities

Pile driving would occur during construction and removal phases of the elevated causeway system near shore and within the surf zone at Joint Expeditionary Base Fort Story, Virginia Beach, Virginia; Joint Expeditionary Base Little Creek, Virginia Beach, Virginia; and Marine Corps Base Camp Lejeune, Jacksonville, North Carolina. Elevated causeway construction would occur once a year at one of the locations.

Sea turtles are present near the proposed elevated causeway construction areas as follows:

- The mouth of the Chesapeake Bay, near the Little Creek, Virginia and Ft. Story, Virginia locations, serves as an important developmental habitat for juvenile Kemp's ridley and loggerhead sea turtles during the summer months (Epperly et al. 1995c; Keinath et al. 1994; Morreale and Standora 2005). The presence of juvenile sea turtles in the Chesapeake Bay area peaks from May through October.

- Migrating or foraging green, hawksbill, or leatherback turtles may occur occasionally near the training areas, but are less likely to occur than loggerhead or Kemp's ridley turtles.

- The beaches at Little Creek, Virginia and Ft. Story, Virginia do not support regular sea turtle nesting; however, Onslow Beach, at the Camp Lejeune, North Carolina location, supports a small amount of loggerhead sea turtle nesting (67 nests laid in 2011 and 52 nests laid in 2012) (Seaturtle.org. 2013). Nesting has been recorded to occur as early as May and as late as early September.

Based on the sound fields produced during the impact installation and vibratory removal of 24-inch steel pipe piles, no injuries to sea turtles are predicted due to sound exposures during pile driving and removal activities associated with Navy training. However, sea turtles may briefly behaviorally respond to pile driving and removal, and may temporarily avoid the area immediately surrounding the pile driving. Because of the limited duration of pile driving activities and associated noise, any impacts are expected to be minor and short term. The likelihood that sea turtles would be disturbed if attempting to nest at Onslow beach, the only location that supports sea turtle nesting, is low because: (1) elevated causeway construction would not occur every year at Camp Lejeune, (2) sea turtle nesting only occurs over a four-month period, whereas elevated causeway construction could occur at any time during the year and may not overlap with nesting, and (3) pile driving and removal noise would be produced in the water for only about 80 minutes per day (about six percent of any day) over no more than about three weeks in total.

Proposed pile driving locations are not near sea turtle critical habitat in Puerto Rico and St. Croix, U.S. Virgin Islands. Pile driving and removal activities would not occur in the range of the American crocodile and would not occur near American crocodile critical habitat. American alligators are present at Camp Lejeune, North Carolina, but are not found in the area where pile driving and removal would occur.

Pursuant to the ESA, noise associated with pile driving during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, green, hawksbill, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle or American crocodile critical habitat.*

Testing Activities

Testing activities under Alternative 1 do not include pile driving.

3.5.3.1.9.3 Alternative 2 (Preferred Alternative)

Training Activities

Under Alternative 2, there would be no change to pile driving installation and removal associated with Navy training activities as described in Alternative 1. Therefore, the effects under Alternative 2 would be the same as those previously described to sea turtles and crocodilians (American crocodile and American alligator) under Alternative 1.

Pursuant to the ESA, noise associated with pile driving during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, green, hawksbill, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on sea turtle and American crocodile critical habitat.*

Testing Activities

Testing activities under Alternative 2 do not include pile driving.

3.5.3.1.10 Impacts from Swimmer Defense Airguns

Airguns can introduce brief impulsive, broadband sounds into the marine environment. These sounds are likely within the audible range of most sea turtles. Sounds from airguns are capable of causing PTS or TTS (Section 3.5.3.1.2.2, Hearing Loss) or behavioral responses (Section 3.5.3.1.2.5, Behavioral Reactions). Single, small airguns would not cause direct trauma to sea turtles. Impulses from these small airguns lack the strong shock wave and rapid pressure increases of explosions that can cause primary blast injury or barotraumas (criteria for determining impacts on sea turtles from impulsive sound are discussed in Sections 3.5.3.1.3.2 Impulsive Sounds). The limited information on assessing sea turtle behavioral responses to impulsive sounds is discussed in Section 3.5.3.1.2.5 (Behavioral Reactions).

The behavioral response of sea turtles to the repeated firing of airguns has been studied for seismic survey airguns (e.g., oil and gas exploration) (Section 3.5.3.1.2.5, Behavioral Reactions). Sea turtles were shown to avoid higher level exposures or become agitated when exposed to higher level sources. However, the airguns proposed for use in Navy testing are smaller and fire a limited number of times, so reactions would likely be less than those observed in the studies.

3.5.3.1.10.1 Model-Predicted Impacts

Estimates of the number of sea turtles exposed to levels capable of causing these impacts were calculated using the Navy Acoustic Effects Model. For all testing activities using airguns, no PTS or TTS impacts were predicted.

3.5.3.1.10.2 No Action Alternative

Training Activities

Training activities under the No Action Alternative do not use airguns.

Testing Activities

Testing activities that impart underwater impulsive noise from airguns under the No Action Alternative include pierside integrated swimmer defense testing activities at pierside locations at Joint Expeditionary Base Little Creek, Virginia Beach, Virginia, and Newport, Rhode Island, as described in Table 2.8-3. Small airguns (60 cubic inches [$in.^3$]) would release a limited number of impulses in inland waters around Navy piers. These areas are industrialized, and the waterways carry a high volume of vessel traffic in addition to Navy vessels. These areas tend to have high ambient noise levels and limited numbers of sea turtles present due to the high levels of human activity. If sea turtles are present, they may alert, startle, avoid the immediate area, or not respond at all while the airgun is firing. Substantial behavioral impacts in these areas due to the proposed use of the swimmer defense airgun are unlikely. Impulses from swimmer defense airguns are not predicted to cause any PTS or TTS impacts on sea turtles. The increase in the number of sea turtles that may experience behavioral effects between the alternatives is small compared to the size of sea turtle populations and would not result in long-term consequences to the species.

Airgun use would not occur near sea turtle critical habitat. Use of airguns would occur outside the range where American crocodiles or American alligators are expected to be present and would not occur near American crocodile critical habitat.

Pursuant to the ESA, use of swimmer defense airguns during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.10.3 Alternative 1

Training Activities

Training activities under Alternative 1 do not use airguns.

Testing Activities

Testing activities that impart underwater impulsive noise from airguns under Alternative 1 include pierside integrated swimmer defense testing activities at Little Creek, Virginia Beach, Virginia and Newport, Rhode Island, as described in Table 2.8-3 and stationary source testing at Naval Surface Warfare Center, Panama City Division Testing Range. The types of impacts on sea turtles from exposures to airguns under Alternative 1 are the same as those described under the No Action Alternative. The increase in the number of sea turtles that may experience behavioral effects between the alternatives is small compared to the size of sea turtle populations and would not result in long-term consequences to the species.

Airguns use would not occur near sea turtle critical habitat. Use of airguns would occur outside the range where American crocodiles or American alligators are expected to be present and would not occur near American crocodile critical habitat.

Pursuant to the ESA, use of swimmer defense airguns during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.10.4 Alternative 2 (Preferred Alternative)

Training Activities

Training activities under Alternative 2 do not use airguns.

Testing Activities

Testing activities that impart underwater impulsive noise from airguns under Alternative 2 would increase compared to the No Action Alternative. Compared to Alternative 1, use of airguns would increase by about 10 percent, but locations and types of activities would be the same. The types of impacts on sea turtles from exposures to airguns under Alternative 2 are the same as those described under the No Action Alternative. The increase in the number of sea turtles that may experience behavioral effects between the alternatives is small compared to the size of sea turtle populations and would not result in long-term consequences to the species.

Airguns use would not occur near sea turtle critical habitat. Use of airguns would occur outside the range where American crocodiles or American alligators are expected to be present and would not occur near American crocodile critical habitat.

Pursuant to the ESA, use of swimmer defense airguns during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.11 Impacts from Weapons Firing, Launch, and Impact Noise

Sea turtles may be exposed to weapons firing and launch noise and sound from the impact of non-explosive munitions on the water's surface, as well as sound from in-air explosions near the water surface. The sounds produced by these activities are described in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Reactions by sea turtles to these specific stressors have not been recorded; however, sea turtles may be expected to react to weapons firing, launch, and non-explosive impact noise as they would other transient sounds (Section 3.5.3.1.2.5, Behavioral Reactions).

Sea turtles exposed to firing, launch, and non-explosive impact noise may exhibit brief startle reactions, avoidance, diving, or no reaction at all. Gunfire noise would typically consist of a series of impulsive sounds. Due to the short-term, transient nature of gunfire noise, animals may be exposed to multiple sounds but over a short time period. Launch noise would be transient and of short duration, lasting no more than a few seconds at any given location as a projectile travels. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Any launch noise transmitted into the water would likely be due only to launches from vessels. Most events would consist of single launches. Non-explosive bombs, missiles, and targets could impact the water with great force and produce a short duration impulsive sound underwater that would depend on the size, weight, and speed of the object at impact.

Animals that are within the area of any of these sounds would likely alert, startle, dive, or avoid the immediate area. An animal near the surface directly beneath the firing of a large gun may possibly experience sound exposure levels sufficient to cause a threshold shift; however, this potential impact may be unlikely if a sea turtle reacts to the presence of the vessel before a large gunfire event.

3.5.3.1.11.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface. Activities could occur throughout the Study Area but would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area, mostly in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. The number of events and their proposed locations are described in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).

An animal very near a launch or impact location could experience hearing impacts, although the potential for this effect has not been studied, any impact would only likely occur very close to the firing or impact point, and an animal may avoid vessel interactions before the firing of a gun. Sea turtles that experience PTS would have permanently reduced perception of sound within a limited frequency range. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would

have long-term consequences for that individual, as the sea turtle hearing range is already limited. A long-term consequence could be an impact on an individual turtle's ability to sense biologically important sounds, such as predators or prey, reducing that animal's fitness. TTS would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure.

Any behavioral reactions would likely be short-term and consist of brief startle reactions, avoidance, or diving. Any significant behavioral reactions could lead to a sea turtle expending energy and missing opportunities to secure resources. However, because most events would consist of a limited number of firings or launches and would not occur over long durations, there would be an opportunity to recover from an incurred energetic cost.

Although some individuals may be impacted by activities that include weapons firing, launch, and non-explosive impact noise, population-level impacts are not expected.

These activities are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Additionally, any occurrence of these activities near these waters would have no effect on critical habitat since the noise associated with these activities would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

These activities would not occur in areas where American crocodiles or the American alligator are expected to be present, nor would they occur near American crocodile critical habitat.

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities under the No Action Alternative include activities that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface. Activities could occur throughout the Study Area but would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area, in all of the range complexes, and at Naval Surface Warfare Center, Panama City Division Testing Range. The number of events and their proposed locations are described in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

An animal very near a launch or impact location could experience hearing impacts, although the potential for this effect has not been studied, any impact would only likely occur very close to the firing or impact point, and an animal may avoid vessel interactions before the firing of a gun. Sea turtles that experience PTS would have permanently reduced perception of sound within a limited frequency range. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would have long-term consequences for that individual, as the sea turtle hearing range is already limited. A long-term consequence could be an impact on an individual turtle's ability to sense biologically

important sounds, such as predators or prey, reducing that animal's fitness. TTS would result in short-term reduced perception of sound within a limited frequency range, lasting from minutes to days, depending on the exposure.

Any behavioral reactions would likely be short-term and consist of brief startle reactions, avoidance, or diving. Any significant behavioral reactions could lead to a sea turtle expending energy and missing opportunities to secure resources. However, because most events would consist of a limited number of firings or launches and would not occur over long durations, there would be an opportunity to recover from an incurred energetic cost. Although some individuals may be impacted by activities that include weapons firing, launch, and non-explosive impact noise, population-level impacts are not expected.

These activities are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Additionally, any occurrence of these activities near these waters would have no effect on critical habitat since the noise associated with these activities would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

These activities would not occur in areas where American crocodiles or the American alligator are expected to be present, nor would they occur near American crocodile critical habitat.

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.11.2 Alternative 1

Training Activities

Training activities under Alternative 1 that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface would increase compared to the No Action Alternative. The locations and types of activities would be similar to those under the No Action Alternative. The number of events and their proposed locations are described in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).

Although the impacts on sea turtles are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual sea turtle would remain the same. For the reasons provided in Section 3.5.3.1.11.1 (No Action Alternative), although some individuals may be impacted by activities that include weapons firing, launch, and non-explosive impact, population-level impacts are not expected.

These activities are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Additionally, any occurrence of these activities near these waters would have no effect on critical habitat since the noise associated with these activities would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

These activities would not occur in areas where American crocodiles or the American alligator are expected to be present, nor would they occur near American crocodile critical habitat.

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities under Alternative 1 that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface would increase compared to the No Action Alternative. Additional types of testing activities would be conducted under Alternative 1, notably addition of activities in the Caribbean Sea Large Marine Ecosystem at the Key West Range Complex. The number of events and their proposed locations are described in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

Although the impacts on sea turtles are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual sea turtle would remain the same. For the reasons provided in Section 3.5.3.1.11.1 (No Action Alternative), although some individuals may be impacted by activities that include weapons firing, launch, and non-explosive impact, population-level impacts are not expected.

These activities are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Additionally, any occurrence of these activities near these waters would have no effect on critical habitat since the noise associated with these activities would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

These activities would not occur in areas where American crocodiles or the American alligator are expected to be present, nor would they occur near American crocodile critical habitat.

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.11.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.5.3.1.11.2 (Alternative 1).

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities under Alternative 2 that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface would increase from the No Action Alternative. Locations and types of activities would be the same as those under Alternative 1, although the number of activities that produce in-water noise from weapons firing, launch, and non-explosive munitions impact with the water's surface would increase by about 10 percent. The number of events and their proposed locations are described in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

Although the impacts on sea turtles are expected to increase under Alternative 2 compared to the No Action Alternative, the expected impacts on any individual sea turtle would remain the same. For the reasons provided in Section 3.5.3.1.11.1 (No Action Alternative), although some individuals may be impacted by activities that include weapons firing, launch, and non-explosive impact, population-level impacts are not expected.

These activities are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Additionally, any occurrence of these activities near these waters would have no effect on critical habitat since the noise associated with these activities would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

These activities would not occur in areas where American crocodiles or the American alligator are expected to be present, nor would they occur near American crocodile critical habitat.

Pursuant to the ESA, noise associated with weapons firing, launch, and non-explosive impact during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles;*
- *will have no effect on ESA-listed American crocodiles or ESA-listed American alligators; and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.12 Impacts from Vessel and Aircraft Noise

Vessel Noise

Vessel movements could occur throughout the Study Area, although some portions would have limited or no activity. Many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Navy traffic is heaviest just offshore of Norfolk, Virginia, and Jacksonville,

Florida, as well as along the coastal waters between the two ports (Mintz and Filadelfo 2011). Additionally, a variety of smaller craft are operated within the Study Area. Small craft types, sizes, and speeds vary. During training, speeds generally range from 10 to 14 knots; however, ships/craft can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. A detailed description of vessel noise is provided in Section 3.0.5.3.1.6 (Vessel Noise).

Vessel noise has the potential to disturb sea turtles or crocodilians and potentially elicit an alerting, avoidance, or other behavioral reaction. Sea turtles are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. It is likely that some sea turtles have habituated to vessel noise and may be more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). The American crocodile and alligator are primarily freshwater and estuarine species, so their interactions with vessels are likely more limited, as noted by the South Florida Multi-Species Recovery Plan (U.S. Fish and Wildlife Service 1999), which indicated that recreational boating, including the use of jet skis, is limited in portions of American crocodile habitat but is likely to increase in the future. Little empirical research is available regarding the reactions of crocodilians to vessel noise. One study with the speckled caiman (*Caiman crocodilus*) in Costa Rica noted that these animals were frequently observed avoiding oncoming boats, a response that the authors considered was likely due in part to avoiding anthropogenic threats such as hunting as well as boat collisions (Grant and Lewis 2010). Generally, since crocodilians hear better at lower frequencies both in air and underwater (Higgs et al. 2002) and have a similar, if not slightly expanded, hearing range compared to sea turtles, their reactions to vessel noise may be similar. Any reactions are likely to be minor and short-term avoidance reactions, leading to no long-term consequences.

Auditory masking can occur due to vessel noise, potentially masking biologically important sounds for sea turtles (e.g., sounds of prey or predators) and crocodilians (e.g., sounds of prey, conspecifics for mating, or their young), which these species may rely upon. Potential for masking can vary depending on the ambient noise level within the environment (Section 3.0.4.5, Ambient Noise), the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. Masking by passing ships or other sound sources transiting the Study Area would be short-term, intermittent, and, therefore, unlikely to result in any substantial energetic costs or consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of auditory masking for sea turtles, which could reduce an animal's ability to find prey, find mates, avoid predators, or navigate. However, Navy vessels make up a very small percentage of the overall traffic and the rise of ambient noise levels in these areas is a problem related to all ocean users including commercial and recreational vessels and shoreline development and industrialization.

Surface combatant ships (e.g., guided missile destroyer, guided missile cruiser, and Littoral Combat Ship) and submarines are designed to be very quiet to evade enemy detection. While surface combatants and submarines may be detectable by sea turtles over ambient noise levels at distances of up to a few kilometers, any auditory masking would be minor and temporary. Other Navy ships and small craft have higher source levels, similar to equivalently sized commercial ships and private vessels. Ship noise tends to be low-frequency and broadband; therefore, it may have the largest potential to mask all sea turtle hearing. Noise from large vessels and outboard motors on small craft can produce source levels of 160 to over 200 dB re 1 µPa at 1 m for some large commercial vessels and outboard engines. Therefore, in the open ocean, noise from noncombatant Navy vessels may be detectable over ambient levels for tens of kilometers and some auditory masking is possible. In noisier inshore areas around Navy ports

and ranges, vessel noise may be detectable above ambient for only several hundred meters. Some auditory masking to sea turtles is likely from noncombatant Navy vessels, especially in quieter, open-ocean environments.

Navy ports such as Mayport and Norfolk are heavily trafficked with private and commercial vessels in addition to naval vessels. Because Navy ships make up a small portion of the total ship traffic, even in the most concentrated port and inshore areas, proposed Navy vessel transits are unlikely to cause long-term abandonment of habitat by sea turtles.

Since the American crocodile and American alligator are primarily freshwater or estuarine species, their habitat likely only overlaps with a very small percentage of vessels activities that would occur during Navy training and testing in the nearshore waters. Because surface combatant ships and submarines require deeper waters to maneuver, they generally operate in the offshore marine environment. As a result, vessel noise from these sources would likely be undetectable to crocodilians over ambient levels due to the distance from the source. Smaller vessels that operate in the nearshore marine environment or in some estuarine habitats associated with ports and bays within the Study Area have more potential to overlap with habitat where the American crocodile or alligator may be present. In noisier inshore areas around Navy ports and ranges, vessel noise may be detectable above ambient for only several hundred meters. Since these training and testing activities would likely occur at the periphery of crocodilian habitat, any exposures would likely occur at a distance from source. Therefore, these animals would be expected to receive very low levels of exposure, if at all, because levels associated with these received signals would likely be indistinguishable from other background sources of noise from other anthropogenic (e.g., commercial or recreational boat traffic) or natural (e.g., waves, snapping shrimp) sources.

Aircraft Noise

Fixed- and rotary-wing aircraft are used for a variety of training and testing activities throughout the Study Area. Sea turtles may be exposed to aircraft-generated noise wherever aircraft overflights occur in the Study Area. Most of these sounds would be centered on airbases and fixed ranges within each range complex. Aircraft produce extensive airborne noise from either turbofan or turbojet engines. Rotary-wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al. 2003). A severe but infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. A detailed description of aircraft noise as a stressor is provided in Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the craft in a narrow cone area, as discussed in greater detail in Section 3.0.4 (Acoustic and Explosives Primer). Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. The maximum sound levels in water from aircraft overflight are about 150 dB re 1 µPa for an F/A-18 aircraft at 980 ft. altitude; about 125 dB re 1 µPa for an H-60 helicopter hovering at 50 ft.; and under ideal conditions, sonic booms from aircraft at 3,280 ft. could reach up to 178 dB re 1 µPa at the water's surface (Section 3.0.5.3.1.7, Aircraft Overflight Noise provides additional information on aircraft noise characteristics).

Sea turtles or crocodilians may respond to both the physical presence and to the noise generated by aircraft, making it difficult to attribute causation to one or the other stimulus. In addition to noise produced, all low-flying aircraft make shadows, which can cause animals at the surface to react.

Helicopters may also produce strong downdrafts, a vertical flow of air that becomes a surface wind, which can also affect an animal's behavior at or near the surface.

In most cases, exposure of a sea turtle or crocodilians to fixed-wing or rotary-wing aircraft presence and noise would last for only seconds as the aircraft quickly passes overhead. Animals would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Take-offs and landings from Navy vessels could startle sea turtles; however, these events only produce in-water noise at any given location for a brief period of time as the aircraft climbs to cruising altitude. Some sonic booms from aircraft could startle sea turtles, but these events are transient and happen infrequently at any given location within the Study Area. Repeated exposure to most individuals over short periods (days) is unlikely, except for animals that are resident in inshore areas around Navy ports, on Navy fixed-ranges, or during major training exercises.

Low flight altitudes of helicopters during some activities, which often occur under 100 ft. altitude, may elicit a somewhat stronger behavioral response due to the proximity to the water; the slower airspeed and therefore longer exposure duration; and the downdraft created by the helicopter's rotor. Sea turtles would likely avoid the area under the helicopter. It is unlikely that an individual would be exposed repeatedly for long periods as these events typically transit open ocean areas within the Study Area.

Little is known about American crocodile or alligator responses to sounds from vessel transits and aircraft overflights. Their reactions to these sounds are expected to be similar to those anticipated for sea turtles.

3.5.3.1.12.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include noise from vessel movements and fixed- and rotary-wing aircraft overflights. Navy vessel and aircraft traffic associated with training could occur in all of the range complexes and throughout the Study Area while in transit. Certain portions of the Study Area such as areas near Navy ports and airfields, installations, and training ranges are used more heavily by vessels and aircraft than other portions of the Study Area, as described in further detail in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

Helicopters typically train closer to shore and at lower altitudes than fixed-wing aircraft. Sea turtles foraging in shallow waters or approaching nesting beaches may be exposed to in-water noise from helicopter overflights near Norfolk, Virginia; Camp Lejeune, North Carolina, and Jacksonville, Florida. Navy vessel traffic in the Study Area would be heavily concentrated near the Norfolk and Mayport Navy ports and within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Vessel transits would be more concentrated near major ports at Norfolk, Virginia, and Jacksonville, Florida, as vessels transit to and from offshore training areas. The overlap between crocodilian habitats and activities that include vessel movement and fixed- and rotary-wing aircraft is expected to be more limited than for sea turtles. Small boats used for training activities in inshore waters associated with ports and bays have the most potential to overlap with these species, but even these activities are likely to occur on the periphery of their habitat because the American crocodile and alligator are primarily freshwater or estuarine species.

Sea turtles and crocodiles exposed to a passing Navy vessel or aircraft may not respond at all, or they may exhibit a short-term behavioral response such as avoidance or changing dive behavior. Short-term

reactions to aircraft or vessels are not likely to disrupt major behavioral patterns or to result in serious injury to any sea turtles or crocodilians. Acoustic masking may occur due to vessel sounds, especially from noncombatant ships. Acoustic masking may prevent an animal from perceiving biologically relevant sounds during the period of exposure, potentially resulting in missed opportunities to obtain resources.

Long-term impacts due to the proposed activities are unlikely because the density of Navy ships in the Study Area is low overall and many Navy ships are designed to be as quiet as possible. Abandonment of habitat is unlikely due to proposed Navy activities because of the low overall density of Navy vessel and aircraft in the Study Area. No long-term consequences for individuals or the population would be expected.

Naval vessel transits and aircraft overflights are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Any occurrence of these activities near these waters would have no effect on critical habitat since they would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

Under the No Action Alternative, there is low potential for overlap between vessel noise and fixed- and rotary-wing aircraft overflight noise associated with Navy training activities and critical habitat designated for the American crocodile. However, the occurrence of these activities in or near critical habitat would have no effect on the critical habitat because sounds from these activities would not result in the destruction or impairment of the habitat to support American crocodile populations. Therefore, there would be no effect from training activities associated with the No Action Alternative on critical habitat for the American crocodile.

Pursuant to the ESA, noise associated with vessels and aircraft during training as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities under the No Action Alternative include noise from vessel movements and fixed- and rotary-wing aircraft overflights. Navy vessel and aircraft traffic associated with testing could occur in all of the range complexes, at Naval Surface Warfare Center, Panama City Division Testing Range, Naval Undersea Warfare Center Division, Newport Testing Range, and throughout the Study Area while in transit. Certain portions of the Study Area, such as areas near Navy ports, installations, and testing ranges are used more heavily by vessels than other portions of the Study Area, as described in further detail in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

Helicopters typically fly closer to shore and at lower altitudes than fixed-wing aircraft. Sea turtles foraging in shallow waters or approaching nesting beaches may be exposed to in-water noise from helicopter overflights near Norfolk, Virginia; Camp Lejeune, North Carolina; Jacksonville, Florida; and Panama City, Florida. Navy vessel traffic in the Study Area would be heavily concentrated near the

Norfolk and Mayport Navy ports and within the range complexes. Vessel transits would be more concentrated near major ports at Norfolk, Virginia, and Jacksonville, Florida, as vessels transit to and from offshore testing areas. The overlap between crocodilian habitats and activities that include vessel movement and fixed- and rotary-wing aircraft is expected to be more limited than for sea turtles. Small boats used for training activities in inshore waters associated with ports and bays have the most potential to overlap with these species, but even these activities are likely to occur on the periphery of their habitat since the American crocodile and alligator are primarily freshwater or estuarine species.

Sea turtles and crocodiles exposed to a passing Navy vessel or aircraft may not respond at all, or they may exhibit a short-term behavioral response such as avoidance or changing dive behavior. Short-term reactions to aircraft or vessels are not likely to disrupt major behavioral patterns or to result in serious injury to any sea turtles or crocodilians. Acoustic masking may occur due to vessel sounds, especially from noncombatant ships. Acoustic masking may prevent an animal from perceiving biologically relevant sounds during the period of exposure, potentially resulting in missed opportunities to obtain resources.

Long-term impacts due to the proposed activities are unlikely because the density of Navy ships in the Study Area is low overall and many Navy ships are designed to be as quiet as possible. Abandonment of habitat is unlikely due to proposed Navy activities because of the low overall density of Navy vessel and aircraft in the Study Area. No long-term consequences for individuals or the population would be expected.

Naval vessel transits and aircraft overflights are unlikely to occur in the nearshore waters where critical habitat has been designated in Puerto Rico and St. Croix for sea turtles. Any occurrence of these activities near these waters would have no effect on critical habitat since they would not result in the destruction or impairment of the habitat to support the foraging and development of green and hawksbill turtles or mating and nesting activities for the leatherback sea turtle.

Under the No Action Alternative, there is low potential for overlap between vessel noise and fixed- and rotary-wing aircraft overflight noise and critical habitat designated for the American crocodile. However, the occurrence of these activities in or near critical habitat would have no effect on the critical habitat since sounds from these activities would not result in the destruction or impairment of the habitat to support American crocodile populations.

Pursuant to the ESA, noise associated with vessels and aircraft during testing as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.12.2 Alternative 1

Training Activities

Training activities proposed under Alternative 1 would increase vessel traffic and aircraft flight hours compared to the No Action Alternative, increasing overall amounts of aircraft and vessel noise. Certain portions of the Study Area such as areas near Navy ports and airfields, installations, and training ranges are used more heavily by vessels and aircraft than other portions of the Study Area, as described in

further detail in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise). The types and locations of noise from vessels and aircraft would be similar to those under the No Action Alternative.

Although more sea turtles and crocodilians exposures to noise from vessels and aircraft could occur, predicted impacts from vessel or aircraft noise would not differ substantially from those under the No Action Alternative. Significant behavioral reactions by sea turtles or crocodiles due to passing vessel or aircraft noise are not expected. For the reasons stated in Section 3.5.3.1.12.1 (No Action Alternative), even though vessel and aircraft noise may cause short-term impacts, no long-term consequences for individuals or populations would be expected. Similarly, no impacts on critical habitats would occur.

Pursuant to the ESA, noise associated with vessels and aircraft during training as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities proposed under Alternative 1 would increase Navy vessel traffic and aircraft overflights compared to the No Action Alternative, increasing overall amounts of vessel and aircraft noise. In addition to activities under the No Action Alternative, additional ship trials would be conducted in the Northeast, VACAPES, JAX, and GOMEX Range Complexes, and activities that include the use of vessels would increase at the South Florida Ocean Measurement Facility Testing Range. New vessels proposed for testing under Alternative 1, such as the Littoral Combat Ship, the Joint High Speed Vessel, and the Expeditionary Fighting Vehicle, are all fast moving and designed to operate in nearshore waters. Overall noise levels may increase in these environments. The number of events and proposed locations are discussed in further detail in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

Although more sea turtles and crocodilians exposures to noise from vessels and aircraft could occur, predicted impacts from vessel or aircraft noise would not differ substantially from those under the No Action Alternative. Significant behavioral reactions by sea turtles, crocodiles, or alligators due to passing vessel or aircraft noise are not expected. For the reasons stated in Section 3.5.3.1.12.1 (No Action Alternative), even though vessel and aircraft noise may cause short-term impacts, no long-term consequences for individuals or populations would be expected. Similarly, no impacts on critical habitats would occur.

Pursuant to the ESA, noise associated with vessels and aircraft during testing as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.1.12.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities generating vessel noise under Alternative 2 are identical to training activities under Alternative 1; however, training activities generating aircraft noise would increase, specifically due to a 20 percent increase in air combat maneuver training in the Key West Range Complex. Other than the increase in noise generated by the increase in flight hours at Key West Range Complex, the number and location of training activities producing aircraft noise under Alternative 2 are identical to training activities under Alternative 1 (Section 3.5.3.1.12.2).

Although more sea turtles and crocodilian exposures to noise from vessels and aircraft overflights could occur, predicted impacts from vessel or aircraft noise would not differ substantially from those under the No Action Alternative. Significant behavioral reactions by sea turtles or crocodilians due to passing vessel or aircraft noise are not expected. For the reasons stated in Section 3.5.3.1.12.1 (No Action Alternative), even though vessel and aircraft noise may cause short-term impacts, no long-term consequences for individuals or populations would be expected. Similarly, no impacts on critical habitats would occur.

Pursuant to the ESA, noise associated with vessels and aircraft during training as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

Testing Activities

Testing activities proposed under Alternative 2 would increase Navy vessel traffic and aircraft overflights compared to the No Action Alternative, increasing overall amounts of vessel and aircraft noise. The types of activities and their locations would be similar to those under Alternative 1, although overall activities would increase by about 10 percent. The number of events and proposed locations are discussed in further detail in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

Although more sea turtle and crocodilian exposures to noise from vessels and aircraft could occur, predicted impacts from vessel or aircraft noise would not differ substantially from those under the No Action Alternative. Significant behavioral reactions by sea turtles or crocodiles due to passing vessel or aircraft noise are not expected. For the reasons stated in Section 3.5.3.1.12.1 (No Action Alternative), even though vessel and aircraft noise may cause short-term impacts, no long-term consequences for individuals or populations would be expected. Similarly, no impacts on critical habitats would occur.

Pursuant to the ESA, noise associated with vessels and aircraft during testing as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed American crocodiles, American alligators, and ESA-listed loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles and*
- *will have no effect on critical habitat designated for sea turtles or the American crocodile.*

3.5.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from (1) electromagnetic devices and (2) high energy lasers.

3.5.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. Section 3.0.5.3.2.1 (Electromagnetic Devices) discusses the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative. Aspects of electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

Well over a century ago, electromagnetic fields were introduced into the marine environment within the Study Area by a wide variety of sources (e.g., power transmission cables), yet little is known about potential impacts from these sources. Studies on behavioral responses to magnetic fields have been conducted on green and loggerhead turtles. Loggerheads were found to be sensitive to field intensities ranging from 0.0047 to 4000 microteslas, and green turtles were found to be sensitive to field intensities from 29.3 to 200 microteslas (Normandeau et al. 2011). Since these data are the best available information, for this analysis, it is assumed the responses would be similar for other sea turtle species.

Sea turtles use geomagnetic fields to navigate at sea, and therefore changes in those fields could impact their movement patterns (Lohmann and Lohmann 1996b; Lohmann et al. 1997). Turtles in all life stages orient to the earth's magnetic field to position themselves in oceanic currents; this helps them locate seasonal feeding and breeding grounds and to return to their nesting sites (Benhamou et al. 2011; Lohmann and Lohmann 1996b; Lohmann et al. 1997). Experiments show that sea turtles can detect changes in magnetic fields, which may cause them to deviate from their original direction (Lohmann and Lohmann 1996a; Lohmann et al. 1997). For example, Lohmann and Lohmann (1996a) found that loggerhead hatchlings tested in a magnetic field of 52,000 nanoteslas swam eastward, and when the field was decreased to 43,000 nanoteslas, the hatchlings swam westward. Sea turtles also use nonmagnetic cues for navigation and migration, and these additional cues may compensate for variations in magnetic fields.

3.5.3.2.1.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, training activities involving electromagnetic devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area–specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Use of electromagnetic devices is concentrated within the VACAPES Range Complex. All sea turtle species in the Study Area could potentially occur in these locations, and could potentially be exposed to the electromagnetic devices.

If in the immediate area (within about 650 ft. [200 m]) where electromagnetic devices are being used, sea turtles could deviate from their original movements, but the extent of this disturbance is likely to be inconsequential. The electromagnetic devices used in training activities are not expected to cause more than a short-term behavioral disturbance to sea turtles because of the (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) very localized potential impact area, and (3) temporary duration of the activities (hours). Potential impacts of exposure to

electromagnetic stressors are not expected to result in substantial changes to an individual's growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and are not expected to result in population-level impacts. The use of electromagnetic devices does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, or loggerhead turtles and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, testing activities involving electromagnetic devices occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Activities using electromagnetic devices are concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. All sea turtle species in the Study Area could potentially occur in these locations and could potentially be exposed to the electromagnetic devices.

The electromagnetic devices used in testing activities are not expected to cause more than a short-term behavioral disturbance to sea turtles because of the (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) highly localized potential impact area, and (3) temporary duration of the activities (hours). Sea turtles may have a detectable response to electromagnetic exposure but would likely recover completely. Potential impacts of exposure to electromagnetic stressors are not expected to result in substantial changes to an individual's growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment and are not expected to result in population-level impacts. The use of electromagnetic devices does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, or loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.2.1.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use in the Study Area would increase by less than 2 percent compared to the No Action Alternative. Training activities involving electromagnetic devices would continue to occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. In addition, activities would be introduced within the Gulf of Mexico Large Marine Ecosystem—specifically within the GOMEX Range Complex—as well as in any of the following bays or inland waters: Sandy Hook

Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas. Electromagnetic device activities would remain concentrated within the VACAPES Range Complex. All sea turtle species in the Study Area could potentially occur in these locations and could potentially be exposed to the electromagnetic devices.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may slightly increase the risk of sea turtles being exposed to electromagnetic energy. Additionally, the introduction of activities in the GOMEX Range Complex and in the bays or inland waters specified above may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from electromagnetic devices on any exposed sea turtles during training activities would not be discernible from those described in Section 3.5.3.2.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.2.1.1 (No Action Alternative), the use of electromagnetic devices is not expected to cause more than a short-term behavioral disturbance to sea turtles or have any lasting impacts on their survival, growth, annual reproductive success, lifetime reproductive success (fitness), or species recruitment and are not expected to result in population-level impacts. The use of electromagnetic devices does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

As discussed in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase by about 14 percent in the Study Area compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, activities would be introduced within the Southeast U.S. Continental Shelf Large Marine Ecosystem, specifically within the South Florida Ocean Measurement Facility Testing Range, and anywhere within the Gulf of Mexico. Activities involving electromagnetic device use would remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. All sea turtle species in the Study Area could potentially occur in these locations and could potentially be exposed to the electromagnetic devices.

In comparison to the No Action Alternative, the 14 percent increase in activities presented in Alternative 1 may increase the risk of sea turtles being exposed to electromagnetic energy. Additionally, the introduction of activities in the VACAPES and JAX Range Complexes and within the South Florida Ocean Measurement Facility Testing Range may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from electromagnetic devices on any exposed sea turtles during testing activities would not be discernible from those described in Section 3.5.3.2.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.2.1.1 (No Action Alternative), the use of electromagnetic devices is not expected to cause

more than a short-term behavioral disturbance to sea turtles or have lasting impacts on their survival, growth, recruitment, or reproduction. The use of electromagnetic devices does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will be identical to those described in Section 3.5.3.2.1.2 (Alternative 1).

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, electromagnetic device use would increase by about 35 percent in the Study Area compared to the No Action Alternative but only increases by about 18 percent compared to Alternative 1. The location of testing activities and species potentially impacted under Alternative 2 are identical to those specified under Alternative 1. All sea turtle species in the Study Area could potentially occur in these locations and could potentially be exposed to the electromagnetic devices.

In comparison, the 35 percent increase in activities over the No Action Alternative and 18 percent increase in activities over Alternative 1 may increase the risk of sea turtles being exposed to electromagnetic energy under Alternative 2. However, the differences in species overlap and potential impacts from electromagnetic devices on any exposed sea turtles during testing activities would not be discernible from those described in Section 3.5.3.2.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.2.1.1 (No Action Alternative), the use of electromagnetic devices is not expected to cause more than a short-term behavioral disturbance to sea turtles or have any lasting impacts on their growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment and are not expected to result in population-level impacts. The use of electromagnetic devices does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.2.2 Impacts from High Energy Lasers

This section analyzes the potential impacts of high energy lasers on sea turtles. As discussed in Section 3.0.5.3.2.2 (Lasers), high energy laser weapons are designed to disable targets, rendering them immobile. The primary concern is the potential for a sea turtle to be struck with the laser beam at or near the water's surface, which could result in injury or death. However, sea turtles would only be exposed to a laser if the beam missed the target. Should the laser strike the sea surface, a sea turtle at or near the surface could be exposed. The potential for exposure to a high energy laser beam decreases as the water depth increases, so a sea turtle on the surface is more likely to be exposed than a sea turtle that is submerged. Because the lasers are specifically designed to hit the target, any exposure of sea turtles to the laser beam is extremely unlikely.

The potential for a sea turtle to be directly struck by a high energy laser beam was evaluated using statistical probability modeling (Appendix G, Statistical Probability Model for Estimating Direct Strike Impact and Number of Potential Exposures) to estimate the probability of striking a sea turtle for a worst-case scenario. Input values include high energy laser use data (frequency and footprint), size of the testing area, sea turtle density data, and animal footprint. To estimate the potential to strike a sea turtle in a worst-case scenario, the impact area of all laser events was totaled over one year in the testing area for each alternative. Finally, the sea turtle species with the highest average seasonal density within the testing area was used.

Within the statistical probability model, the estimated potential for a sea turtle strike is influenced by the following assumptions:

- The model is two-dimensional and assumes that all sea turtles would be at or near the surface 100 percent of the time, when in fact, sea turtles spend a majority of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006).
- The model assumes the animal is stationary and does not account for any movement of the sea turtle or any potential avoidance of the testing activity.

Furthermore, standard operating procedures described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) require the testing area to be cleared before high energy laser tests are conducted.

3.5.3.2.2.1 No Action Alternative

Under the No Action Alternative, no high energy lasers would be used during training or testing activities.

3.5.3.2.2.2 Alternative 1 and Alternative 2 (Preferred Alternative)

Training Activities

Under Alternative 1 and Alternative 2, no high energy lasers would be used during training activities.

Testing Activities

As discussed in Section 3.0.5.3.2.2 (Lasers), under Alternatives 1 and Alternative 2, high energy laser weapons tests would be introduced in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex. All species of sea turtles could occur within this portion of the Study Area and could potentially be exposed to high energy lasers.

The model results indicate that even for the species with the highest average seasonal density in the activity location (loggerhead sea turtle), the probability of a potential strike annually is 0.01 percent. Considering the assumptions in the model outlined above, there is a high level of certainty in the conclusion that a sea turtle would not be struck by a high energy laser. Furthermore, the high energy lasers used in testing activities under Alternative 2 are not expected to strike a sea turtle because sea turtles are likely to be submerged, and the potential for exposure to a high energy laser beam decreases as water depth increases. Potential impacts of exposure to high energy lasers are not expected to result in substantial changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and are not expected to result in population-level impacts. The use of high energy lasers does not overlap with designated critical habitat for sea turtles.

Pursuant to the ESA, the use of high energy lasers during testing activities as described under Alternatives 1 and 2:

- *will have no effect on ESA-listed green, hawksbill, Kemp's ridley, leatherback, or loggerhead turtles; and*
- *will have no effect on critical habitat.*

3.5.3.3 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors used by Navy during training and testing activities within the Study Area. For a list of Navy activities that involve physical disturbance and strike stressors, refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). The physical disturbance and strike stressors that may impact sea turtles include (1) vessels, (2) in-water devices, (3) military expended materials, and (4) seafloor devices. Sections 3.5.3.1.1 (Sound Producing and Explosive Activities) through 3.5.3.1.12 (Impacts from Vessel and Aircraft Noise) contain the analysis of the potential for disturbance of visual or acoustic cues.

The impact that a physical disturbance might have on a sea turtle would depend in part on the relative size of the object, the speed of the object, the location of the sea turtle in the water column, and the behavioral reaction of the sea turtle. It is not known at what point or through what combination of stimuli (visual, acoustic, or detection in pressure changes) an animal becomes aware of a vessel or other potential physical disturbances before reacting or being struck. Like marine mammals, if a sea turtle reacts to physical disturbance, the individual must stop its activity and divert its attention in response to the stressor. The energetic costs of reacting to a stressor are dependent on the specific situation, but one can assume that the caloric requirements of a response may reduce the amount of energy available for other biological functions. Given that the presentation of a physical disturbance should be rare and brief, the cost from the response is likely to be within the normal variation experienced by a sea turtle during its daily routine unless the animal is struck. If a strike does occur, the cost to the individual could range from slight injury to death.

3.5.3.3.1 Impacts from Vessels

Most training and testing activities under all alternatives involve some level of vessel activity. For a discussion of the types of activities that include the use of vessels, where they are used, and the speed and size characteristics of vessels used, see Section 3.0.5.3.3.1 (Vessels). Vessels include ships, submarines and boats ranging in size from small, 22-ft. (7-m) rigid-hull inflatable boats to aircraft carriers with lengths up to 1,092 ft. (333 m). Large Navy ships generally operate at speeds in the range of 10 to 15 knots, and submarines generally operate at speeds in the range of 8 to 13 knots. Small craft (for this discussion, less than 40 ft. [12 m] in length) have much more variable speeds (dependent on the mission). While these speeds are representative of most activities, some vessels need to operate outside these parameters. For example, to produce the required relative wind speed over the flight deck, an aircraft carrier vessel group engaged in flight operations must adjust its speed through the water accordingly. Conversely, there are other instances such as launch and recovery of a small rigid-hull inflatable boat; vessel boarding, search, and seizure training activities; or retrieval of a target when vessels will be dead in the water or moving slowly ahead to maintain steerage. There are a few specific activities, including high-speed tests of newly constructed vessels such as aircraft carriers, amphibious assault ships, and the Joint High Speed Vessel (which will operate at an average speed of 35 knots [64.8 km/h]), in which vessels operate at higher speeds. Up to 46 amphibious landings are planned only at Onslow Beach (Marine Corps Base Camp Lejeune), in the Navy Cherry Point Range Complex. Under Alternatives 1 and 2, up to six amphibious landings would also occur at Naval Station Mayport, specifically Seminole Beach.

Naval Station Mayport and Marine Corps Base Camp Lejeune have specific Integrated Natural Resource Management Plans for addressing sea turtles, and those plans include project avoidance and minimization actions that reduce threats from military activities to nesting sea turtles to a minimal level. Also, during the spring and summer, personnel implement an intensive sea turtle monitoring, nest relocation, and protection program so that amphibious landings and other training activities can be conducted without impacting protected species. Equally important, nest-free training areas are maintained by base personnel so that trainers do not have to work around active turtle nests. Therefore, with these measures in-place, amphibious assault activities would not cause any potential risk to adult sea turtles approaching the beach or to adults and hatchlings leaving the beach.

The number of Navy vessels in the Study Area at any given time varies and depends on local training or testing requirements. Most activities include either one or two vessels and may last from a few hours up to two weeks. Vessel movement as part of the Proposed Action would be widely dispersed throughout the Study Area but more concentrated in portions of the Study Area near ports, naval installations, range complexes, and testing ranges.

In an attempt to determine traffic patterns for Navy and non-Navy vessels, the Center for Naval Analysis conducted a review of historic data for commercial vessels, coastal shipping patterns, and Navy vessels (Mintz and Parker 2006). Commercial and non-Navy traffic, which included cargo vessels, bulk carriers, passenger vessels and oil tankers (all more than 65 ft. [20 m] long), was heaviest near the major shipping ports from the Gulf of Maine to southern Florida, as well as in specific international shipping lanes. Compared to coastal vessel activity, there was relatively little concentration of vessels in the other portions of the Study Area (Mintz and Parker 2006). Navy traffic was heaviest just offshore of Norfolk and Jacksonville, as well as along the coastal waters between the two ports.

Data from 2009 were analyzed by Mintz and Filadelfo (2011) and indicated that along the Atlantic U.S. Exclusive Economic Zone, Navy vessels accounted for slightly less than 6 percent of the total large-

vessel traffic (from estimated hours) in that area. In the VACAPES and JAX Range Complexes where Navy vessel activity is concentrated, the Navy vessels accounted for 7 and 9 percent (respectively) of the total large vessel traffic. Barco et al. (2009) found that military vessels were 10.4 percent of the total vessels transiting (inbound and outbound) the Chesapeake Bay channel, an area of highly concentrated Navy activity because of the proximity of Naval Station Norfolk. Military vessels would account for an even smaller portion of total vessels if smaller vessels (less than 65 ft. [20 m] long) were included in these analyses.

Sea turtles can detect approaching vessels, likely by sight rather than by sound (Bartol and Ketten 2006; Hazel et al. 2007). Sea turtles seem to react more to slower moving vessels (2.2 knots) than to faster vessels (5.9 knots or greater). Vessel-related injuries to sea turtles are more likely to occur in areas with high boating traffic. For example, propeller wounds on loggerhead sea turtles are found often in southeast Florida, from Palm Beach County to Miami-Dade County, likely due to the prevalence of recreational boating in that region (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007d). Although sea turtles likely hear and see approaching vessels, they may not be able to avoid all collisions. High-speed collisions with large objects can be fatal to sea turtles.

Minor strikes may cause temporary reversible impacts, such as diverting the turtle from its previous activity or causing minor injury. Major strikes are those that can cause permanent injury or death from bleeding/trauma, paralysis and subsequent drowning, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals some time after a strike. Numerous sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls (Hazel et al. 2007; Lutcavage et al. 1997), suggesting that not all vessel strikes are lethal. Conversely, fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data.

Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Sea turtles spend most of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). Leatherback turtles are more likely to feed at or near the surface in open ocean areas. Green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to forage nearshore, and although they may feed along the seafloor, they surface periodically to breathe while feeding and moving between nearshore habitats. These species are distributed widely in all offshore portions of the Study Area.

To assess the risk or probability of a physical strike, the number, size, and speed of Navy vessels were considered, as well as the sensory capability of sea turtles to identify an approaching vessel. Because of the wide dispersal of large vessels in open ocean areas and the widespread, scattered distribution of turtles at sea, strikes during open-ocean transits of Navy vessels are unlikely. For very large vessels, the bow wave may even preclude a sea turtle strike. The probability of a strike is further reduced by Navy mitigation measures and standard operating procedures to avoid sea turtles (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). Smaller, faster vessels that operate in nearshore waters, where green, hawksbill, Kemp's ridley, and loggerhead sea turtles can be more densely concentrated, pose a greater risk (Chaloupka et al. 2008). Some vessels associated with training and testing can travel at high speeds, (see Section 3.0.5.3.3.1, Vessels) which increase the strike risk to sea turtles (Hazel et al. 2007). Most nearshore vessel movements through sea turtle foraging habitats occur near southern ports, such as Jacksonville and Panama City, Florida; and Corpus Christi, Texas. Vessels

transiting in shallow waters to and from ports travel at slower speeds and pose less risk of strikes to sea turtles (Section 3.0.5.3.3.1, Vessels).

3.5.3.3.1.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) provides estimates of relative vessel use and location for each alternative. These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel usage is dependent upon military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Training and testing concentrations are most dependent upon locations of Navy shore installations and established training and testing areas. Even with the introduction of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade and, therefore, the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5 Standard Operating Procedures, Mitigation, and Monitoring. The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Section 3.0.5.3.3.1 (Vessels), the majority of the training activities under all alternatives involve vessels. This section provides a representative list of Navy vessel sizes and speeds and a graphic that illustrates the location for the Preferred Alternative and the relative use of vessels. These activities could be widely dispersed throughout the Study Area but would be more concentrated near naval ports, piers, and range areas. Navy training vessel traffic would especially be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem, and Naval Station Mayport in Jacksonville, Florida, in the Southeast U.S. Continental Shelf Large Marine Ecosystem. There is no seasonal differentiation in Navy vessel use. Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with most traffic flowing in a direct line between Naval Stations Norfolk and Jacksonville. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open-ocean portions of the Study Area because of the concentration of vessel movements in those areas. Support craft would be more concentrated in the coastal areas near naval installations, ports, and ranges. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Given the concentration of Navy vessel movements near naval ports, piers and range areas, this training activity could overlap with green, Kemp's ridley, and loggerhead turtles occupying these waters. Hawksbill turtles occur in these areas, but less frequently than green, Kemp's ridley, and loggerhead turtles. Leatherback turtles are more likely to be farther offshore, in the open ocean, although in the summer they are known to forage in nearshore environments such as Pamlico Sound and the capes along North Carolina. Navy vessel activity during training exercises is less concentrated in the Gulf of Mexico, where all these species may occur, but Kemp's ridley and green turtles are more abundant.

Under the No Action Alternative, Alternative 1, and Alternative 2, exposure to vessels used in training activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. As demonstrated by scars on all species of sea turtles, they cannot always avoid being struck; therefore, vessel strikes are a potential cause of mortality for these species. Although the likelihood of being struck is minimal, sea turtles that overlap with Navy exercises are more likely to encounter vessels. Potential impacts of exposure to vessels may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to vessels are not expected to result in population-level impacts. The use of vessels does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, vessel use during training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect and is likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback or loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.1 (Vessels), most testing activities involve the use of vessels. However, the number of vessels used for testing activities is comparatively lower than the number of vessels used for training (less than 10 percent). In addition, testing often occurs jointly with training, so it is likely that the testing activity would occur on a training vessel. Vessel movement in conjunction with testing activities could be widely dispersed throughout the Study Area but would be concentrated near naval ports, piers, range complexes, and especially the testing ranges off the northeast United States, off south Florida, and in the Gulf of Mexico. There would be a higher likelihood of vessel strikes over the continental shelf portions of the Study Area because of the concentration of vessel movement there.

Propulsion testing activities, also referred to as high-speed vessel trials, occur infrequently but pose a higher strike risk because of the high speeds at which the vessels need to transit to complete the testing activity. These activities would most often occur in the Gulf of Mexico Large Marine Ecosystem in the Gulf of Mexico but may occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the Northeast Range Complexes, the Gulf Stream Open Ocean Area, and the North Atlantic Gyre Open Ocean Area in the VACAPES and JAX Range Complexes. However, there are just a few of these activities proposed per year, so the increased risk is nominal compared to all vessel use in the Proposed Action. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Given the concentration of Navy vessel movements near naval ports, piers, and range areas; over the continental shelf portions of the Study Area; and in the Gulf of Mexico, testing activity could overlap with any sea turtle species.

Under the No Action Alternative, Alternative 1, and Alternative 2, exposure to vessels used in testing activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. As demonstrated by scars on all species of sea turtles, they cannot always avoid being struck; therefore, vessel strikes are a potential cause of mortality for these species. Although the likelihood of being struck is minimal, sea turtles that overlap with Navy exercises are more likely to encounter vessels. Potential impacts of exposure to vessels may result in changes to an individual's behavior,

growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to vessels are not expected to result in population-level impacts. The use of vessels does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, vessel use during testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect and is likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback or loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.2 Impacts from In-Water Devices

In-water devices are generally smaller (several inches to 111 ft. [34 m]) than most Navy vessels. Section 3.0.5.3.3.2 (In-Water Devices) discusses the types of activities that use in-water devices, where they are used, and how many activities would occur under each alternative. This section also includes a list of representative types, sizes, and speeds of Navy in-water devices used in the Study Area.

Devices that pose the greatest collision risk to sea turtles are those that are towed or operated at high speeds, including remotely operated high-speed targets and mine warfare systems. Devices that move slowly through the water column have a very limited potential to strike a sea turtle because sea turtles in the water could avoid a slow-moving object.

3.5.3.3.2.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.2 (In-Water Devices) provides estimates of relative in-water device use and locations for each of the alternatives. These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy in-water device usage is dependent upon military training requirements, deployment schedules, annual budgets and other unpredictable factors. Training and testing concentrations are most dependent upon locations of Navy shore installations and established training and testing areas. Even with the introduction of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of in-water device use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in in-water device use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where in-water devices have been used over the last decade and therefore the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring. The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of an in-water device strike in any meaningful way.

Training Activities

As discussed in Section 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices occur in the Gulf of Mexico, Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, and the

Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Use of in-water devices is concentrated within the VACAPES Range Complex. The number of activities that employ in-water devices increases by 66 percent under Alternative 1 and Alternative 2 compared to the No Action Alternative. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Under the No Action Alternative, Alternative 1, and Alternative 2, exposure to in-water devices used in training activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. However, these devices move slowly through the water column and have very limited potential to strike a sea turtle because sea turtles in the water could avoid a slow-moving object. Potential impacts of exposure to in-water devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to vessels are not expected to result in population-level impacts. The use of in-water devices does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of in-water devices during training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback or loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

As discussed in Section 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem, Southeast U.S. Continental Shelf Large Marine Ecosystem, and the Gulf of Mexico Large Marine Ecosystem—specifically within the Northeast Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; VACAPES Range Complex; JAX Range Complex; South Florida Ocean Measurement Facility Testing Range (Alternatives 1 and 2 only); and Naval Surface Warfare Center, Panama City Division Testing Range—although some activities could occur anywhere in the Study Area. Use of in-water devices is concentrated within the VACAPES Range Complex; Naval Undersea Warfare Center Division, Newport Testing Range; and Naval Surface Warfare Center, Panama City Division Testing Range. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all off-shore portions of the Study Area.

Under the No Action Alternative, Alternative 1, and Alternative 2, exposure to in-water devices used in testing activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. However, these devices move slowly through the water column and have very limited potential to strike a sea turtle because sea turtles in the water could avoid a slow-moving object. Potential impacts of exposure to in-water devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to in-water devices are not expected to result in population-level impacts. The use of in-water devices does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of in-water devices during testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback or loggerhead turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.3 Impacts from Military Expended Materials

This section analyzes the strike potential to sea turtles from the following categories of military expended materials (1) non-explosive practice munitions, (2) fragments from high-explosive munitions and (3) expended materials other than munitions, such as sonobuoys and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes). The analysis of all potential impacts of military expended materials on critical habitat is included in this section.

While disturbance or strike from an item as it falls through the water column is possible, it is not very likely because the objects generally sink through the water slowly and can be avoided by most sea turtles. Therefore, the discussion of military expended materials strikes will focus on the potential of a strike at the surface of the water.

While no strike from military expended materials has ever been reported or recorded, the possibility of a strike still exists. Therefore, the potential for sea turtles to be struck by military expended materials was evaluated using statistical probability modeling to estimate the likelihood. Specific details of the modeling approach including model selection and calculation methods can be found in Appendix G, (Statistical Probability Model for Estimating Direct Strike Impact and Number of Potential Exposures) which estimates the highest probability of striking a sea turtle. Input values include munitions data (frequency, footprint, and type), size of the training and testing area, sea turtle density data, and size of the animal (area of potential impact). To estimate the potential to strike a sea turtle, the highest probability of a strike was calculated by totaling the impact area of all bombs and projectiles over one year in the training or testing area for each alternative with the highest projected use (concentration of military expended materials), and using the sea turtle species with the highest average seasonal density within the activity at each location. These highest estimates would then provide a point of comparison for all other areas and species. The areas with the greatest concentration of expended materials are expected to be the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, and the Gulf Stream Open Ocean Area (specifically within the VACAPES and JAX Range Complexes). Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors) provides estimates of expended materials throughout the Study Area. The analysis of the potential for a sea turtle strike is influenced by the following assumptions:

- The model is two-dimensional and assumes that all sea turtles would be at or near the surface 100 percent of the time, when in fact, sea turtles spend most of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006).
- The model assumes the animal is stationary and does not account for any movement of the sea turtle or any potential avoidance of the training or testing activity.

The model does not account for the ability of Navy observers to see and avoid sea turtles. The model also does not account for the fact that most of the projectiles fired during training and testing activities

are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force. The potential of fragments from high-explosive munitions or expended material other than munitions to strike a sea turtle is likely lower than for the worst-case scenario calculated below because those activities happen with much lower frequency. Fragments may include metallic fragments from the exploded target as well as from the exploded munitions.

The probability of a strike is further reduced by Navy mitigation measures and standard operating procedures to avoid sea turtles (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

There is a remote possibility that an individual turtle at or near the surface may be struck directly if it is in the target area at the point of physical impact at the time of non-explosive munitions delivery. Expended munitions may strike the water surface with sufficient force to cause injury or mortality. While any species of sea turtle may move through the open ocean, most will only surface intermittently. Sea turtles are generally at the surface for short periods and spend most of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). The leatherback turtle is more likely to be foraging at or near the surface in the open ocean than other species, but the likelihood of being struck by a projectile remains very low. Furthermore, projectiles are aimed at targets, which will absorb the impact of the projectile.

3.5.3.3.3.1 No Action Alternative

Training Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. This section also provides details of the number and location of military expended materials used within the Study Area. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Activities using military expended materials are concentrated within the VACAPES and JAX Range Complexes. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all off-shore portions of the Study Area.

Under the No Action Alternative, exposure to military expended materials used in training activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. However, sea turtles are generally at the surface only for short periods and spend most of their time submerged, so the likelihood of being struck by military expended material is very low. Projectiles are aimed at targets, which will absorb the impact of the projectile. The model results presented in Table 3.5-17 indicate a high level of certainty that sea turtles would not be struck by military expended materials during training activities. Potential impacts of exposure to military expended materials may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to military expended materials are not expected to result in population-level impacts. The use of military expended materials does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of military expended materials during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

Table 3.5-17: Probability of a Military Expended Materials Strike for a Representative Sea Turtle Species by Area and Alternative

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
Virginia Capes Range Complex						
Species	Training			Testing		
	No Action	Alternative 1	Alternative 2	No Action	Alternative 1	Alternative 2
Loggerhead Turtle	0.74%	1.78%	1.78%	1.51%	2.29%	2.42%
Southeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
Jacksonville Range Complex						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Loggerhead Turtle	0.50%	1.04%	1.04%	0.17%	0.28%	0.31%

Testing Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. This section also provides details of the number and location of military expended materials used within the Study Area. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Naval Surface Warfare Center Panama City Division Testing Range, the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes—and in the Other AFTT Areas while vessels are in transit. Activities using military expended materials are concentrated within the VACAPES Range Complex. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all off-shore portions of the Study Area.

Under the No Action Alternative, exposure to military expended materials used in testing activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. However, sea turtles are generally at the surface only for short periods and spend most of their time submerged, so the likelihood of being struck by a projectile is very low. Projectiles are aimed at targets, which will absorb the impact of the projectile. The model results presented in Table 3.5-17 indicate a high level of certainty that sea turtles would not be struck by military expended materials during testing activities. Potential impacts of exposure to military expended materials may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to military expended materials are not expected to

result in population-level impacts. The use of military expended materials does not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of military expended materials during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.3.2 Alternative 1

Training Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. This section also provides details on the number and location of military expended materials used within the Study Area. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is more than three times the amount expended in the No Action Alternative. The locations of activities and types of military expended materials under Alternative 1 would be the same as the No Action Alternative, with the addition of military expended materials associated with activities in Other AFTT Areas while vessels are in transit. Activities using military expended materials are concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 1, exposure to military expended materials used in training activities may cause short-term disturbance to an individual turtle, or if struck, could lead to injury or death. However, sea turtles are generally at the surface only for short periods and spend most of their time submerged, so the likelihood of being struck by a military expended material is very low. Projectiles are aimed at targets, which will absorb the impact of the projectile. The model results presented in Table 3.5-17 indicate a high level of certainty that sea turtles would not be struck by military expended materials during training activities. Potential impacts of exposure to military expended materials may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to military expended materials are not expected to result in population-level impacts. Military expended materials would not overlap any designated sea turtle critical habitat.

Pursuant to the ESA, the use of military expended materials during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small-

and medium-caliber projectiles. This section also provides details of the number and location of military expended materials used within the Study Area. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is nearly four times the amount expended in the No Action Alternative. The activities and type of military expended materials under Alternative 1 would be expended in the same geographic locations as the No Action Alternative. Activities using military expended materials are concentrated within the VACAPES Range Complex. Military expended materials would typically be of the same type listed under the No Action Alternative. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 1, exposure to military expended materials used in testing activities may cause short-term disturbance to an individual turtle, or, if struck, could lead to injury or death. However, sea turtles are generally at the surface only for short periods and spend most of their time submerged, so the likelihood of being struck by a military expended material is very low. Projectiles are aimed at targets, which will absorb the impact of the projectile. The model results presented in Table 3.5-17 indicate a high level of certainty that sea turtles would not be struck by military expended materials during testing activities. Potential impacts of exposure to military expended materials may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to military expended materials are not expected to result in population-level impacts. Military expended materials would not overlap any designated sea turtle critical habitat.

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.3.3.2 (Alternative 1).

Testing Activities

Tables in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. This section also provides details of the number and location of military expended materials used within the Study Area. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2, the total amount of military expended materials is more than four times the amount expended in the No Action Alternative but only increases by 11 percent compared to Alternative 1. The activities and type of military expended materials under Alternative 2 would be expended in the same geographic locations as the No Action Alternative. Activities using military expended materials are concentrated within the VACAPES Range Complex. Military expended materials would typically be of the same type listed under the No Action Alternative. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether

feeding or periodically surfacing to breathe. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 2, exposure to military expended materials used in testing activities may cause short-term disturbance to an individual turtle, or, if struck, could lead to injury or death. However, sea turtles are generally at the surface only for short periods and spend most of their time submerged, so the likelihood of being struck by a military expended material is very low. Projectiles are aimed at targets, which will absorb the impact of the projectile. The model results presented in Table 3.5-17 indicate a high level of certainty that sea turtles would not be struck by military expended materials during testing activities. Potential impacts of exposure to military expended materials may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to military expended materials are not expected to result in population-level impacts. Military expended materials would not overlap any designated sea turtle critical habitat.

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.4 Impacts from Seafloor Devices

Section 3.0.5.3.3.4 (Seafloor Devices) discusses the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative. These include items that are placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom-placed targets that are recovered (not expended).

As discussed in Section 3.5.3.3.3 (Impacts from Military Expended Materials), objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. The only seafloor device used during training and testing activities that has the potential to strike a sea turtle at or near the surface is an aircraft-deployed mine shape, which is used during aerial mine laying activities. These devices are identical to non-explosive practice bombs; therefore, the analysis of the potential impacts from those devices is considered in the military expended material strike analysis (Section 3.5.3.3.3, Impacts from Military Expended Materials).

3.5.3.3.4.1 No Action Alternative

Training Activities

Section 3.0.5.3.3.4 (Seafloor Devices) lists the number and locations where seafloor devices are used. As discussed in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Any sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Additionally, sea turtles in coastal habitats can occur near the bottom when foraging or resting. These species are distributed widely in all offshore portions of the Study Area.

Under the No Action Alternative, exposure to seafloor devices used in training activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. However, objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. Potential impacts of exposure to seafloor devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to seafloor devices are not expected to result in population-level impacts. Seafloor devices would not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of seafloor devices during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) lists the number and locations where seafloor devices are used. As discussed in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices occur in the Gulf of Mexico, Northeast, and Southeast U.S. Continental Shelf Large Marine Ecosystems, as well as Gulf Stream Open Ocean Area—specifically within the VACAPES and Northeast Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; and Naval Surface Warfare Center, Panama City Division Testing Range. A few events could also occur at any of the pierside testing locations. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Additionally, sea turtles in coastal habitats can occur near the bottom when foraging or resting. These species are distributed widely in all offshore portions of the Study Area.

Under the No Action Alternative, exposure to seafloor devices used in testing activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. However, objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. Potential impacts of exposure to seafloor devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to seafloor devices are not expected to result in population-level impacts. Seafloor devices would not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.4.2 Alternative 1

Training Activities

Section 3.0.5.3.3.4 (Seafloor Devices) lists the number and locations where seafloor devices are used. As discussed in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices would increase by 44 percent compared to the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic locations as the No Action Alternative. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Additionally, sea turtles in coastal habitats can occur near the bottom when foraging or resting. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 1, exposure to seafloor devices used in training activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. However, objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. Potential impacts of exposure to seafloor devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to seafloor devices are not expected to result in population-level impacts. Seafloor devices would not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) lists the number and locations where seafloor devices are used. As discussed in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices would increase by approximately two times compared to the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic locations as the No Action Alternative. In addition, testing activities that expend seafloor devices would occur in the Navy Cherry Point and JAX Range Complexes as well as throughout the Gulf of Mexico. Any of the sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Additionally, sea turtles in coastal habitats can occur near the bottom when foraging or resting. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 1, exposure to seafloor devices used in testing activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. However, objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. Potential impacts of exposure to seafloor devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to seafloor devices are not expected to result in population-level impacts. Seafloor devices would not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.3.4.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.3.4.2 (Alternative 1).

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) lists the number and locations where seafloor devices are used. As discussed in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2, the number of activities using seafloor devices is about twice that of the No Action Alternative, but only an increase of 13 percent compared to Alternative 1. The activities using seafloor devices under Alternative 2 would occur in the same geographic locations as the No Action Alternative. In addition, testing activities that expend seafloor devices would also occur in the Navy Cherry Point and JAX Range Complexes as well as throughout the Gulf of Mexico. Any sea turtle species found in the Study Area can occur at or near the surface in open-ocean and coastal areas, whether feeding or periodically surfacing to breathe. Additionally, sea turtles in coastal habitats can occur near the bottom when foraging or resting. These species are distributed widely in all offshore portions of the Study Area.

Under Alternative 2, exposure to seafloor devices used in testing activities may cause short-term disturbance to an individual turtle or, if struck, could lead to injury or death. However, objects falling through the water column will slow as they sink toward the bottom and could be avoided by most sea turtles. Potential impacts of exposure to seafloor devices may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to seafloor devices are not expected to result in population-level impacts. Seafloor devices would not overlap with any designated sea turtle critical habitat.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback turtles; and*
- *will have no effect on sea turtle critical habitat.*

3.5.3.4 Entanglement Stressors

This section analyzes the potential for entanglement of sea turtles with the various types of expended materials used by the Navy during training and testing activities within the Study Area. This section does not analyze impacts on critical habitat because Section 3.5.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of expended materials on designated critical habitat. This analysis includes the potential impacts from two types of military expended materials: (1) fiber optic cables and guidance wires and (2) parachutes. Aspects of entanglement stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.4 (Conceptual Framework for Assessing Effects from Entanglement). The number and location of training and testing events that involve the use of items that may pose an entanglement risk are provided in Section 3.0.5.3.4 (Entanglement Stressors).

3.5.3.4.1 Impacts from Fiber Optic Cables and Guidance Wires

Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) discusses the types of activities that use cables and wires, where they are used, and how many events will occur under each alternative. A sea turtle that becomes entangled in nets, lines, ropes, or other foreign objects underwater may suffer only a temporary hindrance to movement before it frees itself, may suffer minor injuries but recover fully, or it may die as a result of the entanglement.

The likelihood of a sea turtle encountering and becoming entangled in a fiber optic cable or guidance wire depends on several factors. The amount of time that the fiber optic cable or guidance wire is in the same vicinity as a sea turtle can increase the likelihood of it posing an entanglement risk. Since these items will only be within the water column during the activity and while it sinks, the likelihood of a sea turtle encountering and becoming entangled within the water column is extremely low. Guidance wires sink to the seafloor at a rate of 0.7 ft. (0.2 m) per second; therefore it is most likely that a sea turtle would encounter a guidance wire once it had settled to the seafloor. The length of the cable or wire may influence the ability of a sea turtle to encounter or become entangled in these items. The length of fiber optic cables and guidance wires vary. Fiber optic cables can range in size up to about 900 ft. (300 m). Greater lengths of these items may increase the likelihood that a sea turtle could become entangled. The behavior and feeding strategy of a species can also determine whether they may encounter items on the seafloor, where fiber optic cables and guidance wires will most likely be available. There is potential for those species that feed on the seafloor to encounter these items and potentially become entangled; however, the relatively few fiber optic cables and guidance wires being expended within the Study Area limits the potential for encounters. Lastly, the properties of the items themselves may limit the risk of entanglement. The physical characteristics of guidance wires and fiber optic cables are detailed in Section 3.0.5.3.4 (Entanglement Stressors). This analysis indicates that these items pose a potential, although unlikely, entanglement risk to sea turtles. For instance, the physical characteristics of the fiber optic material render the cable brittle and easily broken when kinked, twisted, or bent sharply (i.e., to a radius greater than 360 degrees). Thus, the fiber optic cable would not loop, greatly reducing or eliminating any potential issues of entanglement with regard to marine life. In addition, based on degradation times, the guidance wires would break down within one to two years and therefore no longer pose an entanglement risk.

The Navy previously analyzed the potential for entanglement of sea turtles by guidance wires and concluded that the potential for entanglement is low (U.S. Department of the Navy 1996). Except for a chance encounter with the guidance wire at the surface or in the water column while the cable or wire is sinking to the seafloor, a sea turtle would be vulnerable to entanglement only if its diving and feeding

patterns place it in direct contact with the bottom. Bottom-feeding sea turtles tend to forage in nearshore areas, and these wires are expended in deeper waters.

Tube-launched, optically tracked, wire-guided (TOW) missiles would expend wires in the nearshore or offshore waters of the Navy Cherry Point Range Complex during training only and are discussed together with torpedo guidance wires because their potential impacts would be similar to those for torpedo guidance wires, which are also expended in the Navy Cherry Point Range Complex.

3.5.3.4.1.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, fiber optic cables would be expended in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. The area that will have the greatest concentration of expended fiber optic cables or guidance wires is within the VACAPES Range Complex (specifically W-50). The W-50 location includes 123 nm^2 of sea space. Under the No Action Alternative, there would be approximately six fiber optic cables per nm^2 if they were expended evenly throughout the area.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, torpedoes expending guidance wire would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes as well as the Gulf of Mexico. Guidance wires would be concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem in the JAX Range Complex. Guidance wires could also be expended outside the range complexes—specifically within the Sinking Exercise Box.

Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface.

Under the No Action Alternative, exposure to cables and wires used in training activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a cable or wire, it could free itself, or the entanglement could lead to injury or death. Potential impacts of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, cables and wires are generally not expected to cause disturbance to sea turtles because of (1) the relatively low number of cables and wires expended, (2) the physical characteristics of the cables and wires, and (3) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Potential impacts of exposure to cables and wires are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, activities that expend fiber optic cables would occur in the Northeast and Southeast U.S. Continental Shelf, and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex and Naval Surface Warfare Center Panama City, Division Testing Range. Training events using fiber optic cables would be equally split between these two locations.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, torpedoes expending guidance wire would occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes. Fiber optic cables and guidance wires would be expended with greatest concentration in the Gulf of Mexico Large Marine Ecosystem (specifically Naval Surface Warfare Center, Panama City Division Testing Range). Under the No Action Alternative, there would be approximately one fiber optic cable per 17 nm^2 if they were expended evenly throughout the areas. Guidance wire could also be expended outside the range complexes—specifically within the Sinking Exercise Box.

Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface. Based on the low concentration described above and the likely location of these cables and wires relative to the preferred habitat of the species, the likelihood of an animal encountering one of these items is extremely low.

Under the No Action Alternative, exposure to cables and wires used in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to cables and wires may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, cables and wires are generally not expected to cause disturbance to sea turtles because of (1) the relatively low number of cables and wires expended, (2) the physical characteristics of the cables and wires, and (3) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Potential impacts of exposure to cables and wires are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.4.1.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, more than three times as many fiber optic cables and 21 percent more guidance wires, compared to the No Action Alternative, would be expended during training activities. As with the No Action Alternative, they could be expended anywhere within the Study Area but would be expended with greatest concentration in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically the VACAPES Range Complex). This would result in a maximum concentration of approximately one fiber optic cable every 16 nm^2 if they were expended evenly throughout the area.

Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface. Based on the low concentration described above and the likely location of these cables and wires relative to the preferred habitat of the species, the likelihood of an animal encountering one of these items is extremely low.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk of sea turtles being exposed to cables and wires. Additionally, the introduction of activities in the GOMEX Range Complex and Other AFTT Areas may expose additional sea turtles that would not have been encountered by activities under the No Action Alternative. However, the differences in species overlap and potential impacts from cables and wires on sea turtles during training activities would not be discernible from those described for training activities in Section 3.5.3.4.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.4.1.1 (No Action Alternative), the use of cables and wires in training activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to cables and wires are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, the number of activities that expend fiber optic cables is more than two times that of the No Action

Alternative. The activities using fiber optic cables under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except that activities may occur in the JAX Range Complex and throughout the Gulf of Mexico. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended evenly throughout the area. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, the number of torpedo activities that expend guidance wire is almost six times that of the No Action Alternative. The torpedo activities using guidance wire under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing guidance wires in the Gulf of Mexico portion of the Study Area and eliminating guidance wire use in the Navy Cherry Point Range Complex.

Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk of sea turtles being exposed to cables and wires. Additionally, the introduction of activities in the Gulf of Mexico portion of the Study Area may expose additional sea turtles that would not have been encountered during activities under the No Action Alternative. However, the differences in species overlap and potential impacts from cables and wires on sea turtles during testing activities would not be discernible from those described for testing activities in Section 3.5.3.4.1.1 (No Action Alternative). For the same reasons stated in Section 3.5.3.4.1.1 (No Action Alternative), the use of cables and wires in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to cables and wires are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.4.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.4.1.2 (Alternative 1).

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As described in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 2, the number of testing activities that expend fiber optic cables is 2.5 times higher than that of the No Action Alternative but only increases by about 17 percent compared to Alternative 1. The testing activities using fiber optic cables under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except that activities may occur in the JAX Range Complex and throughout the Gulf of Mexico. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended randomly in this area.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 2, the number of torpedo activities that expend guidance wire is approximately seven times that of the No Action Alternative but only increases by about 13 percent compared to Alternative 1. The torpedo activities using guidance wire under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except for introducing guidance wires in the Gulf of Mexico portion of the Study Area and eliminating guidance wire use in the Navy Cherry Point Range Complex.

Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, Kemp's ridley, and loggerhead turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface.

In comparison to the No Action Alternative and Alternative 1, the increase in activities presented in Alternative 2 may increase the risk of sea turtles being exposed to cables and wires. Additionally, the introduction of activities in the Gulf of Mexico portion of the Study Area may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from cables and wires on sea turtles during testing activities would not be discernible from those described for testing activities in Section 3.5.3.4.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.4.1.1 (No Action Alternative), the use of cables and wires in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to cables and wires are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.4.2 Impacts from Parachutes

Parachutes of varying sizes are used during training and testing activities. Section 3.0.5.3.4.2 (Parachutes) discusses the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative.

Because of the physical characteristics of parachutes discussed in Section 3.0.5.3.4.2 (Parachutes), they pose a potential, though unlikely, entanglement risk to sea turtles. The parachute and housing are designed to sink to the seafloor and become flattened after being on the surface for a very short time. Parachutes or lines associated with the parachute may present a potential risk for sea turtles to become entangled, particularly while at the surface. To become entangled, a sea turtle would have to surface to breathe or grab prey from under the parachute, and swim into the parachute or the associated lines, during the brief time before the parachute sinks to the bottom.

While in the water column, a sea turtle is not likely to become entangled because the parachute would have to land directly on the turtle, or the turtle would have to swim into the parachute before it sank. If the parachute and associated lines sink to the seafloor in an area where the bottom is calm, it would remain there undisturbed. In an area with bottom currents or active tidal influence, the parachute may move along the seafloor, away from the location in which it was expended. Over time, it may become covered by sediment in most areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for reintroduction as an entanglement risk. Bottom-feeding sea turtles tend to forage in nearshore areas rather than offshore, where these parachutes are used; therefore, green, hawksbill, Kemp's ridley, and loggerhead sea turtles are not likely to encounter parachutes once they reach the seafloor. The potential for a leatherback sea turtle to encounter an expended parachute while feeding at the surface or in the water column is still extremely low, given the sink rate of the parachute, and is even less probable at the seafloor, given the general behavior of the species to feed near the surface.

3.5.3.4.2.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.4.2 (Parachutes), under the No Action Alternative, activities involving parachute use would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes, and anywhere in the Gulf of Mexico portion of the Study Area, as well as anywhere in the Study Area, outside the range complexes while vessels are in transit. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with the greatest concentration. For training events, the greatest concentration would occur in the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 2 nm^2 if they were evenly expended throughout the area. Any species of sea turtle that occurs in the Study Area could at some time encounter expended parachutes.

Under the No Action Alternative, exposure to parachutes used in training activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a parachute, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to a parachute may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, parachutes are generally not expected to cause disturbance to sea turtles because (1) the parachute and housing are designed to sink to the seafloor and become flattened after being on the surface for a very short time and (2) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Potential impacts of exposure to parachutes are not expected to result in population-level impacts.

Pursuant to the ESA, the use of parachutes during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.4.2 (Parachutes), under the No Action Alternative, testing activities involving parachute use would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and in the Sinking Exercise Box outside the range complexes. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with the greatest concentration. For testing events, the greatest concentration would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 22 nm^2 if the parachutes were expended evenly throughout the area. Any species of sea turtle that occurs in the Study Area could at some point in time encounter expended parachutes.

Under the No Action Alternative, exposure to parachutes used in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a parachute, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to a parachute may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, parachutes are generally not expected to cause disturbance to sea turtles because (1) the parachute and housing are designed to sink to the seafloor and become flattened after being on the surface for a very short time and (2) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Potential impacts of exposure to parachutes are not expected to result in population-level impacts.

Pursuant to the ESA, the use of parachutes during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.4.2.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.4.2 (Parachutes), under Alternative 1, the number of activities involving the use of parachutes is 5 percent higher than that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, parachutes would also be expended in the Key West and GOMEX Range Complexes. Under Alternative 1, there would be a concentration of approximately one parachute per 2 nm^2 if the parachutes were expended evenly throughout the area. Any species of sea turtle that occurs in the Study Area could at some time encounter expended parachutes.

In comparison to the No Action Alternative, the increase in training activities presented in Alternative 1 may increase the risk of sea turtles being exposed to parachutes. Additionally, the introduction of activities in the Key West and GOMEX Range Complexes may expose additional sea turtles that would not been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes on sea turtles during training activities would not be discernible from those described in Section 3.5.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.4.2.1 (No Action Alternative), the use of parachutes in training activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a parachute, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to parachutes may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to parachutes are not expected to result in population-level impacts.

Pursuant to the ESA, the use of parachutes during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.4.2 (Parachutes), under Alternative 1 the number of activities involving the use of parachutes is four times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing parachutes in the Key West Range Complex; and anywhere in the Gulf of Mexico portion of the Study Area. Some activities could occur throughout the Study Area, including outside the range complexes while vessels are in transit. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with the greatest concentration. For testing events, the greatest concentration would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under Alternative 1, there would be a concentration of approximately one parachute per 5 nm^2 if the parachutes were expended evenly throughout the area. Any species of sea turtle that occurs in the Study Area could at some point in time encounter expended parachutes.

In comparison to the No Action Alternative, the increase in testing activities presented in Alternative 1 may increase the risk of sea turtles being exposed to parachutes. Additionally, the introduction of activities in the Gulf of Mexico and anywhere in the Study Area, outside the range complexes while vessels are in transit, may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes on sea turtles during testing activities would not be discernible from those described in Section 3.5.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.4.2.1 (No Action Alternative), the use of parachutes in testing activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a parachute, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to parachutes may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to parachutes are not expected to result in population-level impacts.

Pursuant to the ESA, the use of parachutes during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.4.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are nearly identical to training activities under Alternative 1 (i.e., three additional parachutes). Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.4.2.2 (Alternative 1).

Pursuant to the ESA, the use of parachutes during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.4.2 (Parachutes), under Alternative 2, the number of activities involving the use of parachutes is more than five times that of the No Action Alternative but only increases by about 19 percent compared to Alternative 1. The activities using parachutes would occur in the same geographic locations as the No Action Alternative, except for introducing parachutes in the Key West Range Complex, anywhere in the Gulf of Mexico portion of the Study Area, and anywhere in the Study Area, outside the range complexes while vessels are in transit. Under Alternative 2, there would be a concentration of approximately one parachute per 4 nm^2 if the parachutes were expended evenly throughout the area.

In comparison to the No Action Alternative and Alternative 1, the increase in testing activities presented in Alternative 2 may increase the risk of sea turtles being exposed to parachutes. Additionally, the introduction of activities in the Key West Range Complex, anywhere in the Gulf of Mexico, and anywhere in the Study Area, outside the range complexes while vessels are in transit, may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes on sea turtles during testing activities would not be discernible from those described in Section 3.5.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.4.2.1 (No Action Alternative), the use of parachutes in testing activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a parachute, it could free itself or the entanglement could lead to injury or death. Potential impacts of exposure to parachutes may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential impacts of exposure to parachutes are not expected to result in population-level impacts.

Pursuant to the ESA, the use of parachutes during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, hawksbill, Kemp's ridley, loggerhead, or leatherback sea turtles.*

3.5.3.5 Ingestion Stressors

This section analyzes the potential ingestion impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5 (Conceptual Framework for Assessing Effects from Ingestion). This analysis includes two categories of military expended materials: (1) munitions (both non-explosive practice munitions and fragments from high-explosive munitions), which are expected to sink to the seafloor, and (2) military expended materials other than munitions (including fragments from targets, chaff, flares, and parachutes), which may remain at the surface or in the water column for some time prior to sinking. This section does not analyze impacts on critical habitat because Section 3.5.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of expended materials on designated critical habitat.

The potential impacts from ingesting these materials is dependent upon the probability of the animal encountering these items in their environment, which is primarily contingent on where the items are expended and how a sea turtle feeds. Ingestion of expended materials by sea turtles could occur in all large marine ecosystems and open ocean areas and can occur at the surface, in the water column, or at the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the turtle. Floating material could be eaten by turtles, such as leatherbacks that feed at or near the water surface, while materials that sink to the seafloor pose a potential risk to bottom-feeding turtles such as hawksbills. Descriptions of feeding behavior by species appear in Sections 3.5.2.4 (Green Sea Turtle [*Chelonia mydas*]) through 3.5.2.10 (American Alligator [*Alligator mississippiensis*]).

Leatherbacks feed primarily on jellyfish throughout the water column and may mistake floating debris for prey. Items found in a sample of leatherbacks who had ingested plastic included plastic bags, fishing line, twine, Mylar balloon fragments, and a plastic spoon (Mrosovsky et al. 2009). Kemp's ridleys, loggerheads, and green turtles in coastal Florida were found to ingest bits of plastic, tar, rubber, and aluminum foil (Bjorndal et al. 1994). Oceanic-stage loggerhead turtles in the North Atlantic were found to ingest "small pieces of hard plastic," corks, and white Styrofoam pieces (Frick et al. 2009). Juvenile loggerheads in the Mediterranean ingested plastic most frequently, followed by tar, Styrofoam, wood, feathers, lines, and net fragments (Tomás et al. 2002). Similar trends in types of items ingested were observed in Kemp's ridley, loggerhead, and green turtles off the Texas coast (Stanley et al. 1988), in loggerheads in the Adriatic Sea (Lazar and Gracan 2011), and in green turtles in the Pacific Ocean (Parker et al. 2011). The variety of items ingested by turtles suggests that feeding is nondiscriminatory and they are prone to ingesting nonprey items. Ingestion of these items may not be directly lethal; however, ingestion of plastic and other fragments can restrict food intake and have sublethal impacts caused by reduced nutrient intake (McCauley and Bjorndal 1999). Poor nutrient intake can lead to decreased growth rates, depleted energy, reduced reproduction, and decreased survivorship. These long-term sublethal impacts may lead to population-level impacts, but this is difficult to assess because the compromised individuals remain at sea and the trends may only arise after several generations have passed.

Because bottom-feeding occurs in nearshore areas, materials that sink to the seafloor in the open ocean are less likely to be ingested due to their location, as depth in areas where munitions are fired ranges from about 20 to 200 m in areas far offshore. While these depths may be within the diving capabilities of most sea turtle species, bottom foraging species (i.e., greens, hawksbills, Kemp's ridleys, and loggerheads) are more likely to forage in the shallower waters. This overlaps with only a small portion of the depth range at which munitions are expended. The consequences of ingestion could range from temporary and inconsequential to long-term physical stress or even death. Aspects of ingestion

stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5 (Conceptual Framework for Assessing Effects from Ingestion).

3.5.3.5.1 Impacts from Munitions or Fragments from High-Explosive Munitions

Many different types of explosive and non-explosive practice munitions are expended at sea during training and testing activities. This section analyzes the potential for sea turtles to ingest non-explosive practice munitions and fragments from high-explosive munitions. This section does not analyze impacts on critical habitat because Section 3.5.3.3.3 (Impacts from Military Expended Materials) already analyzed the potential impacts of munitions on designated critical habitat.

Types of non-explosive practice munitions generally include projectiles, missiles, and bombs. Of these, only small- or medium-caliber projectiles would be small enough for a sea turtle to ingest. Small- and medium-caliber projectiles include all sizes up to and including 2.25 in. (57 mm) in diameter. These solid metal materials would quickly move through the water column and settle to the seafloor. Ingestion of non-explosive practice munitions is not expected to occur in the water column because the munitions sink quickly. Instead, they are most likely to be encountered by species that forage on the bottom. A discussion of the types, numbers, and locations of activities using these devices under each alternative is presented in Sections 3.0.5.3.5.1 (Non-Explosive Practice Munitions).

Types of high-explosive munitions that can result in fragments include demolition charges, grenades, projectiles, missiles, and bombs. Fragments would result from fractures in the munitions casing and would vary in size depending on the net explosive weight and munitions type; however, typical sizes of fragments are unknown. These solid metal materials would quickly move through the water column and settle to the seafloor; therefore, ingestion is not expected by most species. Fragments are primarily encountered by species that forage on the bottom. A discussion of the types, numbers, and locations of activities using these devices under each alternative is presented in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions).

Because green, loggerhead, Kemp's ridley, and hawksbill turtles feed along the seafloor, they are more likely to encounter munitions of ingestible size that settle on the bottom than leatherbacks that primarily feed at the surface. Furthermore, these four species typically use nearshore feeding areas, while leatherbacks are more likely to feed in the open ocean. Given the very low probability of a leatherback encountering and ingesting materials on the seafloor, this analysis will focus on green, loggerhead, Kemp's ridley, and hawksbill turtles and ingestible materials expended nearshore, within range complexes and testing ranges.

3.5.3.5.1.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.5.1 (Non-Explosive Practice Munitions), under the No Action Alternative, the areas with the greatest amount of small- and medium-caliber projectiles would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Use of small- and medium-caliber projectiles is concentrated within the VACAPES and JAX Range Complexes. The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and the animal's feeding habitat.

As discussed in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions), under the No Action Alternative, the areas with the greatest amount of high-explosive munitions would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. In addition, activities would occur outside the range complexes in the Sinking Exercise Box. Use of high-explosive munitions is concentrated within the VACAPES Range Complex. The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and the animal's feeding habitat.

Sublethal impacts due to ingestion of munitions used in training activities may cause short-term or long-term disturbance to an individual turtle because (1) if a sea turtle were to incidentally ingest and swallow a projectile or solid metal high-explosive fragment, it could potentially disrupt its feeding behavior or digestive processes and (2) if the item is particularly large in proportion to the turtle ingesting it, the projectile could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential impacts of exposure to munitions may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, munitions used in training activities are generally not expected to cause disturbance to sea turtles because (1) sea turtles are not expected to encounter most small- and medium-caliber projectiles or high-explosive fragments on the seafloor because of the depth at which these would be expended and (2) in some cases, a turtle would likely pass the projectile through its digestive tract and expel the item without impacting the individual. Potential impacts of exposure to munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of munitions from training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill sea turtles; and*
- *will have no effect on leatherback sea turtles.*

Testing Activities

As indicated in Section 3.0.5.3.5.1 (Non-Explosive Practice Munitions), under the No Action Alternative, the areas with the greatest amount of small- and medium-caliber projectiles would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, JAX, and GOMEX Range Complexes and the Naval Surface Warfare Center, Panama City Division Testing Range. The amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and the animal's feeding habits.

As discussed in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions), under the No Action Alternative, testing activities involving high-explosive munitions would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area. Testing activities would specifically occur within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes, the Naval Surface Warfare Center, Panama City Division Testing Range, and in other areas outside the range complexes. The amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and the animal's feeding habits.

Sublethal impacts due to ingestion of munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle because (1) if a sea turtle were to incidentally ingest and swallow a projectile or solid metal high-explosive fragment, it could potentially disrupt its feeding behavior or digestive processes and (2) if the item is particularly large in proportion to the turtle ingesting it, the item could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential impacts of exposure to munitions may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, munitions used in testing activities are generally not expected to cause disturbance to sea turtles because (1) sea turtles are not expected to encounter most small- and medium-caliber projectiles or high-explosive fragments on the seafloor because of the depth at which these would be expended; and (2) in some cases, a turtle would likely pass the projectile through its digestive tract and expel the item without impacting the individual. Potential impacts of exposure to munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of munitions from testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill sea turtles; and*
- *will have no effect on leatherback sea turtles.*

3.5.3.5.1.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.5.1 (Non-Explosive Practice Munitions), under Alternative 1, the number of small- and medium-caliber projectiles is more than three times that of the No Action Alternative. The activities using small- and medium-caliber projectiles under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing small- and medium-caliber projectiles in the Northeast Range Complexes, and less than 10 percent of the total small- and medium-caliber projectiles could be expended anywhere in the Study Area, outside the range complexes while vessels are in transit. Any bottom-feeding sea turtle may occur in these range complexes, although the amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and the animal's feeding habits.

As discussed in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions), under Alternative 1, the number of events that use high-explosive munitions would increase substantially (more than 13 times) compared to the No Action Alternative. The majority of this increase is due to the inclusion of medium-caliber projectiles that were not analyzed as high-explosive munitions under the No Action Alternative. The activities using high-explosive munitions under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing high-explosive munitions in the Key West Range Complex and in the Other AFTT Areas while vessels are in transit. Use of high-explosive munitions would be most concentrated in the VACAPES and JAX Range Complexes. Any bottom-feeding sea turtle may occur in these range complexes, although the amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and the animal's feeding habits.

In comparison to the No Action Alternative, the increase in training activities presented in Alternative 1 increases the risk of sea turtles being exposed to munitions. Additionally, the introduction of activities in

the Key West Range Complexes and in Other AFTT Areas may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from munitions on sea turtles during training activities would not be discernible from those described in Section 3.5.3.5.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.1.1 (No Action Alternative), sublethal impacts due to ingestion of munitions used in training activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of munitions from training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill turtles; and*
- *will have no effect on leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.5.1 (Non-Explosive Practice Munitions), under Alternative 1, the amount of small- and medium-caliber projectiles expended is more than four times that of the No Action Alternative. The activities using small- and medium-caliber projectiles under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing small- and medium-caliber projectiles in the Key West Range Complex, and testing activities could occur throughout the Study Area. The use of small- and medium-caliber projectiles would be most concentrated in the VACAPES and JAX Range Complexes. Any bottom-feeding sea turtle may occur in these range complexes, although the amount of small- and medium-caliber projectiles that an individual animal would encounter is generally low based on the patchy distribution of both the projectiles and the animal's feeding habitat.

As discussed in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions), under Alternative 1, the number of events that use high-explosive munitions would increase substantially compared to the No Action Alternative. The majority of this increase is due to the inclusion of medium-caliber projectiles that were not analyzed as high-explosive munitions under the No Action Alternative. The activities using high-explosive munitions under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing high-explosive munitions in the Key West Range Complex. The use of small- and medium-caliber projectiles would be most concentrated in the VACAPES and JAX Range Complexes. Any bottom-feeding sea turtle may occur in these range complexes, although the amount of high-explosive munitions fragments that an individual animal would encounter is generally low based on the patchy distribution of both the munitions and the animal's feeding habits.

In comparison to the No Action Alternative, the increase in testing activities presented in Alternative 1 increases the risk of sea turtles being exposed to munitions. Additionally, the introduction of activities in the Key West Range Complex may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from munitions on sea turtles during testing activities would not be discernible from those described in Section 3.5.3.5.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.1.1 (No Action Alternative), sublethal impacts due to ingestion of munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of munitions from testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill turtles; and*
- *will have no effect on leatherback sea turtles.*

3.5.3.5.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.5.1.2 (Alternative 1).

Pursuant to the ESA, the potential for ingestion of munitions from training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill turtles; and*
- *will have no effect on leatherback sea turtles.*

Testing Activities

As discussed in Section 3.0.5.3.5.1 (Non-Explosive Practice Munitions), under Alternative 2, the amount of small- and medium-caliber projectiles is more than 4times that expended under the No Action Alternative, but it only increases by about 4 percent compared to Alternative 1. The activities using small- and medium- caliber projectiles under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except for introducing small- and medium-caliber projectiles in the Key West Range Complex and testing activities could occur throughout the Study Area. The use of small-and medium-caliber projectiles would be most concentrated in the VACAPES and JAX Range Complexes. Any bottom-feeding sea turtle may occur in these range complexes.

As discussed in Section 3.0.5.3.5.2 (Fragments from High-Explosive Munitions), under Alternative 2, the number of events that use high-explosive munitions would increase more than 14 times compared to the No Action Alternative but only increases by about 7 percent compared to Alternative 1. The majority of this increase is due to the inclusion of medium-caliber projectiles that were not analyzed as high-explosive munitions under the No Action Alternative. The activities using high-explosive munitions under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except for introducing high-explosive munitions in the Key West Range Complex. The use of small- and medium-caliber projectiles would be most concentrated in the VACAPES and JAX Range Complexes. Any bottom-feeding sea turtle may occur in these range complexes.

The increase in testing activities over the No Action Alternative and the slight increase in activities over Alternative 1 increases the risk of sea turtles being exposed to munitions. However, the differences in species overlap and potential impacts from munitions on sea turtles during testing activities would not be discernible from those described in Section 3.5.3.5.1.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.1.1 (No Action Alternative), sublethal impacts due to ingestion of munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of munitions from testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed green, loggerhead, Kemp's ridley, and hawksbill turtles; and*
- *will have no effect on leatherback sea turtles.*

3.5.3.5.2 Impacts from Military Expended Materials Other Than Munitions

Several different types of materials other than munitions are expended at sea during training and testing activities. The following military expended materials other than munitions have the potential to be ingested by sea turtles:

- Target-related materials
- Chaff (including fibers, end caps, and pistons)
- Flares (including end caps and pistons)
- Parachutes (cloth, nylon, and metal weights)

A discussion of the types, numbers, and locations of activities using these devices under each alternative is presented in Section 3.0.5.3.5.3 (Military Expended Materials Other than Munitions). This section does not analyze impacts on critical habitat because Section 3.5.3.3.3 (Impacts from Military Expended Materials) and Section 3.5.3.4 (Entanglement Stressors) already analyzed the potential impacts of military expended materials other than munitions on designated critical habitat.

Because leatherbacks are more likely to feed at or near the surface, they are more likely to encounter materials at the surface than are other species of turtles that primarily feed along the seafloor. Furthermore, leatherbacks typically feed in the open ocean, while other species are more likely to feed in nearshore areas. Though they are bottom-feeding species that generally feed nearshore, green, hawksbill, Kemp's ridley, and loggerhead sea turtles may occur in the open ocean during migrations. Given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, this analysis focuses on leatherback sea turtles and those materials expended in the open ocean.

3.5.3.5.2.1 No Action Alternative

Training Activities

As discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes, in the Sinking Exercise Box outside the range complexes, and anywhere in the Gulf of Mexico portion of the Study Area.

Under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

Under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes.

All sea turtle species could potentially be exposed to parachutes, target materials, chaff, or flares in the areas listed above, but given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, leatherback sea turtles are more likely to be exposed.

Given the low number of parachutes expended in the open ocean and the rapid sink rate of the parachute, the likelihood of a leatherback or other sea turtle species encountering and ingesting a parachute is extremely low. The likelihood of a leatherback encountering and ingesting a flare end cap or target fragment is also very low, as leatherbacks typically forage farther offshore rather than within range complexes such as the Key West Range Complex, and other sea turtle species primarily forage on the bottom in nearshore habitats.

Although chaff fibers are too small for sea turtles to confuse with prey and forage, there is some potential for chaff to be incidentally ingested along with other prey items, particularly if the chaff attaches to other floating marine debris. If ingested, chaff is not expected to impact sea turtles due to the low concentration that would be ingested and the small size of the fibers. While no similar studies to those discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) on the impacts of chaff have been conducted on sea turtles, they are also not likely to be impacted by incidental ingestion of chaff fibers. For instance, some sea turtles ingest spicules (small spines within the structure of a sponge) in the course of eating the sponges, without harm to their digestive system. Since chaff fibers are of similar composition and size as these spicules (Spargo 1999), ingestion of chaff should be inconsequential for sea turtles.

Sublethal impacts due to ingestion of military expended materials other than munitions used in training activities may cause short-term or long-term disturbance to an individual turtle because (1) if a sea turtle were to incidentally ingest and swallow a parachute, target fragment, chaff or flare component, it could potentially disrupt its feeding behavior or digestive processes and (2) if the item is particularly large in proportion to the turtle ingesting it, the item could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential impacts of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, parachutes, target fragments, chaff, and flare components used in training activities are generally not expected to cause disturbance to sea turtles because (1) leatherbacks are likely to forage further offshore than within range complexes, and other sea turtles primarily forage on the bottom in nearshore areas; (2) in some cases, a turtle would likely pass the item through its digestive tract and expel the item without impacting the individual; and (3) chaff, if ingested, would occur in very low concentration and is similar to spicules, which sea turtles ingest without harm. In addition, the impacts of ingesting these forms of expended materials on sea turtles would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- The limited period of time these military expended materials would remain in the water column

- The unlikely chance that a sea turtle might encounter and swallow these items on the seafloor
- The ability of sea turtles to reject and not swallow nonfood items incidentally ingested

Potential impacts of exposure to military expended materials other than munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions from training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

Testing Activities

As discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes and in the Sinking Exercise Box outside the range complexes. Parachute use under Alternative 1 would increase by 10 percent compared to the No Action Alternative and would be concentrated primarily in the JAX Range Complex.

Under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, JAX, and GOMEX Range Complexes. In addition, activities that expend target materials would occur at Naval Surface Warfare Center, Panama City Division Testing Range and within Other AFTT Areas.

Under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

All sea turtle species could potentially be exposed to parachutes, target materials, chaff, or flares in the areas listed above, but given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, leatherback sea turtles are more likely to be exposed.

Sublethal impacts due to ingestion of military expended materials other than munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle because (1) if a sea turtle were to incidentally ingest and swallow a parachute, target fragment, chaff or flare component, it could potentially disrupt its feeding behavior or digestive processes and (2) if the item is particularly large in proportion to the turtle ingesting it, the item could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential impacts of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, parachutes, target fragments, chaff, and flare components used in testing activities are generally not expected to cause disturbance to sea turtles because (1) leatherbacks are likely to forage further offshore than within range complexes, and other sea turtles are primarily bottom-feeders in

nearshore areas; (2) in some cases a turtle would likely pass the item through its digestive tract and expel the item without impacting the individual; and (3) chaff fibers, if ingested, would occur in very low concentration and are similar to spicules, which sea turtles ingest without harm. In addition, the impacts of ingesting these forms of expended materials on sea turtles would be minor because of the following factors:

- The limited geographic area where materials other than munitions are expended during a given event
- The limited period of time these military expended materials would remain in the water column
- The unlikely chance that a sea turtle might encounter and swallow these items on the seafloor
- The ability of sea turtles to reject and not swallow nonfood items incidentally ingested

Potential impacts of exposure to military expended materials other than munitions are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

3.5.3.5.2.2 Alternative 1

Training Activities

As discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 1, the number of activities involving the use of parachutes is about 5 percent higher than that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, parachutes would also be expended in the Key West Range Complex, as well as anywhere in the Study Area, outside the range complexes while vessels are in transit. Any species of sea turtle that occurs in the Study Area could at some time encounter expended parachutes.

Under Alternative 1, the number of activities that expend target-related materials is about four times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Northeast Range Complexes, as well as anywhere in the Study Area, outside the range complexes while vessels are in transit.

Under Alternative 1, the number of activities that expend chaff would decrease by about 30 percent from the No Action Alternative, and flares would increase by about 30 percent. The activities using chaff and flares under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of expending flares within the Northeast Range Complexes.

All sea turtle species could potentially be exposed to parachutes, target materials, chaff, or flares in the areas listed above, but given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, leatherback sea turtles are more likely to be exposed.

In comparison to the No Action Alternative, the increase in training activities presented in Alternative 1 increases the risk of sea turtles being exposed to parachutes, target materials, and flares. Additionally, the introduction of activities in the Northeast Range Complexes and outside the range complexes may

expose additional sea turtles that were not analyzed under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes, target materials, chaff, and flares on sea turtles during training activities would not be discernible from those described in Section 3.5.3.5.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.2.1 (No Action Alternative), sublethal impacts due to ingestion of military expended materials other than munitions used in training activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. The impacts of ingesting these forms of expended materials on sea turtles would be minor because of the factors given for the No Action Alternative, and are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

Testing Activities

As discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 1, the number of activities involving the use of parachutes is approximately four times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except for introducing parachutes in the Key West Range Complex; Naval Surface Warfare Center, Panama City Division Testing Range; and anywhere in the Gulf of Mexico portion of the Study Area. In addition, testing activities could expend parachutes throughout the Study Area. Any species of sea turtle that occurs in the Study Area could at some point in time encounter expended parachutes.

Under Alternative 1, the number of activities that expend target-related materials of ingestible size is approximately two times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the GOMEX Range Complexes. In addition, testing activities could expend target-related materials throughout the Study Area.

Under Alternative 1, the number of activities that expend chaff and flares would increase four times and three times, respectively, compared to the No Action Alternative. The activities using chaff and flares under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

All sea turtle species could potentially be exposed to parachutes, target materials, chaff, or flares in the areas listed above, but given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, leatherback sea turtles are more likely to be exposed.

In comparison to the No Action Alternative, the increase in testing activities presented in Alternative 1 increases the risk of sea turtles being exposed to parachutes, target materials, chaff, and flares. Additionally, the introduction of activities in the Key West Range Complex and the Gulf of Mexico portion of the Study Area may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes, target materials, chaff, and flares on sea turtles during testing activities would not be

discernible from those described in Section 3.5.3.5.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.2.1 (No Action Alternative), sublethal impacts due to ingestion of military expended materials other than munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. The impacts of ingesting these forms of expended materials on sea turtles would be minor because of the factors given for the No Action Alternative and are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

3.5.3.5.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and locations of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be as described in Section 3.5.3.5.2.2 (Alternative 1).

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

Testing Activities

As discussed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 2 the number of activities involving the use of parachutes is more than five- times that of the No Action Alternative but only increases by about 20 percent compared to Alternative 1. The activities using parachutes under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except for introducing parachutes in the Key West Range Complex; Naval Surface Warfare Center, Panama City Division Testing Range; and anywhere in the Gulf of Mexico portion of the Study Area. In addition, testing activities could expend parachutes throughout the Study Area.

Under Alternative 2, the number of activities that expend target-related materials that could be of ingestible size is more than 2.5 times that of the No Action Alternative but only increases by about 10 percent from Alternative 1. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the GOMEX Range Complexes. In addition, testing activities could expend target-related materials throughout the Study Area.

Under Alternative 2, the number of activities that expend chaff is nearly four times greater than under the No Action Alternative but would only increase by about 10 percent from Alternative 1. Under Alternative 2, the number of activities that expend flares is nearly three times that of the No Action Alternative but would only increase by about 10 percent from Alternative 1. The activities using chaff and flares under Alternative 2 would occur in the same geographic locations as the No Action Alternative.

All sea turtle species could potentially be exposed to parachutes, target materials, chaff, or flares in the areas listed above, but given the very low probability of nearshore, bottom-feeding species encountering and ingesting materials at the surface, leatherback sea turtles are more likely to be exposed.

Under Alternative 2, the increase in testing activities over the No Action Alternative and the slight increase in activities over Alternative 1 increases the risk of sea turtles being exposed to parachutes, target materials, chaff, and flares. Additionally, the introduction of activities in the Key West Range Complex and the Gulf of Mexico portion of the Study Area may expose additional sea turtles that would not have been encountered under the No Action Alternative. However, the differences in species overlap and potential impacts from parachutes, target materials, chaff, and flares on sea turtles during testing activities would not be discernible from those described in Section 3.5.3.5.2.1 (No Action Alternative). For the reasons stated in Section 3.5.3.5.2.1 (No Action Alternative), sublethal impacts due to ingestion of military expended materials other than munitions used in testing activities may cause short-term or long-term disturbance to an individual turtle. Potential impacts of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. The impacts of ingesting these forms of expended materials on sea turtles would be minor because of the factors given for the No Action Alternativeand are not expected to result in population-level impacts.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles.*

3.5.3.6 Secondary Stressors

This section analyzes potential impacts on sea turtles exposed to stressors indirectly through impacts on their habitat (i.e., sediments and water quality) and prey availability. The activities that potentially contribute to indirect impacts on habitat do not co-occur with ESA-listed American crocodiles or American alligators, and therefore will not be discussed further. For this analysis, indirect impacts on sea turtles via sediments or water quality (not by trophic transfer, e.g., bioaccumulation) are considered here. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences but instead describe how the impact may occur to an organism. Bioaccumulation is considered in the *Ecosystem Technical Report for the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement* (U.S. Department of the Navy 2012b).

Stressors from Navy training and testing activities could pose indirect impacts on turtles via habitat. These include: (1) explosives, (2) explosive byproducts and unexploded ordnance, (3) metals, and (4) chemicals. Activities associated with these stressors and analyses of their potential impacts are discussed in Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats).

3.5.3.6.1 Explosives

In addition to directly impacting sea turtles and sea turtle habitat, underwater explosions could impact other species in the food web, including prey species that sea turtles feed on. The impacts of underwater explosions would differ depending on the type of prey species in the area of the blast.

In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source (Hazel et al. 2007). This startle and flight response is the most common secondary defense among animals (Mather 2004). The abundance of prey species near the detonation point could be diminished for a short period before being repopulated by animals from adjacent waters. Many sea turtle prey items, such as jellyfish and sponges, have limited mobility and ability to react to pressure waves. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting impact on prey availability or the pelagic food web would be expected. Furthermore, most explosions occur in depths exceeding that which normally support seagrass beds, protecting these habitats.

3.5.3.6.2 Explosion Byproducts and Unexploded Ordnance

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high explosives (Section 3.1.3.1.3, Ordnance Failure and Low-Order Detonations). Undetonated explosives associated with ordnance disposal and mine clearance are collected after the activity is complete; therefore, potential impacts are assumed to be inconsequential for these activities, but other activities could leave these items on the seafloor. Sea turtles may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of Royal Demolition Explosive, 98 percent of the products are common seawater constituents; the remaining products are rapidly diluted below threshold impact level (Section 3.1.3.1.5, Impacts from Explosives and Explosion Byproducts). Explosion byproducts associated with high order detonations present no secondary stressors to sea turtles through sediment or water. However, low order detonations and unexploded ordnance present elevated likelihood of impacts on sea turtles.

Indirect impacts of explosives and unexploded ordnance to sea turtles via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways discussed in Section 3.1.3.1 (Explosives and Explosion Byproducts). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment 6 to 12 in. (15 to 30 cm) away from degrading ordnance, concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (1 to 2 m) from the degrading ordnance (Section 3.1.3.1, Explosives and Explosion Byproducts). Taken together, it is possible that various life stages of sea turtles could be impacted by the indirect impacts of degrading explosives within a very small radius of the explosive 1 to 6 ft. (0.3 to 2 m).

3.5.3.6.3 Metals

Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2, Metals). Some metals bioaccumulate, and physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals (Section 3.3, Marine Habitats, and Section 4.0, Cumulative Impacts). Indirect impacts of metals to sea turtles via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Sea turtles may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion

of contaminated sediments. Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that sea turtles would be indirectly impacted by toxic metals via water.

3.5.3.6.4 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, principally flares and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls (PCBs) are discussed in Section 3.1.3.3 (Chemicals Other than Explosives), but there is no additional risk to sea turtles because the Proposed Action does not introduce this chemical into the Study Area, and the use of PCBs has been nearly zero since 1979. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment. Sea turtles may be exposed by contact with contaminated water or ingestion of contaminated sediments.

Missile and rocket fuel poses no risk of indirect impact on sea turtles via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Section 3.1.3.3, Chemicals Other than Explosives). It is conceivable that various life stages of sea turtles could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential effects would diminish rapidly as the propellant degrades.

3.5.3.6.5 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training

Pursuant to the ESA, secondary stressors resulting from training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect ESA-listed leatherback, green, hawksbill, Kemp's ridley, or loggerhead turtles;*
- *will have no effect on ESA-listed American crocodiles or American alligators; and*
- *will have no effect on critical habitat.*

3.5.3.6.6 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Testing

Pursuant to the ESA, secondary stressors resulting from testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect ESA-listed sea turtles;*
- *will have no effect on ESA-listed American crocodiles or American alligators; and*
- *will have no effect on critical habitat.*

3.5.4 Summary of Impacts on Sea Turtles and Other Marine Reptiles

3.5.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above and summarized in Section 3.5.4.2 (Endangered Species Act

Determinations). Combined impacts of all stressors are not an issue for crocodilians since they would potentially only be exposed to a single stressor.

There are generally two ways that a sea turtle could be exposed to multiple stressors. The first would be if the animal were exposed to multiple sources of stress from a single activity (e.g., a mine warfare activity may involve explosives and vessels that could introduce potential acoustic and physical strike stressors). The potential for a combination of these impacts from a single activity would depend on the range of effects of each of the stressors and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a sea turtle were within the potential impact range of those activities, it may be impacted by multiple stressors simultaneously. This would be more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercise or composite training unit exercise).

Second, an individual sea turtle could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., near naval ports, testing ranges, and routine activity locations outlined in Table 3.0-2) and in areas that individual sea turtles frequently visit because they are within the animal's home range, migratory route, breeding area, or foraging area. Except for in the few concentrated areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time such that it would be very unlikely that any individual sea turtles would be exposed to stressors from multiple activities. However, animals with a small home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory route. The majority of the proposed activities are unit level. Unit level events occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Time is a factor with respect to the probability of exposure. Because most Navy stressors persist for a time shorter than or equal to the duration of the activity, the odds of exposure to combined stressors is lower than would be the case for persistent stressors. For example, strike stressors cease with the passage of the object; ingestion stressors cease (mostly) when the object settles to the seafloor. The animal would have to be present during each of the brief windows that the stressors occur. Multiple stressors may also have synergistic effects. For example, sea turtles that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Sea turtles that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors on sea turtles are difficult to predict.

Although potential impacts on certain sea turtle species from the Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Section 3.5.4.2 (Endangered Species Act Determinations) with respect to the ESA.

3.5.4.2 Endangered Species Act Determinations

Administration of ESA obligations associated with sea turtles are shared between NMFS and U.S. Fish and Wildlife Service, depending on life stage and specific location of the sea turtle. NMFS has jurisdiction

over sea turtles in the marine environment, and U.S. Fish and Wildlife Service has jurisdiction over sea turtles on land. The U.S. Fish and Wildlife Service has jurisdiction over the American crocodile and American alligator. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with NMFS for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative), with regard to sea turtles. Because no activities analyzed in this EIS/OEIS occur on land, consultation with U.S. Fish and Wildlife Service is not required for sea turtles. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with U.S. Fish and Wildlife Service for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative), with regard to impacts on the American crocodile and American alligator. Table 3.5-18 below summarizes the Navy's determination of impacts on federally listed reptiles for the Preferred Alternative.

Table 3.5-18: Summary of Endangered Species Act Determinations for Sea Turtles, the American Crocodile, and the American Alligator for Training and Testing Activities for the Preferred Alternative

Navy Activities and Stressors		Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Loggerhead Turtle	Leatherback Turtle	American Crocodile[1]	American Alligator[1]
Acoustic Stressors								
Sonar and Other Active Acoustic Sources	Training Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	May affect not likely to adversely affect
	Testing Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	May affect not likely to adversely affect
Explosives	Training Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	No effect
	Testing Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	No effect
Pile Driving	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Swimmer Defense Airguns	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect

[1] For the American crocodile and American alligator, Endangered Species Act determinations for stressors which did not overlap with species occurrence or critical habitat were considered to be 'no effect'.

Table 3.5-18: Summary of Endangered Species Act Determinations for Sea Turtles, the American Crocodile, and the American Alligator for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Loggerhead Turtle	Leatherback Turtle	American Crocodile[1]	American Alligator[1]
Acoustic Stressors (Continued)								
Weapons Firing, Launch, and Impact Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Vessel and Aircraft Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Energy Stressors								
Electromagnetic Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
High Energy Lasers	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect

[1] For the American crocodile and American alligator, Endangered Species Act determinations for stressors which did not overlap with species occurrence or critical habitat were considered to be 'no effect'.

Table 3.5-18: Summary of Endangered Species Act Determinations for Sea Turtles, the American Crocodile, and the American Alligator for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Loggerhead Turtle	Leatherback Turtle	American Crocodile[1]	American Alligator[1]
Physical Disturbance and Strike Stressors								
Vessels	Training Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	No effect
	Testing Activities	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect	No effect	No effect
In-Water Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Military Expended Materials	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Seafloor Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Entanglement Stressors								
Fiber Optic Cables and Guidance Wires	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect

[1] For the American crocodile and American alligator, Endangered Species Act determinations for stressors which did not overlap with species occurrence or critical habitat were considered to be 'no effect'.

Table 3.5-18: Summary of Endangered Species Act Determinations for Sea Turtles, the American Crocodile, and the American Alligator for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Green Turtle	Hawksbill Turtle	Kemp's Ridley Turtle	Loggerhead Turtle	Leatherback Turtle	American Crocodile[1]	American Alligator[1]
Entanglement Stressors (Continued)								
Parachutes	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Ingestion Stressors								
Munitions	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect	No effect
Military Expended Materials Other than Munitions	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
Secondary Stressors								
Secondary Stressors	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	No effect

[1] For the American crocodile and American alligator, Endangered Species Act determinations for stressors which did not overlap with species occurrence or critical habitat were considered to be 'no effect'.

Note: The scientific names of the listed species are as follows: green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), Kemp's ridley turtle (*Lepidochelys kempii*), loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), American crocodile (*Crocodylus acutus*), and American alligator (*Alligator mississippiensis*).

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3.6 BIRDS

BIRDS SYNOPSIS

The Navy considered all potential stressors for birds and analyzed the following:

- Acoustic (sonar and other active acoustic sources; explosives and swimmer defense airguns; pile driving; weapons firing, launch, and impact noise; aircraft and vessel noise)
- Energy (electromagnetic devices, high energy lasers)
- Physical disturbance and strikes (aircraft and aerial targets, vessels and in-water devices, military expended materials)
- Ingestion (military expended materials)
- Secondary (general emissions)

Preferred Alternative

- Acoustic: Pursuant to the Endangered Species Act (ESA), the use of sonar and other active acoustic sources may affect but is not likely to adversely affect ESA-listed roseate terns and will have no effect on ESA-listed piping plover (and its critical habitat), ESA-candidate red knot, or ESA-listed Bermuda petrel. The use of explosives, swimmer defense airguns, aircraft, and vessels may affect but is not likely to adversely affect ESA-listed or ESA-candidate bird species, and will have no effect on piping plover critical habitat. Pile driving may affect but is not likely to adversely affect ESA-listed piping plover and roseate terns, and will have no effect on the ESA-candidate red knot, the ESA-listed Bermuda petrel, or piping plover critical habitat. Weapons firing, launch, and impact noise may affect but is not likely to adversely affect ESA-listed Bermuda petrel or roseate terns, the ESA-candidate red knot, and will have no effect on piping plover (and its critical habitat).
- Energy: Pursuant to the ESA, the use of electromagnetic devices during training and testing activities may affect but is not likely to adversely affect ESA-listed piping plover (and its critical habitat), Bermuda petrel, roseate tern, or ESA-candidate red knot. The use of high energy lasers during training and testing activities will have no effect on ESA-listed piping plover (and its critical habitat), Bermuda petrel, roseate tern, or ESA-candidate red knot.
- Physical Disturbance and Strikes: Pursuant to the ESA, the use of aircraft and aerial targets, vessels and in-water devices, and military expended materials may affect but is not likely to adversely affect ESA-listed piping plover, Bermuda petrel, roseate tern, or ESA-candidate red knot, and will have no effect on piping plover critical habitat.
- Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials used during training and testing activities may affect but is not likely to adversely affect ESA-listed Bermuda petrel or roseate tern and will have no effect on the ESA-listed piping plover or the ESA-candidate red knot.
- Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed or ESA-candidate bird species and will have no effect on critical habitat.
- Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

3.6.1 INTRODUCTION

This section analyzes potential impacts on birds found in the Study Area. This section introduces the Endangered Species Act (ESA)-listed species, the major taxonomic groups of birds that occur in the Study Area, species protected under the Migratory Bird Treaty Act, and United States (U.S.) Fish and Wildlife Service Birds of Conservation Concern. Section 3.6.2 (Affected Environment) provides detailed information on the baseline affected environment. Complete analysis and summary of potential impacts of the Proposed Action on birds are found in Sections 3.6.3 (Environmental Consequences) and 3.6.4 (Summary of Potential Impacts on Birds), respectively.

3.6.1.1 Endangered Species Act Species

Three bird species that occur in the Study Area are listed as endangered or threatened under the ESA, and one species is a candidate for ESA listing (U.S. Fish and Wildlife Service 2010b). One ESA species, the piping plover, has critical habitat that is described in greater detail in Section 3.6.2.6.1 (Status and Management). The ESA status, presence, and nesting occurrence of ESA-listed birds in the Study Area are listed in Table 3.6-1. These species are discussed further in Section 3.6.2 (Affected Environment).

3.6.1.2 Major Bird Groups

There are 10 major taxonomic groups of birds represented in the Study Area (Table 3.6-2). Birds may be found in the air, at the water's surface, or in the water column of the Study Area. The vertical distribution descriptions provided in Table 3.6-2 provide a representative description of the taxonomic group; however, due to variations in species behavior, these descriptions may not apply to all species within each group. Distribution in the water column is indicative of a species known to dive under the surface of the water (for example, during foraging). More detailed species descriptions, including diving behavior, are provided in Sections 3.6.2.9 (Geese, Swans, Dabbling, and Diving Ducks [Order Anseriformes]) through 3.6.2.18 (Neotropical Migrant Songbirds, Thrushes, Allies, Cuckoos, Swifts, and Owls [Orders Passeriformes, Cuculiformes, and Apodiformes]).

All 10 major taxonomic groups of birds in the Study Area occur in open ocean areas (Labrador Current, North Atlantic Gyre, Gulf Stream) or coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea), as shown in Table 3.6-2. Refer to Figure 3.0-1 for a map of open ocean areas and large marine ecosystems in the Study Area.

3.6.1.3 Migratory Bird Treaty Act Species

A variety of bird species would be encountered in the Study Area including those listed under the Migratory Bird Treaty Act (U.S. Fish and Wildlife Service 2010c). The Migratory Bird Treaty Act established federal responsibilities for protecting nearly all migratory species of birds, eggs, and nests. Bird migration is defined as the periodic seasonal movement of birds from one geographic region to another, typically coinciding with available food supplies or breeding seasons. Of the 1,007 species protected under the Migratory Bird Treaty Act, 184 occur in the Study Area. These species are not analyzed individually, but rather are grouped by taxonomic or behavioral similarities based on the stressor being analyzed. Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 Code of Federal of Regulations [C.F.R.] Part 21), the U.S. Fish and Wildlife Service promulgated a rule that permits the incidental take of migratory birds during Department of Defense (DoD) military readiness activities necessary for national defense (Section 3.0.1, Regulatory Framework). Conclusions of potential impacts on species protected under the Migratory Bird Treaty Act are presented in Section 3.6.4 (Summary of Potential Impacts on Birds).

Table 3.6-1: Endangered Species Act Status and Presence of Endangered Species Act–Listed and Candidate Bird Species in the Study Area

Species Name and Regulatory Status			Presence in the Study Area[1]		
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean Area**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Bermuda Petrel	*Pterodroma cahow*	Endangered	North Atlantic Gyre (nesting), Gulf Stream	Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf	None
Roseate Tern	*Sterna dougallii*	Endangered Threatened[2]	North Atlantic Gyre, Gulf Stream	Scotian Shelf (nesting), Northeast U.S. Continental Shelf (nesting), Southeast U.S. Continental Shelf, Gulf of Mexico (nesting), Caribbean Sea (nesting)	Sandy Hook Bay (Earle, NJ); Lower Chesapeake Bay (Hampton Roads, VA); Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); St. Andrew Bay (Panama City, FL); Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Piping Plover	*Charadrius melodus*	Threatened	None	Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	Sandy Hook Bay (Earle, NJ); Lower Chesapeake Bay (Hampton Roads, VA); Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); St. Mary's River Inlet (St. Mary's, GA); St. Johns River and Fort George River Inlets (Jacksonville, FL); St. Andrew Bay (Panama City, FL); Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Red Knot	*Calidris canutus rufa*	Candidate	North Atlantic Gyre, Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	Sandy Hook Bay (Earle, NJ); Lower Chesapeake Bay (Hampton Roads, VA); Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); St. Andrew Bay (Panama City, FL); Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)

Source: (U.S. Fish and Wildlife Service 2010b), for ESA Status.

Note: The abbreviations in the table are defined as follows—DE: Delaware; FL: Florida; GA: Georgia; NC: North Carolina; NJ: New Jersey; TX: Texas; U.S.: United States; VA: Virginia.

[1] Presence in the Study Area indicates open ocean areas (North Atlantic Gyre, Gulf Stream, and Labrador Current) and coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea) in which the species are found. Open ocean areas and coastal waters where breeding occurs are indicated as (nesting).

[2] The roseate tern is listed as endangered under the ESA along the Atlantic coast south to North Carolina, Canada (Newfoundland, Nova Scotia, Quebec), and Bermuda. It is listed as threatened under the ESA in the Western Hemisphere and adjacent oceans, including Florida, Puerto Rico, and the Virgin Islands.

Table 3.6-2: Major Groups of Birds in the Study Area

Major Bird Groups		Vertical Distribution in the Study Area		
Common Name (Taxonomic Group)	**Description**	**Open Ocean Areas**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Geese, Swans, Dabbling and Diving Ducks (Order Anseriformes)	Diverse group of geese, swans, and ducks that inhabit shallow waters, coastal areas, and deeper waters. Feed at the surface by dabbling or by diving in deeper water. Often occur in large flocks.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Loons (Order Gaviiformes)	Superficially duck-like, fish-eating birds that capture prey by diving and underwater pursuit.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Grebes (Order Podicipediformes)	Small diving birds, superficially duck-like. May occur in small groups.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Albatrosses, fulmars, Petrels, Shearwaters, and Storm-Petrels (Order Procellariiformes)	Group of largely pelagic seabirds. Fly nearly continuously when at sea. Soar low over the water surface to find prey. Some species dive below the surface.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Tropicbirds, Boobies, Gannets, Pelicans, Cormorants, and Frigatebirds (Order Pelecaniformes)	Diverse group of large, fish-eating seabirds with four toes joined by webbing. Often occur in large flocks near high concentrations of bait fish.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Herons, Egrets, Ibis, Spoonbill (Order Ciconiiformes)	Small- to medium-sized wading birds with dagger-like, down-curved, or spoon-shaped bills used to capture prey in water or mud.	None	Airborne, surface	Airborne, surface
Flamingos (Order Phoenicopteriformes)	Large, wading birds with unique angled bill to filter invertebrates from water or mud.	None	Airborne, surface	Airborne, surface
Osprey, Bald Eagles, Peregrine Falcons (Orders Accipitriformes, and Falconiformes)	Large raptors that inhabit habitats with open water, including coastal areas. Feed on fish, waterfowl, or other mammals. Migrate and forage over open water.	None	Airborne, surface	Airborne, surface
Shorebirds, Phalaropes, Gulls, Noddies, Terns, Skimmer, Skuas, Jaegers, and Alcids (Order Charadriiformes)	Diverse group of small- to medium-sized shorebirds, seabirds, and allies inhabiting coastal, nearshore, and open-ocean waters.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Neotropical Migrant Songbirds, Warblers, Thrushes, and Allies (Orders Passeriformes Cuculiformes, Strigiformes, and Apodiformes)	Largest and most diverse group of birds in North America, primarily occur in coastal, and inland areas, but often occur in large numbers over the open ocean (particularly over the Gulf of Mexico) during annual spring and fall migration periods.	Airborne	Airborne	Airborne

Sources: American Ornithologists' Union (1998), Sibley (2007), and Onley and Scofield (2007), for major bird taxonomic groups.

3.6.1.4 United States Fish and Wildlife Service Birds of Conservation Concern

Birds of Conservation Concern are species, subspecies, and populations of migratory and nonmigratory birds that the U.S. Fish and Wildlife Service determined to be the highest priority for conservation actions (U.S. Fish and Wildlife Service 2008). The purpose of the Birds of Conservation Concern list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions needed to conserve these species. Of the 184 species that occur within the Study Area, 54 are considered Birds of Conservation Concern (Table 3.6-3). These species are not analyzed individually, but rather are grouped by taxonomic or behavioral similarities based on the stressor being analyzed.

Table 3.6-3: Birds of Conservation Concern that Occur within the Study Area

Family/Subfamily	Common Name	Scientific Name
Order Gaviiformes		
Family Gaviidae		
	Common loon	*Gavia immer*
Order Podicipediformes		
Family Podicipedidae		
	Horned grebe	*Podiceps auritus*
	Pied billed grebe	*Podilymbus podiceps*
Order Procellariiformes		
Family Procellariidae		
	Audubon's shearwater	*Puffinus lherminieri*
	Black-capped petrel	*Pterodroma hasitata*
	Greater shearwater	*Puffinus gravis*
Family Hydrobatidae		
	Band-rumped storm petrel	*Oceanodroma castro*
Order Pelecaniformes		
Family Sulidae		
	Brown booby	*Sula leucogaster*
Family Phalacrocoracidae		
	Great cormorant	*Phalacrocorax carbo*
Family Frigatidae		
	Magnificent frigatebird	*Fregata magnificens*
Order Ciconiiformes		
Family Threskiornithidae		
	Roseate spoonbill	*Platalea ajaja*
Family Ardeidae		
	Reddish egret	*Egretta rufescens*
	Snowy egret	*Egretta thula*
Order Falconiformes		
Family Falconidae		
	Peregrine falcon	*Falco peregrinus*

Table 3.6-3: Birds of Conservation Concern that Occur within the Study Area (Continued)

Family/Subfamily	Common Name	Scientific Name
Order Accipitriformes		
Family Accipitridae		
Subfamily Accipitrinae	Bald eagle	*Haliaeetus leucocephalus*
	Swallow-tailed kite	*Elanoides forficatus*
Order Charadriiformes		
Family Charadriidae		
Subfamily Charadriinae	Snowy plover	*Charadrius alexandrinus*
	Wilson's plover	*Charadrius wilsonia*
Family Haematopodidae		
	American oystercatcher	*Haematopus palliatus*
Family Scolopacidae		
	Bar-tailed godwit	*Limosa lapponica*
	Dunlin	*Calidris alpina*
	Hudsonian godwit	*Limosa haemastica*
	Lesser yellowlegs	*Tringa flavipes*
	Marbled godwit	*Limosa fedoa*
	Purple sandpiper	*Calidris maritima*
	Red knot	*Calidris canutus*
	Semipalmated sandpiper	*Calidris pusilla*
	Short-billed dowitcher	*Limnodromus griseus*
	Solitary sandpiper	*Tringa solitaria*
	Whimbrel	*Numenius phaeopus*
Family Laridae		
	Arctic tern	*Sterna paradisaea*
	Black skimmer	*Rynchops niger*
	Gull-billed tern	*Gelochelidon nilotica*
	Least tern	*Sternula antillarum*
	Sandwich tern	*Thalasseus sandvicensis*
Order Passeriformes		
Family Tyrannidae		
	Olive-sided flycatcher	*Contopus cooperi*
Family Turdidae		
	Bicknell's thrush	*Catharus bicknelli*
	Wood thrush	*Hylocichla mustelina*
Family Parulidae		
	Bay-breasted warbler	*Dendroica castanea*
	Blue-winged warbler	*Vermivora pinus*
	Canada warbler	*Wilsonia canadensis*
	Cerulean warbler	*Dendroica cerulea*
	Golden-winged warbler	*Vermivora chrysoptera*
	Kentucky warbler	*Oporornis formosus*
	Prairie warbler	*Dendroica discolor*
	Prothonotary warbler	*Protonotaria citrea*

Table 3.6-3: Birds of Conservation Concern that Occur within the Study Area (Continued)

Family/Subfamily	Common Name	Scientific Name
	Swainson's warbler	*Limnothlypis swainsonii*
	Worm-eating warbler	*Helmitheros vermivorum*
Family Cardinalidae		
	Dickcissel	*Spiza americana*
	Painted bunting	*Passerina ciris*
Order Cuculiformes		
Family Cuculidae		
	Mangrove cuckoo	*Coccyzus minor*
	Yellow-billed cuckoo	*Coccyzus americanus*
Order Strigiformes		
Family Strigiformes		
	Short-eared owl	*Asio flammeus*
Order Apodiformes		
Family Apodidae		
	Black swift	*Cypseloides niger*

3.6.2 AFFECTED ENVIRONMENT

At least 184 bird species occur regularly within the Study Area year-round, seasonally, or during the migration seasons. A combination of short-distance migrants, long-distance migrants, and year-round resident bird species occur within the Study Area and range in size from large pelagic seabirds to small songbirds. Birds are distributed throughout the seven large marine ecosystems and three open ocean areas in coastal, nearshore, and open-ocean habitats of the Study Area. Typical bird behavior to be encountered within the Study Area would include breeding, foraging, roosting, and migration.

The Study Area includes portions of three major migration routes: the Atlantic Flyway, the Atlantic Ocean Flyway, and the Mississippi Flyway that overlap all of the large marine ecosystems detailed in Section 3.0.3.1 (Biogeographic Classifications). Many migratory birds fly close to the coastline of the Atlantic Flyway, although large numbers of birds, such as seaducks, shorebirds, and songbirds, follow the Atlantic Ocean Flyway further offshore (throughout this section, offshore refers to areas beyond the immediate nearshore coastal areas both within and outside of the continental shelf). Many neotropical migrants fly across the Gulf of Mexico at the southern end of the Mississippi Flyway (U.S. Geological Survey 2006).

Birds forage in a variety of habitats such as coastal wetlands, estuaries, kelp beds, lagoons, and in the intertidal zone, as well as nearshore (immediately adjacent to the coastline) in shallower waters, and on the open ocean where they catch prey near or at the ocean surface. When and where birds occur is highly dependent on environmental factors and life stage and varies with prey location and time of year. Due to the uneven distribution of prey within the marine environment, some seabirds must fly long distances to obtain food. Other species like neotropical migrants must fly across open water twice a year to reach their wintering or breeding grounds in the search for food (U.S. Geological Survey 2006).

Bird watching is a very common socioeconomic activity and certain groups have been instrumental in ensuring this pastime continues. Accordingly, Important Bird Areas that protect important breeding, roosting, and foraging habitat and concentrations of birds, including some threatened and endangered

species under the ESA, have been designated by the National Audubon Society (a nongovernmental organization). These Important Bird Areas are not protected by federal mandate but occur throughout the Study Area in coastal areas, on off-shore islands, and in some off-shore waters (National Audubon Society 2011). For example, some off-shore areas that support seabird concentrations include the Outer Continental Shelf Important Bird Area, which is within the U.S. Department of the Navy (Navy) Cherry Point Range Complex, and the Stellwagen Bank Important Bird Area, which is within the Boston Operating Area (OPAREA).

Sections 3.6.2.5 (Bermuda Petrel [*Pterodroma cahow*]) through 3.6.2.8 (Red Knot [*Calidris canutus rufa*]) describe ESA-listed species and -candidate species, and Sections 3.6.2.9 (Geese, Swans, Dabbling and Diving Ducks [Order Anseriformes]) through 3.6.2.18 (Neotropical Migrant Songbirds, Thrushes, Allies, Cuckoos, Swifts, and Owls [Orders Passeriformes, Cuculiformes, and Apodiformes]) describe species groups that occur in the Study Area. The emphasis on species-specific information is placed on the ESA-protected species because any threats or potential impacts on those species are subject to consultation with regulatory agencies. Consultation could also occur under the Bald and Golden Eagle Protection Act or the Migratory Bird Treaty Act. Additional information on the biology, life history, and conservation of bird species, including species-specific descriptions, is available from the websites of these sources:

- U.S. Fish and Wildlife Service Endangered Species Program
- Birdlife International
- International Union for Conservation of Nature and Natural Resources Red List of Threatened Species
- National Audubon Society

3.6.2.1 Group Size

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from solitary migration of an individual bird to large concentrations of mixed-species flocks. Depending on season, location, and time of day, the number of birds observed (group size) will vary and will likely fluctuate from year to year. During spring and fall periods, diurnal and nocturnal migrants would likely occur in large groups as they migrate over open water (Elphick 2007). Avian radar studies at sea show nocturnal migrants as well as seabirds moving across open oceans in large numbers (Desholm et al. 2006; Gauthreaux and Belser 2003). During the winter months, large groups of ducks (rafts) could be encountered. During the nesting and breeding season, pelagic seabirds could be encountered in large groups following the currents and upwellings in pursuit of prey (Sibley 2007). In the nearshore environments, terns, gulls, shorebirds, and plovers may occur in large groups while in their breeding and feeding areas.

Within the Study Area, species diversity of foraging seabirds is higher in the Caribbean Sea and lowest in the northern portion of the Study Area (Karpouzi et al. 2007). Though the northern temperate regions have low species diversity, seabird densities and the amount of prey consumed are greater, due to overall higher productivity of northern waters (Karpouzi et al. 2007). Species particularly abundant in the northwest Atlantic include breeding auks in west Greenland, breeding Leach's storm-petrels (*Oceanodroma leucorhoa*) and northern gannets (*Morus bassanus*) in Newfoundland, and nonbreeding shearwaters and sea ducks (Barrett et al. 2006). Most seabirds forage in offshore waters over the continental shelves of North America (Karpouzi et al. 2007).

Many species forage in large groups on shoaling fish or on concentrations of molluscs attached to the seafloor. Water temperatures, currents, upwellings, wind direction, and ocean floor topography can all

influence when, where, and how many seabirds forage (Elphick 2007; Fauchald et al. 2002; Spear and Ainley 1997).

3.6.2.2 Diving

Most of the seabird species found in the Study Area will dive, skim, or grasp prey at the water's surface or within the upper portion (1 to 2 meters [m] or 3 to 6 feet [ft.]) of the water column (Cook et al. 2011; Jiménez et al. 2012; Sibley 2007). Very few seabirds are deep divers, but one exception is the horned grebe, which can dive down to 500 ft. (151 m) (Ehrlich et al. 1988). Some of these species are aerial plunge divers in which they dive from above and make generally shallow dives into the water column after prey (e.g., terns, gannets). Others are considered surface divers where they plunge directly from the surface underwater after prey (e.g., puffins, loons). However, most diving species tend to catch the majority of their prey near the surface of the water column (Cook et al. 2011). More specific diving information in regard to species and taxonomic groups is provided in Sections 3.6.2.5 (Bermuda Petrel [*Pterodroma cahow*]) through 3.6.2.18 (Neotropical Migrant Songbirds, Thrushes, Allies, Cuckoos, Swifts, and Owls [Orders Passeriformes, Cuculiformes, and Apodiformes]).

3.6.2.3 Bird Hearing

Although hearing range and sensitivity has been measured for many land birds, little is known of seabird hearing. The majority of the published literature on bird hearing focuses on terrestrial birds and their ability to hear in air. A review of 32 terrestrial and marine species reveals that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (Beason 2004; Dooling 2002). Very few can hear below 20 hertz (Hz), most have an upper frequency hearing limit of 10 kHz, and none exhibit hearing at frequencies higher than 15 kHz (Dooling 2002; Dooling et al. 2000). Hearing capabilities have been studied for only a few seabirds (Beason 2004; Beuter et al. 1986; Thiessen 1958; Wever et al. 1969); these studies show that seabird hearing ranges and sensitivity are consistent with what is known about bird hearing in general.

There is little published literature on the hearing abilities of birds under water, and the manner in which birds may use sound under water is unclear (Dooling and Therrien 2012). In fact, there are no measurements of the underwater hearing ability of any diving birds (Therrien et al. 2011). Diving birds may not hear as well under water, compared to other (non-avian) terrestrial species, based on adaptations to protect their ears from pressure changes (Dooling and Therrien 2012). There are some studies of bird behavior underwater when exposed to sounds, from which some hearing abilities of birds underwater could be inferred. Common murres (*Uria aalge*) were deterred from gillnets by acoustic transmitters emitting 1.5 kHz pings at 120 decibels (dB) referenced (re) to 1 micro-pascal (µPa); however, there was no significant reduction in rhinoceros auklet (*Cerorhinca monocerata*) bycatch in the same nets (Melvin et al. 1999). In another study, firing of guns over water deterred African penguins (*Spheniscus demersus*) from an area, but playback of Orca (*Orcinus orca*) vocalizations did not (Cooper 1982).

3.6.2.4 General Threats

Threats to bird populations in the Study Area include human-caused stressors and natural-caused stressors. Specific Navy stressors that may impact birds are analyzed in more detail in Section 3.6.3 (Environmental Consequences).

In addition to the Navy stressors, human-caused threats include habitat loss and degradation due to development, lack of prey due to overfishing, death from entanglement in commercial fishing gear, light

pollution at sea, and ingestion of plastic litter due to pollution (North American Bird Conservation Initiative 2009; Onley and Scofield 2007; Waugh et al. 2012; Weimerskirch 2004). Beach-nesting birds are vulnerable to disturbance from people, pets, and off road vehicles that may inadvertently destroy or disturb nests (North American Bird Conservation Initiative 2009). The introduction of feral species (primarily cats and rats, occasionally pigs and cattle) and plants may destroy nesting colonies. Seabirds are especially vulnerable to feral species on islands where nests and populations have been devastated through predation or habitat destruction (Clavero et al. 2009; North American Bird Conservation Initiative 2009).

Lighting on boats and on offshore oil and gas platforms have also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel and Johansen 2011). Recent studies have looked at different lighting systems and how they may impact migrating songbirds (Poot et al. 2008). Oil spills pose a risk to seabirds and shorebirds through direct contamination and destruction of nesting, roosting, and foraging habitats (U.S. Environmental Protection Agency 1999). Natural causes of seabird and shorebird population declines include disease, storms, and harmful algal blooms, although human activities are also associated with harmful algal blooms (Jessup et al. 2009; North American Bird Conservation Initiative 2009, 2010; Onley and Scofield 2007). In addition, seabird distribution, abundance, breeding, and other behaviors are influenced by cyclical environmental events such as El Niño Southern Oscillation (Congdon et al. 2007).

An estimated 39 percent of seabirds that depend on ocean habitats are declining (North American Bird Conservation Initiative 2009). In the long term, global climate change could be the greatest threat to seabirds (North American Bird Conservation Initiative 2010). Climate change impacts include changes in air and sea temperatures, precipitation, the frequency and intensity of storms, and sea level. These changes could impact overall marine productivity, which could in turn have an impact on the food resources, distribution, and reproductive success of seabirds (Aebischer et al. 1990; Congdon et al. 2007; Davoren et al. 2012). Open-ocean species, such as petrels and tropicbirds, are vulnerable to climate change due to their low reproductive rates, their use of islands for nesting, and their reliance on a highly variable marine system (North American Bird Conservation Initiative 2010). Coastal birds are vulnerable to climate change due to rising sea levels, which are expected to impact foraging and nesting habitat quality and quantity by flooding or fragmenting habitats such as barrier islands, beaches, and mudflats (North American Bird Conservation Initiative 2010).

From April to September, 2010, the BP *Deepwater Horizon* off-shore oil platform spilled an estimated 200 million gallons (gal.) (757 million liters [L]) of oil into the Gulf of Mexico (Cornell Lab of Ornithology 2010; U.S. Department of the Interior 2010b). Effects on birds include direct impacts from physical contact, ingestion, inhalation, and absorption of oil; and indirect impacts of oil on long-term reproductive success, and habitat destruction (Mearns et al. 2011; U.S. Department of the Interior 2010b). When oil comes in contact with feathers, their buoyancy and insulating properties are lost, impacting a bird's ability to fly, dive, or float on the water which results in the risk of drowning or freezing to death (Montevecchi et al. 2012). Birds may ingest oil while preening (grooming), which can result in immediate or delayed death due to organ damage. Also, eggs may be damaged when oiled adults sit on nests. Approximately 1.8 million gal. (681 million L) of oil dispersants were used during the *Deepwater Horizon* spill. Dispersants break up large surface oil slicks into small balls that gather and sink deeper in the water column, where they are generally unavailable to foraging birds. The impacts of dispersants on birds are mostly unknown, although dispersant chemicals are less toxic than crude oil (Cornell Lab of Ornithology 2010).

The U.S. gulf coast supports important habitat essential for breeding, wintering, and migratory birds, particularly beach-nesting birds (U.S. Department of the Interior 2010a). The U.S. Fish and Wildlife Service has been monitoring the oil spill's impacts on birds through response and reporting activities (U.S. Department of the Interior 2010d, 2011). Wildlife rescue and collection reports include totals for live and dead birds with visible oiling, no visible oiling, and unknown oiling status. The most current available bird impact report dated 12 May 2011 identified 7,258 birds, covering 132 species, as recovered or rescued; 17 of these species are included in Table 3.6-3. Species with the highest number of impacts were laughing gulls (*Larus atricilla*) (2,981 total impacted birds; 2,719 dead birds), brown pelicans (*Pelecanus occidentalis*) (826 total impacted birds; 546 dead), northern gannets (*Morus bassanus*) (475 total impacted birds; 354 dead), and royal terns (*Sterna maxima*) (289 total impacted birds; 239 dead)(U.S. Department of the Interior 2011).

These numbers represent only a portion of the total birds impacted by the spill (U.S. Department of the Interior 2010e). ESA-listed birds within the Study Area that may be impacted by the oil spill are the roseate terns (*Sterna dougallii*) and piping plovers (*Charadrius melodus*) (U.S. Department of the Interior 2010c). In the 3 November 2010 bird impact report, the U.S. Fish and Wildlife Service reported 110 least terns (*Sternula antillarum*) (98 dead) recovered or rescued (U.S. Department of the Interior 2010e). The areas with the highest concentration of impacted birds (live and dead oiled birds) include coastal and off-shore Louisiana, Mississippi, Alabama, and the Florida panhandle (National Oceanic and Atmospheric Administration 2010). Additional bird impact observation areas include the west coast of Florida, Florida Keys, Texas, and off-shore waters in the vicinity of the oil platform (National Oceanic and Atmospheric Administration 2010). The discussion above represents general threats to birds. Additional threats to individual species within the Study Area are described below in the accounts of those species.

3.6.2.5 Bermuda Petrel (*Pterodroma cahow*)

3.6.2.5.1 Status and Management

The U.S. Fish and Wildlife Service listed the Bermuda petrel as endangered under the ESA in the year 1970. There is no designated critical habitat for this seabird species. This extremely rare seabird nests only on Bermuda in the Atlantic Ocean (White 2004). The Bermuda petrel was thought to be extinct for about three decades until its existence was confirmed in the mid-1900s. In the year 1951, 18 pairs of the Bermuda petrel (commonly referred to as "cahow") were rediscovered breeding on a group of four rocky islets in Castle Harbor, Bermuda. An intensive recovery and management program followed, which included removing predators, such as rats (Murphy and Mowbray 1951), and adapting nest burrow entrances with baffles and artificial burrows to prevent nest site competition with the white-tailed tropicbird (*Phaethon lepturus*) (BirdLife International 2010a; Murphy and Mowbray 1951). Efforts to establish a new breeding colony in the higher areas of Nonsuch Island Nature Reserve have been slow but promising (BirdLife International 2010a; Dobson and Madeiros 2009). There were approximately 250 individuals with 71 breeding pairs in the year 2005 and 96 breeding pairs recorded in the year 2009 (Dobson and Madeiros 2009).

3.6.2.5.2 Habitat and Geographic Range

The petrel is a pelagic species and spends most of its life at sea, except during the breeding season from January to June where it comes ashore to breed. Breeding occurs outside the Study Area, exclusively in Bermuda on four small islets off Nonsuch Island in the North Atlantic Gyre (National Audubon Society 2005). Available islet nesting habitat is limited to 2.4 acres (ac.) (0.97 hectares [ha]), which is occupied by a varying number of breeding pairs each year (BirdLife International 2008). During the breeding season, the Bermuda petrel arrives and leaves the island only at night to avoid predation (Wurster and

Wingate 1968). During the breeding season, the Bermuda petrel nests in colonies, but is otherwise solitary (Onley and Scofield 2007). Due to its solitary behavior they are unlikely to approach ships (Enticott and Tipling 1997; Onley and Scofield 2007). More specific nest density or colony size information was not found.

Open Ocean Areas. In the nonbreeding season (June–December) (Brooke 2004), the species migrates from the breeding grounds in Bermuda to foraging routes over much of the Atlantic Ocean, including waters of the North Atlantic Gyre and the Gulf Stream (includes off-shelf portions of the Virginia Capes [VACAPES] and Navy Cherry Point Range Complexes) (Lee and Mackin 2008; National Audubon Society 2005; Onley and Scofield 2007). However, dispersal and at-sea distribution are generally poorly known (Brooke 2004; Onley and Scofield 2007). One additional migration route was recorded into the northwest Atlantic, off the coast of southwestern Ireland (Dobson and Madeiros 2009).

Southeast U.S. Continental Shelf Large Marine Ecosystem. First reported off North Carolina's Outer Banks in April 1983 (Lee 1987), today the species regularly occurs off the North Carolina coast (National Audubon Society 2005; White 2004).

Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems. Recent data recorded during the nonbreeding season documented western routes to the Gulf Stream and northern movements to the Bay of Fundy, into the Gulf of St. Lawrence, and over the Grand Banks. An additional route was recorded off the coast of southwestern Ireland (Dobson and Madeiros 2009).

3.6.2.5.3 Population and Abundance

This extremely rare seabird is slowly but steadily increasing: 18 pairs were recorded in the year 1951; 70 pairs raising 40 young were recorded in the year 2003; and 71 pairs raising 35 young were recorded in the year 2005 (International Union for Conservation of Nature and Natural Resources 2010). The reproductive output between 2000 to 2001 and 2007 to 2008 ranged from 29 to 40 fledglings per year (Madeiros et al. 2012). Conservation efforts continue and the species is recovering in number, with the population estimated at 250 (International Union for Conservation of Nature and Natural Resources 2010). This estimate is based on 71 breeding pairs and does not include the most current December 2009 report of 96 confirmed pairs (Dobson and Madeiros 2009); 93 of these pairs fledged 52 young in the year 2010 (Dobson 2010).

3.6.2.5.4 Predator and Prey Interactions

Bermuda petrels feed mostly on squid, but their diet also consists of shrimp and small fish (National Audubon Society 2005). Specific information on the feeding behavior of Bermuda petrels is lacking, but petrels of the genus *Pterodroma* land on the ocean surface where they scavenge or grab prey; they also feed on the wing (while flying), where they are able to catch flying fish (Onley and Scofield 2007).

3.6.2.5.5 Species-Specific Threats

Current threats to this species include habitat loss; competition for nest sites with the white-tailed tropicbird (Dobson and Madeiros 2009); egg failure from contaminants (Brooke 2004; Wurster and Wingate 1968); light pollution from a nearby Bermuda airport; sea level rise; and increasing frequency and magnitude of tropical storms and hurricanes, which destroy nests through erosion, wave damage, and flooding (BirdLife International 2008, 2010a; Dobson and Madeiros 2009; Madeiros et al. 2012).

3.6.2.6 Piping Plover (*Charadrius melodus*)

The piping plover (*Charadrius melodus*) is divided into two subspecies of plovers. The piping plovers that breed on the Atlantic coast of the United States and Canada belong to the Atlantic subspecies *Charadrius melodus melodus* (U.S. Fish and Wildlife Service 2009b) and occur within the Study Area.

3.6.2.6.1 Status and Management

The U.S. Fish and Wildlife Service listed the Atlantic Coast piping plover population as threatened under the ESA in the year 1985 and has instituted a recovery plan for this shorebird species (U.S. Fish and Wildlife Service 1996). In the years 2001 and 2002, critical habitat was designated for the Great Lakes breeding population, Northern Great Plains breeding population, and for piping plovers from all three breeding populations while on the wintering grounds. Critical habitat for wintering plovers has been designated in coastal areas near or within the Study Area as shown in Figure 3.6-1 and Figure 3.6-2.

The U.S. Fish and Wildlife Service designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for wintering populations. This critical habitat includes 1,798.3 miles (mi.) (2,891.7 kilometers [km]) of mapped shoreline and 165,211 ac. (66,881 ha) of mapped area along the gulf and Atlantic coasts and along interior bays, inlets, and lagoons (Federal Register [FR] 66 (132): 36038-36086, July 10, 2001). The primary constituent elements of wintering piping plover habitats are those essential to foraging, sheltering, and roosting and are found in coastal areas containing intertidal beaches and flats and dunes above the annual mean high tide (FR 66 (132): 36038-36086, July 10, 2001). Any critical habitat located above the mean high tide line is outside the Study Area, as described in Section 3.0.3 (Ecological Characterization of the Study Area).

The 2004 National Defense Authorization Act allows military installations to be excluded from critical habitat designation for endangered species under the ESA provided that the Integrated Natural Resource Management Plan affords (1) a benefit to the species; (2) certainty that the management plan will be implemented; and (3) certainty that the conservation effort will be effective. On some Navy installations where piping plovers breed or overwinter, the Navy is exempt from critical habitat designations.

3.6.2.6.2 Habitat and Geographic Range

In the Study Area, the Atlantic breeding population of piping plovers nest and breed on coastal beaches from southern Maine to North Carolina and are primarily an inhabitant of sandy shorelines in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems (Haig and Elliott-Smith 2004; O'Brien et al. 2006). Piping plovers nest above the mean high tide line (outside the Study Area) on coastal beaches, sand flats at the ends of sandpits and barrier islands, gently sloping foredunes (dunes parallel to the shoreline), blowout areas behind primary dunes, and washover areas cut into or between dunes (U.S. Fish and Wildlife Service 1996). Individuals migrate through and winter in coastal areas of the United States from North Carolina to Texas and portions of Yucatan in Mexico and the Caribbean (U.S. Fish and Wildlife Service 2009a). In winter, the species is only found in coastal areas using a wide variety of habitats, including mudflats and dredge spoil areas and, most commonly, sandflats (Gratto-Trevor et al. 2012; O'Brien et al. 2006). Plovers appear to prefer sandflats adjacent to inlets or passes, sandy mudflats along spits (beaches formed by currents), and overwash areas as foraging habitats. Piping plover migration routes habitats and habitats overlap breeding and wintering habitats.

Southeast U.S. Continental Shelf Large Marine Ecosystem. Band recovery results from birds banded during the breeding season indicate that most Atlantic coast breeders winter along the southern Atlantic coast from North Carolina to Florida, although some birds have been reported to winter in Texas (Haig and Elliott-Smith 2004). Evidence suggests that most of the Great Lakes population winters south along the Atlantic coast. Both spring and fall migration routes are believed to follow the Atlantic coast (Haig and Elliott-Smith 2004).

Gulf of Mexico Large Marine Ecosystem. Evidence suggests that most of the threatened Northern Plains population winters on the gulf coast (Haig and Elliott-Smith 2004).

Caribbean Sea Large Marine Ecosystem. Islands in the Caribbean, the Bahamas and West Indies, serve as important wintering habitat (U.S. Geological Survey 2007).

3.6.2.6.3 Population and Abundance

The 1991 international census documented 5,482 total piping plover (Haig and Elliott-Smith 2004). The 2001 total population estimate was 5,945 total birds (Haig and Elliott-Smith 2004). Coastal Atlantic United States populations have trended upward since listing, though some areas' breeding populations are remaining at depressed levels and showing little or no increase in size. Since its 1985 listing, the Atlantic Coast population estimate has increased from 790 pairs to an estimated 1,849 pairs in the year 2008, and the United States portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,596 pairs (U.S. Fish and Wildlife Service 2009a). Between 1989 and 2008, the largest population increase occurred in New England (245 percent), followed by New York–New Jersey (74 percent). Overall population growth was tempered by rapid declines in the Southern and Eastern Canada recovery units; the eastern Canada population decreased 21 percent (2002–2005), and the population in the southern half of the Southern recovery unit declined 68 percent (1995–2001) (U.S. Fish and Wildlife Service 2009a). Also, the Maine population declined 64 percent, from 66 pairs in the year 2002 to 24 pairs in 2008, mostly due to loss of habitat from spring storms and dune stabilization projects. Results of the 2006 international piping plover winter census showed a total of 3,355 piping plovers in the United States, with the highest counts occurring in Texas (U.S. Fish and Wildlife Service 2009a). Though the increased abundance of the Atlantic Coast plovers has reduced near-term extinction threats, geographic variation in population growth and sensitivity to survival and productivity are cause for continuing conservation concern (U.S. Fish and Wildlife Service 2009b).

3.6.2.6.4 Predator and Prey Interactions

Feeding habitats of breeding piping plovers include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wrack lines (line of deposited seaweed on the beach), shorelines of coastal ponds, lagoons, and salt marshes (Gratto-Trevor et al. 2012; U.S. Fish and Wildlife Service 1996). They hunt visually using a start-and-stop running method, gleaning and probing prey from the substrate for a variety of small invertebrates (marine worms, crustaceans, molluscs, insects, and the eggs and larvae of many marine invertebrates) (Maslo et al. 2012; U.S. Fish and Wildlife Service 1996). Foraging occurs throughout the day and at night.

Piping plovers are preyed upon by various species. These predators, such as raccoons, foxes, skunks, and domestic and feral cats, are often associated with developed beaches and have been identified as a substantial source of mortality for piping plover eggs and chicks (U.S. Fish and Wildlife Service 2009b; Winter and Wallace 2006).

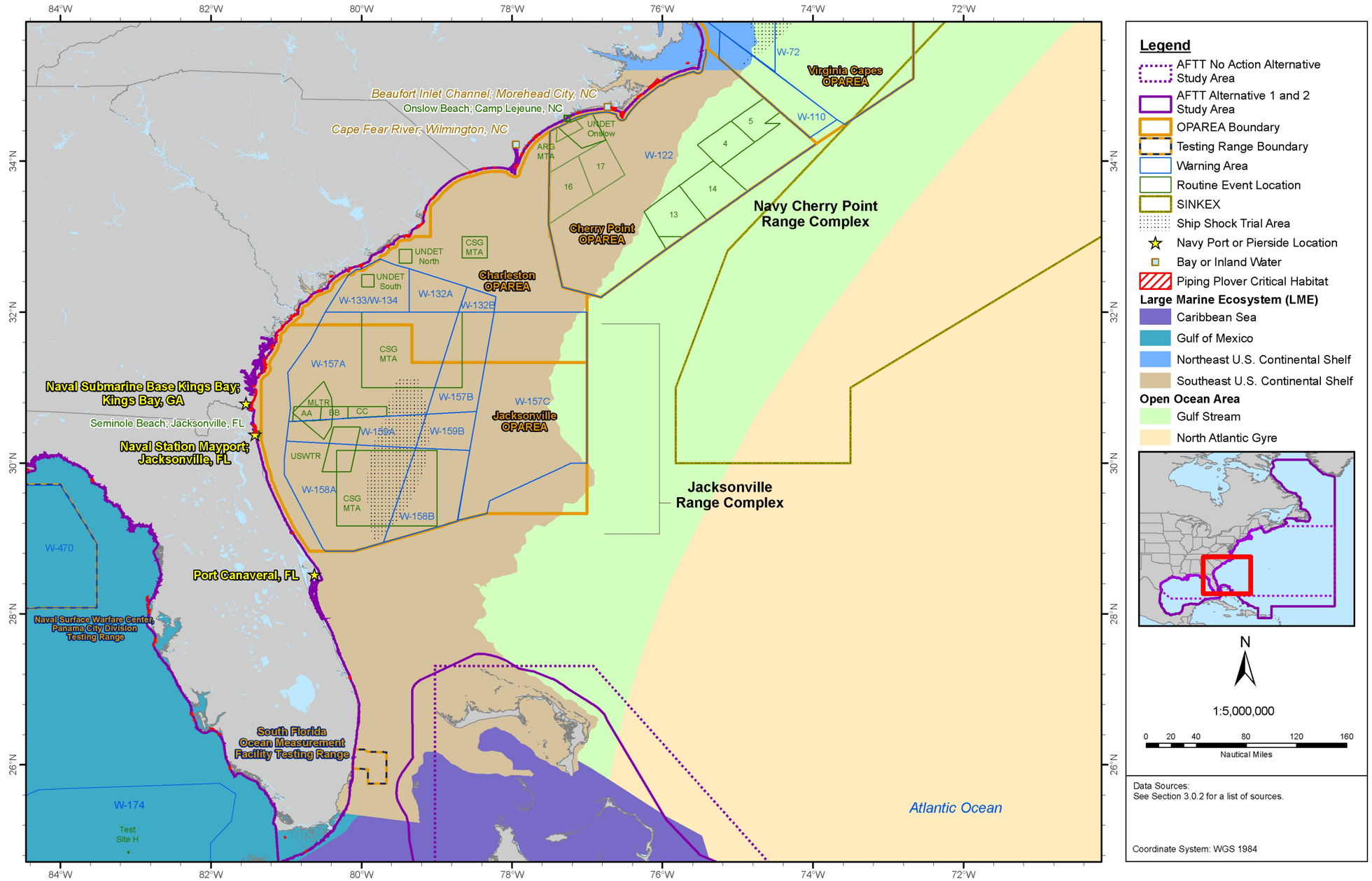

Figure 3.6-1: Critical Habitat Areas for Piping Plover in and Adjacent to the Atlantic Coastal Portions of the Study Area

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; NC: North Carolina; OPAREA: Operating Area; SINKEX: Sinking Exercise; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

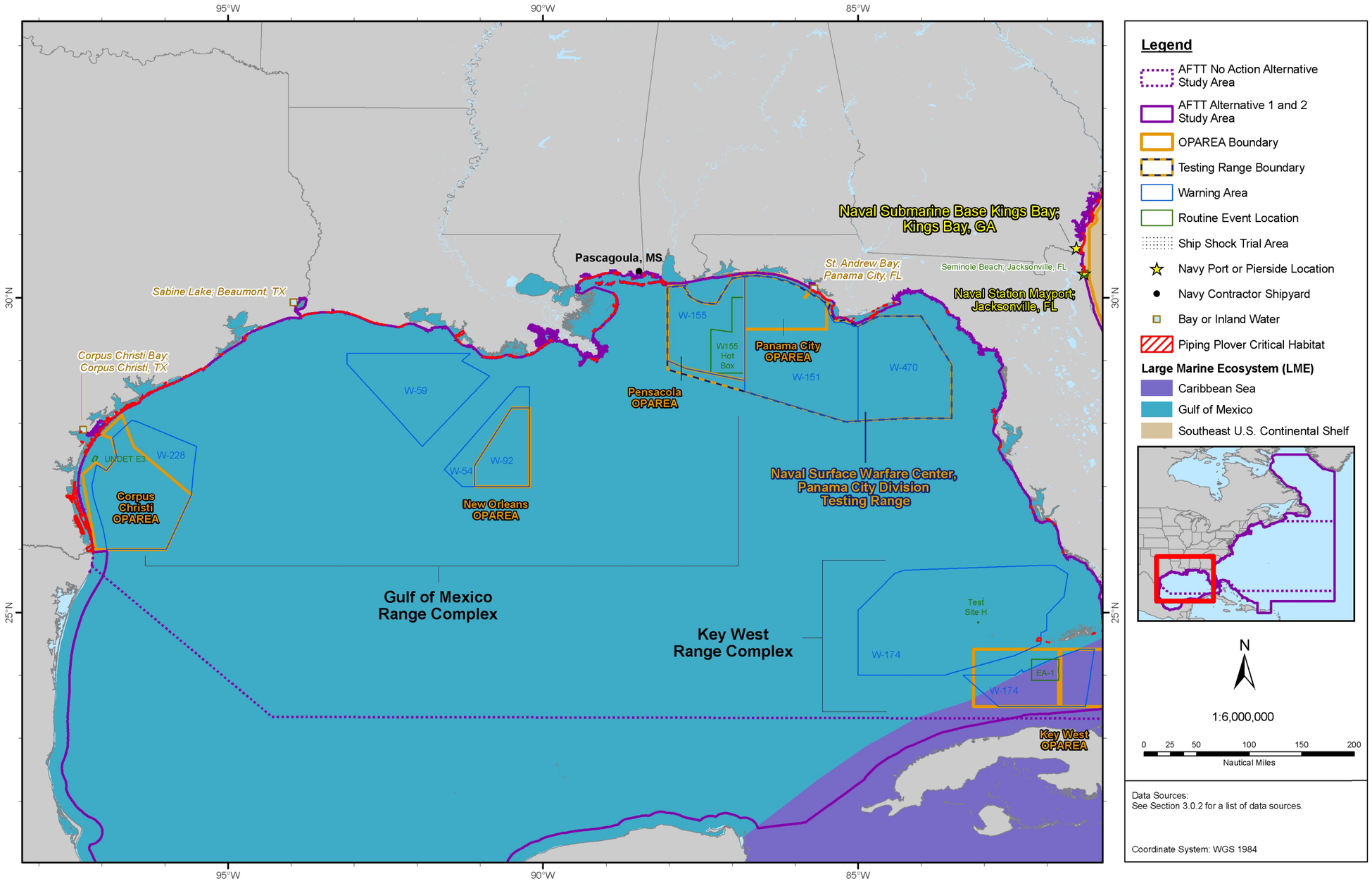

Figure 3.6-2: Critical Habitat Areas for Piping Plover in and Adjacent to the Gulf of Mexico Coastal Portions of the Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; MS: Mississippi; OPAREA: Operating Area; TX: Texas; UNDET: Underwater Detonation

3.6.2.6.5 Species-Specific Threats

The localized declines of the Atlantic coast piping plover population is attributed to habitat loss and degradation and increased predator populations in coastal environments (U.S. Fish and Wildlife Service 1996). Excessive disturbance may cause the parents to flee the nest, exposing eggs or chicks to the hot sun or predators. High disturbance levels around nest sites can also result in the abandonment of nests and, ultimately, decreased breeding success (Cohen and Gratto-Trevor 2011). Causing parents or juveniles to flush while foraging may stress juveniles enough to negatively influence critical growth and development. Few areas used by wintering piping plovers are free of human disturbance, and nearly 50 percent have leashed and unleashed dog presence (U.S. Fish and Wildlife Service 2009b).

Along the Atlantic coast, commercial, residential, and recreational development have decreased the amount of coastal habitat available for piping plovers. Trends show continued loss and degradation of habitat in migration and wintering areas due to sand placement projects, inlet stabilization, sand mining, erosion prevention structures (groins, seawalls, and revetments, exotic and invasive vegetation, and wrack removal (U.S. Fish and Wildlife Service 2009b). Unusual events, such as hurricanes, can impact hundreds of young-of-the-year and adults. Storms can also, over time, positively impact local piping plover populations by leveling dunes and creating suitable nesting habitat (U.S. Fish and Wildlife Service 1996). Beach development and stabilization activities, dredging, recreational activities, and pollution are factors that impact the plover population on wintering grounds (U.S. Fish and Wildlife Service 1996). There are also unknown sources of mortality experienced during migration or on the wintering grounds (Calvert et al. 2006; Root et al. 1992). Recent data suggest that lighting on vessels and on offshore oil and gas platforms may cause mortality and could help explain some of these unknown mortality events (Merkel and Johansen 2011). New potential threats include wind turbine development projects which introduce the possibility of collision, disturbance, and displacement of plovers (Burger et al. 2011). Another threat is climate change resulting in sea level rise that would directly impact Atlantic coast piping plovers breeding and wintering habitat (U.S. Fish and Wildlife Service 2009b).

3.6.2.7 Roseate Tern (*Sterna dougallii*)

Five subspecies of the roseate tern have been described, though some taxonomic designations are uncertain: *S. dougallii dougallii* in the North Atlantic, Europe, and the Caribbean; *S. dougallii korustes* in India, Sri Lanka, and Burma; *S. dougallii gracilis* in Australia and Indonesia; and *S. dougallii arideensis* on the Seychelles Islands (Gochfeld et al. 1998). All subspecies are similar in appearance to *S. dougallii dougallii*, with slight differences in wing length and bill color. The North Atlantic and Caribbean population of *S. dougallii dougallii* is the subspecies that occurs within the Study Area (U.S. Fish and Wildlife Service 2010a).

3.6.2.7.1 Status and Management

In the year 1987, the U.S. Fish and Wildlife Service listed the roseate tern as endangered under the ESA along the Atlantic coast of the United States (Maine to North Carolina); in Canadian provinces of Newfoundland, Nova Scotia, and Quebec, as well as in Bermuda (U.S. Fish and Wildlife Service 2010e). The species is listed as threatened under the ESA in the Western Hemisphere, including Florida, Puerto Rico, and the Virgin Islands (U.S. Fish and Wildlife Service 2010e). No critical habitat has been designated for this species in the United States. In the year 2006, Canada designated critical habitat for the species (U.S. Fish and Wildlife Service 2010a). Recovery and management plans have been implemented to protect breeding colonies, foraging areas, and wintering grounds (Gochfeld et al. 1998). The plans intend to increase breeding population size, distribution, and productivity by maintaining, expanding, and enhancing nesting habitat (U.S. Fish and Wildlife Service 1998). Recovery and management methods

include posting nesting areas with signs and fencing, discouraging and controlling competing gull species, managing vegetation to enhance nesting habitat, and attempting to attract individuals to historically occupied sites (U.S. Fish and Wildlife Service 1998).

3.6.2.7.2 Habitat and Geographic Range

Roseate terns arrive at their breeding grounds in late April and early May (early to mid-May in the Caribbean population) and spend approximately 2 weeks feeding before they occupy nesting grounds (U.S. Fish and Wildlife Service 1998). They migrate in late August and early September, traveling in groups to wintering grounds along the northern and eastern South American coast (Gochfeld et al. 1998; Kirkham and Nettleship 1987; U.S. Fish and Wildlife Service 1998). Their migration route is believed to traverse directly south across the western North Atlantic (U.S. Fish and Wildlife Service 1998). Local commutes of up to 16 mi. (25 km) from nesting grounds to dependable foraging sites have been documented (Nisbet and Spendelow 1999).

There is little information on migration and winter habitat for the roseate tern (Nisbet and Spendelow 1999; U.S. Fish and Wildlife Service 1993). Caribbean roseate terns may mingle with the northeastern birds in South American waters during the winter (U.S. Fish and Wildlife Service 1993).

Roseate terns are colonial breeders, and both the North Atlantic and Caribbean populations are known to nest on a limited number of small islands off New York and Massachusetts (Gochfeld et al. 1998). They nest on islands near or under cover, such as vegetation, rocks, driftwood, and even human-made objects. They have also been documented nesting on sand dunes found at the end of barrier beaches (U.S. Fish and Wildlife Service 1998). North American roseate terns use moderately to heavily vegetated sites for nesting (Burger and Gochfeld 1988). Unlike the northeastern population, Caribbean roseate tern nests are exposed. Nests are near vegetation or rocks, on open sandy beaches, narrow rock ledges close to the water line, or among coral rubble (U.S. Fish and Wildlife Service 1993).

Open Ocean. Within the Study Area, North American roseate terns occur throughout the open ocean (Gulf Stream and North Atlantic Gyre) more often during the winter than during the breeding season (U.S. Fish and Wildlife Service 1999).

Northeast U.S. Continental Shelf Large Marine Ecosystem. Most breeding North American roseate terns occur in this large marine ecosystem from late April/early May to late August/early September (Table 3.6-1). Approximately 80 percent of the northeast population breeds at two large colonies on Great Gull Island, New York; and Bird Island, Massachusetts; with the remaining percentage breeding at 15–20 smaller colonies in Canada and the United States (Connecticut, Massachusetts, Maine, and New York) (Gochfeld et al. 1998). Sand flats and beaches of southeastern Massachusetts, particularly along outer Cape Cod and nearshore islands provide important roosting and loafing habitats during fall staging. The Nantucket Shoal between the Massachusetts mainland and the islands of Martha's Vineyard and Nantucket is a particularly important foraging area for the entire northeastern population (U.S. Fish and Wildlife Service 2010a).

Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea Large Marine Ecosystems. Wintering North American roseate terns occur along the southeast Atlantic and gulf coasts (U.S. Fish and Wildlife Service 2010e). The Caribbean population of roseate tern breeds from the Florida Keys through the West Indies to islands off Central America and northern South America (U.S. Fish and Wildlife Service 1993). Within the Study Area, the Gulf of Mexico and Caribbean Sea Large Marine Ecosystems contain the population in the Florida Keys and Dry Tortugas, and Puerto Rico.

3.6.2.7.3 Population and Abundance

The estimated global population of roseate terns is approximately 70,000 to 82,000 (BirdLife International 2010b). They are a widespread species that breed on every continent except Antarctica, with populations in the Indian Ocean, Caribbean, Australasian, European, African, and North American regions (Gochfeld 1983). The roseate tern populations in North America and the Caribbean are estimated at around 10,000 pairs (Gochfeld 1983). Approximately 2,500 pairs are estimated in the northeast U.S. population, with an additional 125 pairs in Canada and 350 pairs in Florida, which is a reduction of almost 25 percent since the year 2000 (U.S. Fish and Wildlife Service 2010a). The roseate tern experienced drastic declines in the late nineteenth century due to commercial hunting of feathers for the millinery (hat-making) industry (U.S. Fish and Wildlife Service 1998), as well as humans seeking eggs for food (Kirkham and Nettleship 1987). Populations again showed decline in the 1940s and 1970s as the geographic range and the number of breeding colonies decreased (U.S. Fish and Wildlife Service 1998).

Groups of roseate terns can be small due to their limited population size and limited nesting habitat in North America. In the northeast, breeding colonies of roseate terns range from 2 to more than 1,000 pairs, depending on breeding colony location (U.S. Fish and Wildlife Service 1998). After chicks fledge from their breeding colonies, terns tend to congregate in large numbers at post-breeding staging areas to build up energy reserves for their seasonal fall migration to South America (U.S. Fish and Wildlife Service 2010a). Northeastern roseate terns are always mixed with gulls and other species of terns, while populations in the Caribbean and the Seychelles Islands are known to form single-species colonies (Gochfeld et al. 1998). Duffy (1986) found that roseate terns foraging in smaller flocks experienced higher survival rates, while in larger groups they were often out-competed by common terns.

3.6.2.7.4 Predator and Prey Interactions

The roseate tern is a coastal species that forages for small schooling fishes over shallow waters around bays, channels, sandbars, shoals, and reefs (Gochfeld et al. 1998; Nisbet and Spendelow 1999). They are also known to forage out over deeper waters than other tern species (Olsen and Larsson 1995). Roseate terns generally concentrate in areas where prey is available close to the surface, driven there either by water movements or larger predatory fish.

Roseate terns are specialized aerial plunge-divers that often completely submerge themselves when seizing fish (U.S. Fish and Wildlife Service 2010e). Roseate terns tend to plunge from heights above the water's surface ranging from 3 to 20 ft. (1 to 6 m), although plunges from greater than 39 ft. (12 m) have been observed (Gochfeld et al. 1998). Roseate terns do not plunge deep into the water column, usually up to 3 ft. (1 m). Roseate terns will often fly into the wind and hover (a behavior known as "kiting") with rapid wingbeats and then, with accelerated flapping, aerial plunge into the water (Kaufman 1990; U.S. Fish and Wildlife Service 1998, 1999). Prey species are herring, mackerel, anchovies, and sand eels (Gochfeld et al. 1998).

Roseate tern eggs and young are preyed upon by hermit and land crabs, ants, snakes, other birds (e.g., hawks, owls, gulls, and some shorebirds), and mammals such as rats and feral cats (U.S. Fish and Wildlife Service 1993).

3.6.2.7.5 Species-Specific Threats

Roseate tern population declines have been attributed to commercial hunting and egg collection, habitat loss and disturbance, organochlorine contamination, predation, and competition from gulls (U.S. Fish and Wildlife Service 1998). These threats, combined with the small number of breeding sites used by the species, warranted the listing of the species (Nisbet and Spendelow 1999). Roseate terns are sensitive to disturbance on their nesting grounds, and many suitable nesting sites have been lost or abandoned due to the expansion of recreational, residential, and commercial use (Gochfeld 1983). Beach erosion and the expansion of gull populations have also displaced roseate terns from suitable nesting habitat (Gochfeld et al. 1998). Roseate terns are vulnerable to predation and flooding because they nest on the ground, often in low-lying areas (Gochfeld 1983). Storms and prolonged periods of cold, wet weather also impact nest success (U.S. Fish and Wildlife Service 1993). Climate change and sea level rise may exacerbate erosion of nesting grounds and could result in more severe or more frequent storms, which could disturb these habitats and result in reduced survival of adults, eggs, chicks, and fledglings (U.S. Fish and Wildlife Service 2010a). Starvation is likely a greater cause of death during the winter in areas such as the southern Caribbean where nutrients are relatively poor (Gochfeld 1983). Although little is known about roseate tern ecology during migration and wintering periods, one major cause of death is believed to be humans hunting this species on its wintering grounds (outside the United States) (Gochfeld et al. 1998). Emerging potential threats include wind turbine development projects which introduce the possibility of collision, disturbance, and displacement of this species during the breeding and migratory seasons (Burger et al. 2011).

3.6.2.8 Red Knot (*Calidris canutus rufa*)

Red knots (*Calidris canutus*) found on the Atlantic coast of the United States and Canada belong to the subspecies *C. canutus rufa* (Harrington 2001). This subspecies of red knot was designated as a candidate species for listing under the ESA 2006 (Niles et al. 2008); as of 2012 the species was considered for proposed listing by the U.S. Fish and Wildlife Service (FR 77 (225): 69994-70060, November 21, 2012).

3.6.2.8.1 Status and Management

Four petitions to emergency list the red knot have been submitted since 2004; however, the species currently remains listed as a candidate for protection under the ESA (U.S. Fish and Wildlife Service 2010d). A candidate species is one in which there is sufficient information to make a listing, but the listing is precluded by higher priorities. Although candidate species do not receive statutory protection under the ESA, conservation partnerships are encouraged because the species may be listed in the future (U.S. Fish and Wildlife Service 2002). Based on a recommendation from the U.S. Fish and Wildlife Service to include the candidate red knot in the current consultation and because a listing determination on the red knot is anticipated in the near future, the Navy has made an effect determination for this species as if it was already listed under the ESA (FR 77 (225): 69994-70060, November 21, 2012). The five-year goal highlighted in the species action plan is to stabilize and improve the conservation status of the species through increasing habitat protection, reducing disturbance, and protecting key resources at migration and wintering sites (Harrington 2001; U.S. Fish and Wildlife Service 2010d). The Western Hemisphere Shorebird Reserve Network has established an international network of wetlands in an effort to protect important sites used by shorebirds, including the red knot (Tsipoura and Burger 1999).

3.6.2.8.2 Habitat and Geographic Range

The species breeds on the central Canadian arctic tundra but migrates down and winters along the Atlantic and gulf coasts from southern New England to Florida, and as far south as South America (Harrington 2001). Red knots will briefly use important stopover areas such as the Delaware Bay to

forage before returning to their breeding grounds each year. An interior red knot population winters in Texas and Louisiana and migrates through the west and midwest to central Canada.

Open Ocean Areas. Red knots migrate some of the longest distances known for birds, with many individuals annually flying more than 9,300 mi. (15,000 km) (U.S. Fish and Wildlife Service 2005), during which they may cross over each of the open ocean areas in the Study Area. However, outside of migration they are typically found in nearshore habitats along coastlines. Fall migration peaks in August with birds flying south along the Atlantic coast to major wintering grounds on the coasts of Argentina and southern Chile (Harrington 2001).

Northeast U.S. Continental Shelf Large Marine Ecosystem. During migration stopovers, the red knot uses marine habitats and generally prefers coastal, sandy habitats near tidal bays, inlets, and estuaries for foraging (Harrington 2001). Red knots migrate in large flocks and stop over at the same coastal sites along the Atlantic coast during spring migration to feed on eggs of horseshoe crabs (*Limulus polyphemus*). In particular, Delaware Bay is one of the largest known spring (mid-May to early June) stopover sites for this species (FR 71 (176): 53756-53835, September 12, 2006; (Clark et al. 1993). Up to 80 percent of the entire estimated red knot population has been observed at once in the Delaware Bay during spring migration, leading to the area being designated as the first hemispheric site in the Western Hemisphere Shorebird Reserve Network (Clark et al. 1993; Tsipoura and Burger 1999) (Niles et al. 2008).

Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems. During fall and spring migration and winter months, red knots occur in nearshore coastal habitats, along the Atlantic and gulf coasts from southern New England to Florida and into the Gulf of Mexico (Harrington 2001). The Virginia Atlantic barrier islands are a second major stopover location, with red knot peak counts between 5,500 and 9,100 birds since 1995 (Niles et al. 2008). They primarily occur in intertidal surf-zone habitats, particularly near coastal inlets, estuaries, and bays.

3.6.2.8.3 Population and Abundance

The red knot population was previously estimated at 100,000 to 150,000 individuals in the 1980s (Niles et al. 2008). However, annual aerial and ground surveys of Delaware Bay show fluctuation but generally a downward trend. Population surveys during the stopover period in the spring of 1998 at Delaware Bay estimated 50,000 red knots. In the year 2004, the same survey was repeated and the estimated population was substantially lower at 18,000 (Niles et al. 2008). Surveys of red knots at both migration stopover sites and wintering grounds continually show substantial population declines in recent decades (FR 71 (176): 53756-53835, September 12, 2006). For example, surveys during the mid-1980s of wintering red knot populations in South America (Argentina and Chile) provided an estimate of 67,500 individuals (Niles et al. 2008); but according to USFWS, since the year 2005, numbers have been under 20,000 birds, and dipped below 10,000 in the year 2011. Studies from 1994 to 2002 also show decreased annual adult survival rates related to these population declines (Niles et al. 2008).

3.6.2.8.4 Predator and Prey Interactions

Red knots forage by surface pecking and probing for intertidal invertebrates and various species of mussels and other molluscs (Harrington 2001). During spring migration, a major food source for red knots are horseshoe crab eggs; millions of which can be found in the Delaware Bay during the second half of May (Botton et al. 1994). Red knot migration coincides with the horseshoe crabs laying their eggs, allowing birds to restore their fat reserves to continue their northward migration to their breeding grounds in the arctic (Harrington 2001; Tsipoura and Burger 1999).

Outside of the breeding grounds, red knot predators include peregrine falcon (*Falco peregrinus*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), great black-backed gull (*Larus marinus*), and accipiters (goshawks and sparrow hawks) (Niles et al. 2008). Predators on breeding grounds include arctic fox (*Alopex lagopus*), long-tailed jaeger (*Stercorarius longicaudus*), and parasitic jaeger (*Stercorarius parasiticus*) (Piersma et al. 1993).

3.6.2.8.5 Species-Specific Threats

The red knot is threatened under the ESA mainly by habitat loss and degradation of foraging resources such as reduction of horseshoe crab populations (U.S. Fish and Wildlife Service 2010d). Harvesting of horseshoe crab eggs for bait in the conch and eel fishing industries as well as research in the biomedical industry are believed to have caused a reduction in the amount of eggs available for red knots especially in Delaware Bay, causing lower weight gain during migratory stopovers and contributing to lower adult survival (Niles et al. 2008). Beach erosion, shoreline protection and stabilization projects, human disturbance, limited food resources, oil spills, red tides, hunting, and severe weather all threaten the stability of the population (Niles et al. 2008; U.S. Fish and Wildlife Service 2010d). Because large percentages of the entire population gather at single sites during migration (i.e., Delaware Bay) and winter, the species is especially vulnerable to loss of key resources at these sites (Clark et al. 1993; Harrington 2001; Niles et al. 2008).

Sections 3.6.2.9 (Geese, Swans, Dabbling and Diving Ducks [Order Anseriformes]) through 3.6.2.18 (Neotropical Migrant Songbirds, Thrushes, Allies, Cuckoos, Swifts, and Owls [Orders Passeriformes, Cuculiformes, and Apodiformes]) describe the taxonomic groups of non ESA-listed bird species in the Study Area. There are 386 bird species defined as neotropical migrants under the Neotropical Migratory Bird Conservation Act, of which 185 could occur in the Study Area during the spring and fall migration period.

3.6.2.9 Geese, Swans, Dabbling and Diving Ducks (Order Anseriformes)

There are 50 species of swans, geese, and dabbling and diving ducks in the family Anatidae in North America. No birds from this group are considered Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008). Birds from this group range from dabbling ducks found in coastal bays, estuaries, and lagoons to more open water ducks found in deeper water environments. Twenty-three of these species are diving ducks that inhabit nearshore or offshore waters of the Study Area (Sibley 2007). Scaups, eiders scoters, long-tailed duck (*Clangula hyemalis*), and harlequin duck (*Histrionicus histrionicus*) are some diving ducks that winter in nearshore ocean waters. All these divers can be found in deeper water where they dive for food (Sibley 2007), some also forage on the ocean bottom in shallow water. Most duck species dive down to 33 ft. (10 m) but long-tail ducks have been reported to dive down to 218 ft. (66 m) with a dive time of around 35 seconds (s) (Sibley 2007). Some inshore shark species, as well as alligators and crocodiles, prey on ducks on the surface of the water (Ehrlich et al. 1988).

The harlequin duck is small and agile and prefers very turbulent water in streams during the breeding season. Their winter habitat includes coastal intertidal areas, but they roost at night on open water farther offshore (greater than 0.6 mi. [1 km]) (Robertson and Goudie 1999). The long-tailed duck winters in small groups in shallow ocean habitat.

Representative species that can be found in coastal bays, estuaries, and lagoons include geese (e.g., Canada goose [*Branta canadensis*], brant [*Branta bernicla*]); swans (e.g., trumpeter swan [*Cygnus buccinators*], tundra swan [*Cygnus columbianus*]); dabbling ducks (e.g., mallard [*Anas platyrhynchos*], gadwall [*Anas strepera*], mottled duck [*Anas fulvigula*], American black duck [*Anas rubripes*], American

wigeon [*Anas americana*], northern shoveler [*Anas clypeata*], blue-winged teal [*Anas discors*], and green-winged teal [*Anas crecca*]); diving ducks (e.g., redhead [*Aythya americana*], bufflehead [*Bucephala albeola*], common goldeneye [*Bucephala clangula*], and red-breasted merganser [*Mergus serrator*]); eiders (e.g., common eider [*Somateria mollissima*], king eider [*Somateria spectabilis*]; and scoters (e.g., surf scoter [*Melanitta perspicillata*], black scoter [*Melanitta americana*]) (American Ornithologists' Union 1998).

3.6.2.10 Loons (Order Gaviiformes)

There are five species of loons in the family Gaviidae in North America (American Ornithologists' Union 1998), three of which occur in the Study Area. The common loon (*G. immer*) is a Bird of Conservation Concern (U.S. Fish and Wildlife Service 2008). Loons are medium to large fish-eating birds that capture prey by diving underwater (Sibley 2007). Loons can dive down to 250 ft. (76 m) with an average dive time of 40 s (Sibley 2007). Loons move ashore only to breed, and all loon species nest on banks of inland ponds or lakes, requiring specific habitat features such as undeveloped shoreline and nest sites that have steep drop offs so they can approach their nest from underwater (Cornell Lab of Ornithology 2009a). For example, common loons spend their time in both freshwater and saltwater environments but prefer to nest on islands where the shoreline is not developed. Most loons need about 100 ft. (30.5 m) of room to take off, so size is another habitat feature that is important for nesting areas. During migration, loons fly high above land or water in loose groups or singly. They winter in coastal, nearshore, or open water marine habitats (Sibley 2007). For example, the Pacific loon (*G. pacifica*) prefers deep water and is found on the open ocean and in bays. One representative species within the Study Area are the red-throated loon which has a circumpolar distribution, breeds in high latitudes on remote ponds, and winters along the Atlantic and Pacific coasts (American Ornithologists' Union 1998).

3.6.2.11 Grebes (Order Podicipediformes)

There are seven species of grebes in the family Podicipedidae in North America (American Ornithologists' Union 1998). Two of these species, the pied-billed grebe (*Podilymbus podiceps*) and horned grebe (*Podiceps auritus*) are Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008). Grebes forage by diving for small aquatic animals such as insects, fish, and crustaceans in the water column. For example, horned grebes can dive for up to 3 minutes and travel 500 ft. (152 m) underwater, where they are sometimes preyed upon by sharks and orcas (Ehrlich et al. 1988). Grebes tend to escape predators by diving or sinking, leaving only the head exposed, rather than taking flight. All grebe species build floating nests in marshes and winter on the ocean and nearshore coastal areas (Sibley 2007).

3.6.2.12 Albatrosses, Fulmars, Petrels, Shearwaters, and Storm-Petrels (Order Procellariiformes)

Procellariiformes is a large order of pelagic seabirds that are divided into four families: Diomedeidae (albatrosses), Procellariidae (petrels and shearwaters), Hydrobatidae (storm-petrels), and Pelecanoididae (diving-petrels) (Enticott and Tipling 1997; Onley and Scofield 2007). This order includes species that are generally long lived, breed once a year, and lay only one egg; thus, they have a low reproductive output. One of these species is endangered under the ESA (Section 3.6.2.5, Bermuda Petrel [*Pterodroma cahow*]) (U.S. Fish and Wildlife Service 2010b) and four are Birds of Conservation Concern as shown in Table 3.6-3 (U.S. Fish and Wildlife Service 2008).

Many seabirds spend most of their lives at sea and come to land only to breed, nest, and occasionally roost (Schreiber and Chovan 1986). Colonial breeding is believed to have evolved in response to the limited availability of relatively predator-free nesting habitats and distance to foraging sites from breeding grounds (Siegel-Causey and Kharitonov 1990). Benefits of colonial breeding include increased

detection of predators and decreased chance of predation of young while parent birds are foraging away from the nest (Gill 1995).

Seabirds can be found in high numbers resting on the water surface in flocks where prey is concentrated (Enticott and Tipling 1997). Some species are found around fishing boats, where they often feed on bycatch and may become injured from longline gear (Enticott and Tipling 1997; Onley and Scofield 2007). Also, because of their pelagic nature, this group is preyed on by some pelagic shark species (Ehrlich et al. 1988). Oceanic fronts (gradients in current speed, temperature, salinity, density, and enhanced circulation) attract seabirds due to increased foraging opportunities. For example, the at-sea distribution of some seabirds is associated with oceanic fronts, which support increased numbers of prey and provide favorable foraging conditions (Bost et al. 2009).

There are 20 species of Procellariiformes in North America, with 13 species representing two families—the storm-petrels and petrels and shearwaters (American Ornithologists' Union 1998)—occurring within the Study Area. Most of the petrel species in the Study Area are not considered part of the diving petrels and forage along the surface of the ocean. Petrels are colonial nesters and tend to nest on remote islands uninhabited by people.

Storm-petrels pick prey off the surface while foraging. Most breed in natural holes/cryptic burrows and visit their colonies only at night (Enticott and Tipling 1997; Onley and Scofield 2007). Fulmarine petrels, such as the northern fulmar (*Fulmarus glacialis*) and the black-capped petrel (*Pterodroma hasitata*), feed by landing on the sea and grabbing prey near the surface. Most fulmarine petrels nest in burrows or on cliff ledges and visit nests by day (Enticott and Tipling 1997; Onley and Scofield 2007). Gadfly petrels are generally species of the *Pterodroma* genus and are long-winged, fast-flying, and highly pelagic. They feed on the wing and land on the sea (Onley and Scofield 2007). Some gadfly petrels nest in burrows or crevices and visit colonies at night (Enticott and Tipling 1997; Onley and Scofield 2007).

Shearwaters are small- to medium-sized and dive to varying depths for prey (Onley and Scofield 2007). For example, Cory's shearwater (*Calonectris diomedea*) rarely dives to 16 ft. (5 m) below the surface, while sooty (*Puffinus griseus*) and short-tailed shearwaters (*Puffinus tenuirostris*) can reach depths of 230 ft. (70 m), swimming underwater with half-open wings (Enticott and Tipling 1997; Onley and Scofield 2007). Greater shearwaters in the South Atlantic Ocean have been reported to dive down to 62 ft. (19 m) and as long as 40 s in a single dive. However, the majority of their dives were less than 6.6 ft. (2 m) (Ronconi et al. 2010).

3.6.2.13 Tropicbirds, Boobies, Gannets, Pelicans, Cormorants, and Frigatebirds (Order Pelecaniformes)

The Pelecaniformes order is a diverse group of large seabirds including anhingas, pelicans, gannets, boobies, tropicbirds, cormorants, and frigatebirds. This order is composed of 17 species in six families—12 species representing five families (American Ornithologists' Union 1998) that occur within the Study Area. Three of these species are considered Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008). Species of concern within the Study Area include the brown booby (*Sula leucogaster*), great cormorant (*Phalacrocorax carbo*), and magnificent frigatebird (*Fregata magnificens*) (American Ornithologists' Union 1998).

Pelecaniformes are less pelagic than the Procellariiformes, although some of these species such as tropicbirds and frigatebirds are pelagic. Most species are colonial, feed on fish, and use a variety of breeding habitats including trees and bushes (but not burrows). Breeding strategies vary among species,

with some being long-lived and having low breeding success, while others have higher annual breeding success, but higher annual adult death (Enticott and Tipling 1997; Onley and Scofield 2007).

Cormorants are voracious predators on inshore fishes and have been implicated as a major threat to the recovery efforts of Atlantic salmon in the Gulf of Maine where they feed on juvenile salmon (smolts) leaving the estuaries (Fay et al. 2006; National Marine Fisheries Service and U.S. Fish and Wildlife Service 2005). Their offshore foraging range is limited by their need for undisturbed, dry nocturnal roosting sites (Shields 2002). The brown pelican (*Pelecanus occidentalis*) primarily occurs in shallow (less than 150 ft. [46 m]) warm coastal marine and estuarine environments, as well as offshore where they forage primarily on fish by head first plunge-diving. Most plunge-diving is limited to 3.5 to 6.5 ft. (1 to 2 m) within the water column. Foraging occurs within 12 mi. (20 km) of nesting islands during the breeding season, and up to 47 mi. (75 km) offshore during the nonbreeding season (Shields 2002). American white pelicans (*Pelecanus erythrorhynchos*) are found in shallow coastal bays, inlets, and estuaries that support forage fish (Knopf and Evans 2004). Flocks forage cooperatively, swimming and encircling fish as a coordinated group or driving them into shallows, where they are caught with synchronized bill dipping (Enticott and Tipling 1997; Onley and Scofield 2007).

3.6.2.14 Herons, Egrets, Ibis, Spoonbills (Order Ciconiiformes)

Ciconiiformes is a large group composed of long-legged, large billed species that includes herons, egrets, ibis, and spoonbills. This order includes 21 species represented in four families—12 species representing two families (American Ornithologists' Union 1998) occur within the Study Area. The roseate spoonbill (*Platalea ajaja*), reddish egret (*Egretta rufescens*), and snowy egret (*Egretta thula*) are the three species from this group considered Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008).

They are commonly known as wading birds, and many of the species are totally dependent on water for many or all portions of their life cycle including feeding, breeding, and sheltering. Majority of these species are communal breeders and build nests within mixed-species colonies. These wading birds forage in intertidal areas by picking and probing for small aquatic prey (Sibley 2007). Though most of their life cycle is spent in coastal areas, migration over offshore areas does occur (Elphick 2007). Nearly all species of Ciconiiformes have suffered great reductions in numbers over the last century as habitat destruction of wetlands continues (American Ornithologists' Union 1998).

Representative species within the Study Area include the great blue heron (*Ardea herodias*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nyctanassa violacea*), white ibis (*Eudocimus albus*), scarlet ibis (*Eudocimus ruber*), glossy ibis (*Plegadis falcinellus*), and roseate spoonbill (American Ornithologists' Union 1998).

3.6.2.15 Flamingos (Order Phoenicopteriformes)

Flamingos are gregarious (social) wading birds in the genus *Phoenicopterus*, and the only genus in the family Phoenicopteridae. The American flamingo (*Phoenicopterus ruber)* species is found in the Study Area. The distribution range of the flamingo is extremely large and includes many Caribbean and South American countries. However, their occurrence in the United States is limited to the southern tip of Florida (Everglades National Park) (Sibley 2007; Stevens and Pickett 1994).

These wading birds forage in intertidal areas by picking and probing for small aquatic prey (Sibley 2003). Though most of their life cycle is spent along coastal areas, migration over offshore areas does occur (Elphick 2007).

3.6.2.16 Osprey, Bald Eagles, and Kites (Orders Accipitriformes and Falconiformes)

Accipitriformes is a large group consisting of 60 species in three families (American Ornithologists' Union 1998). This order generally has broad wings well-suited for soaring. Accipitriformes hunt by day and feed on a variety of prey, including fish, small mammals, reptiles, and carrion. A variety of raptor species from small falcons to large eagles could occur within the Study Area: the osprey (*Pandion haliaetus),* bald eagle (*Haliaeetus leucocephalus*), peregrine falcon, and swallow-tailed kite (*Elanoides forficatus*) are an example of some species likely to occur more frequently than other raptor species in the Study Area. The bald eagle, peregrine falcon, and swallow-tailed kite are Birds of Conservation Concern

Ospreys live near slow-moving waters of coastal, nearshore, and freshwater environments in many parts of the Study Area. Fish make up a large portion of their diet, and therefore, their vision is well adapted to detecting underwater objects from 33–131 ft. (10–40 m) above water (Poole et al. 2002). Osprey migrate from northern latitudes to southern latitudes twice a year and cross bodies of open ocean to reach their destinations (Lott 2006).

Bald eagles nest, forage, and winter along the Atlantic coast especially in the Chesapeake Bay region. Bald eagles have steadily increased since the ban on DDT from 60 pairs in the 1970s to 646 in the year 2001. The Chesapeake Bay is very important to bald eagles because it is a convergence point for all three geographically distinct populations (northeast, southeast, and Chesapeake Bay) and has played an important part in the recovery of eagles (Watts et al. 2007). Bald eagles are opportunistic feeders that generally prefer fish over other food types (Buehler 2000). Adults are known to scavenge prey items, pirate food from other species, and capture prey such as ducks from the water's surface.

Swallow-tailed kites breed in the southeastern United States but winter in South America, making long distance migrations each year between wintering and breeding grounds. Studies in Florida show swallow-tailed kites feed on various animals in the following proportions: frogs (53 percent), birds (30 percent), and reptiles (11 percent) and the remaining prey were insects (Meyer et al. 2004).

Most peregrine falcons occur throughout the nearshore and coastal portions of the Study Area, particularly near barrier islands and mudflats during the winter months. Some peregrine falcons migrate along the coast, cross bodies of water such as the Gulf of Mexico, and occur offshore of the Atlantic coast to reach their wintering/breeding territories on a yearly basis (Lott 2006). They can reach altitudes up to 12,000 ft. (3,660 m) (Cornell Lab of Ornithology 2011). Peregrine falcons feed mostly on other birds, including shorebirds, ducks, grebes, gulls, and petrels. They occasionally feed on fish while in coastal habitats (Cornell Lab of Ornithology 2011).

3.6.2.17 Shorebirds, Phalaropes, Gulls, Noddies, Terns, Skimmers, Skuas, Jaegers, and Alcids (Order Charadriiformes)

The Charadriiformes include shorebirds, phalaropes, gulls, noddies, terns, skimmers, skuas, jaegers, and alcids (Cornell Lab of Ornithology 2009a). There are 81 species from this diverse group that occur within the Study Area ranging from small shorebirds to large pelagic seabirds. Two endangered species under the ESA belong to this group, the roseate tern and piping plover (U.S. Fish and Wildlife Service 2010b). Nineteen species from this group are Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008). Some species in this order are highly pelagic (e.g., jaegers, skuas, alcids), whereas others are more coastal or nearshore species (e.g., shorebirds, gulls).

Representative species from this group include: semipalmated plover (*Charadrius semipalmatus*), great skua (*Stercorarius skua*), long-tailed jaeger (*Stercorarius longicaudus*), sooty tern (*Onychoprion fuscatus*),

brown noddy (*Anous stolidus*), dovekie (*Alle alle*), common murre (*Uria aalge*), razorbill (*Alca torda*), long-billed murrelet (*Brachyramphus perdix*), Atlantic puffin (*Fratercula arctica*), and red phalarope (*Phalaropus fulicarius*).

Noddies are tropical tern-like seabirds found foraging over warm, open-ocean waters where they feed by swooping or dipping along the surface. Brown noddies breed in colonies on islands, islets, and rocky outcrops in warm seas. They only lay one egg a year and build their nests in trees, shrubs, cliffs, and man-made structures (Sibley 2007).

Terns are generally more marine or pelagic than gulls, though some tern species do occur more commonly within coastal areas (e.g., least terns). In the North Atlantic, Gulf Stream eddies attract foraging seabirds such as the sooty tern and bridled tern (*Onychoprion anaethetus*) (Bost et al. 2009).

Alcids or auks (family Alcidae), are small oceanic species that come to land only to breed (Enticott and Tipling 1997); they nest colonially in crevices or burrows. Alcids do not undergo long-distance foraging trips but form feeding aggregations in areas where food is concentrated, though they do not form tight flocks (Enticott and Tipling 1997). All alcids use their wings to dive underwater where they feed on fishes and invertebrates. Auks are pursuit divers and are entirely wing-propelled rather than foot-propelled, as are loons, grebes, and long-tailed ducks, for example. Atlantic puffins can dive between 135 to 224 ft. (41 and 68 m) for periods of up to 1 minute (Burger and Simpson 1986).

Shorebirds are small, generally long-legged coastal birds that forage in intertidal areas by picking and probing for small aquatic prey (Sibley 2007). Shorebirds undergo some of the longest distance migrations known for birds, for example, the red knot annually migrates more than 9,300 mi. (15,000 km) (U.S. Fish and Wildlife Service 2005). Though most of their life cycle is spent in coastal areas, shorebird migration over open ocean does occur (Elphick 2007). Although taxonomically grouped among some shorebirds, two species of phalaropes in the family Scolopacidae that occur within the Study Area are functionally seabirds, spending the nonbreeding months out on the open ocean. For example, the red-necked phalarope (*Phalaropus lobatus*) spends up to 9 months at sea, gathering in small flocks at upwellings and convergence zones, foraging on zooplankton and other small aquatic animals that rise to the surface (Rubega et al. 2000). The red phalarope ranges farthest from shore, spending 11 months at sea feeding on small invertebrates (Tracy et al. 2002).

The Charadriiformes influence the distribution and abundance of invertebrates, and indirectly algae, in rocky intertidal communities of New England (Ellis et al. 2007). Gulls are one particular group that can be found over land, along the coast, in nearshore, and offshore environments. The great black-backed gull (*Larus marinus*) and the herring gull (*Larus argentatus*) are dominant predators along the rocky shores throughout the North Atlantic, feeding on crabs, sea urchins, and mussels in the rocky intertidal habitat.

3.6.2.18 Neotropical Migrant Songbirds, Thrushes, Allies, Cuckoos, Swifts, and Owls (Orders Passeriformes, Cuculiformes, and Apodiformes)

There are 185 bird species in the orders Passeriformes, Cuculiformes, Apodiformes, and Strigiformes that are considered nocturnal migrants and neotropical migrants with a potential to occur in the Study Area. Nineteen of these species are Birds of Conservation as shown in Table 3.6-3 (U.S. Fish and Wildlife Service 2008). Most of these species are nocturnal migrants and take advantage of favorable weather conditions to migrate (Kerlinger 2009). Oceans are typically an obstacle for this group of birds because most songbirds cannot swim, or even rest on the water's surface. Migrants tend to avoid large water

crossings and follow land to the extent possible. Migration has a substantial risk to birds, ranging from mass mortality events due to inclement weather events (Newton 2007) and other mortality events associated with lighting of vessels (Merkel and Johansen 2011) and oil and gas platforms (Poot et al. 2008). In the Gulf of Mexico, long distance migrants are commonly found stopping over and resting on oil and gas platforms as well as on small boats and vessels. However, most neotropical migrants, especially warblers and thrushes from the family Parulidae and family Turdidae, cross water at some point twice a year to reach their wintering and breeding grounds. For example, the Bicknell's thrush *(Cartharus bicknelli*) breeds in mountainous forests of New England and migrates across open oceans in the fall to reach their wintering grounds in the Caribbean.

3.6.3 ENVIRONMENTAL CONSEQUENCES

For this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), birds are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential effect on all birds in general, on each taxonomic grouping, and on the three birds in the Study Area listed as endangered or threatened under the ESA. As described in Section 3.6.2 (Affected Environment), birds are not distributed uniformly throughout the Study Area, but are closely associated with a variety of habitats, with coastal birds and shorebirds concentrated along nearshore habitats and seabirds with patchy (uneven) distributions in offshore and open ocean areas.

General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and general susceptibilities of living resources to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Stressors vary in intensity, frequency, duration, and location within the Study Area. Certain activities take place in specific locations or depth zones within the Study Area (Section 3.0.5, Overall Approach to Analysis), outside of the range or foraging abilities of birds. Therefore, seafloor device strike, cable and wire entanglement, parachute entanglement, and ingestion of munitions were not carried forward in this analysis for birds. The stressors applicable to ESA-listed species in the Study Area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources; explosives and swimmer defense airguns; pile driving; weapons firing, launch, impact noise; and aircraft and vessel noise)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance and strike (aircraft and aerial targets, vessels and in-water devices, and military expended materials)
- Ingestion (military expended materials)
- Secondary stressors

Each of these components is analyzed for potential impacts on birds within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components within the context of geographic location and overlap of marine bird resources. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.6.3.1 Acoustic Stressors

This section evaluates the potential for non-impulsive and impulsive acoustic stressors to impact birds during training and testing activities in the Study Area. These stressors are associated with sonar and

other underwater active acoustic sources; explosive detonations; aircraft noise; vessel noise; airguns; weapons firing, launch, and impact noise; and pile driving. Following the Conceptual Framework for Assessing Effects from Sound-Producing Activities (Section 3.0.5.7.1), categories of potential impacts from exposure to explosions and sound are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Potential negative nonphysiological consequences to birds from acoustic and explosive stressors include disturbance of foraging, roosting, or breeding; degradation of foraging habitat; and degradation of breeding colonies.

If a bird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotraumas. Barotrauma is physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Damage could occur to the structure of the ear, resulting in hearing loss, or to internal organs, causing hemorrhage and rupture.

If a bird is close to an intense sound source, it could suffer auditory fatigue. Auditory fatigue manifests itself as hearing sensitivity loss over a portion of hearing range, called a noise-induced threshold shift. A threshold shift may be either permanent threshold shift (PTS) or temporary threshold shift (TTS). Studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in seabirds (e.g., Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders and Dooling 1974). A bird may experience permanent threshold shift if exposed to a continuous over 110 dBA re 20 µPa sound pressure level in air or blast noise over 140 dB re 20 µPa sound pressure level in air (Dooling and Therrien 2012). Unlike other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained sound exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling and Therrien 2012). Auditory fatigue can impair an animal's ability to hear biologically important sounds within the affected frequency range. Biologically important sounds come from social groups, potential mates, offspring, or parents; environmental sounds; or predators (see Section 3.0.5.7.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities).

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al. 1996; National Parks Service 1994; Plumpton et al. 2006). The manner in which birds respond to noise depends on several factors, including life history characteristics of the species; characteristics of the noise source, sound source intensity, onset rate, distance from the noise source, presence or absence of associated visual stimuli, and previous exposure (see Section 3.0.5.7.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities).Researchers have documented a range of bird behavioral responses to noise, including no response, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Larkin et al. 1996; National Parks Service 1994; Plumpton et al. 2006; Pytte et al. 2003). Some behavioral responses may be accompanied by physiological responses, such as increased heart rate or short-term changes in stress hormone levels (Partecke J. et al. 2006).

Behavioral responses may depend on the characteristics of the noise, and if the noise is similar to biologically relevant sounds, such as alarm calls by other birds and predator sounds. For example, European starlings (*Sturnus vulgaris*) took significantly longer to habituate to repeated bird distress calls than white noise or pure tones (Johnson et al. 1985). Starlings may have been more likely to continue to

respond to the distress because it is a more biologically meaningful sound. Starlings were also more likely to habituate in winter than summer, possibly meaning that food scarcity or seasonal physiological conditions may affect intensity of behavioral response (Johnson et al. 1985). Similarly, seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al. 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas. The sensitivity of birds to disturbance may also vary during different stages of the nesting cycle. Similar noise levels may be more likely to cause nest abandonment during incubation of eggs than during brooding of chicks because birds have invested less time and energy and have a greater chance of re-nesting (Knight and Temple 1986).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al. 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Bowles et. al. in Larkin et al. 1996; National Parks Service 1994). The reported behavioral and physiological responses of birds to noise exposure can fall within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. These responses can include activation of the neural and endocrine systems, causing changes such as increased blood pressure, available glucose, and blood levels of corticosteroids (Manci et al. 1988). It is possible that individuals would return to normal almost immediately after exposure, and the individual's metabolism and energy budget would not be affected long-term. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996; National Parks Service 1994; Plumpton et al. 2006). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al. 1991), and frequency of and proximity to exposure. Raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area (Andersen et al. 1990). On the other hand, cardinals nesting in areas with high levels of military training activity (including gunfire, artillery, and explosives) were observed to have similar reproductive success and stress hormone levels as cardinals in areas of low activity (Barron et al. 2012).

The types of birds exposed to sound-producing activities or explosive detonations depend on where training and testing activities occur relative to the coast. Seabirds can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, tropicbirds, boobies, and some terns that forage over the ocean and nest on oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those few species such as skuas, jaegers, Franklin’s gull, Bonaparte’s gulls, ring-billed gulls, and black terns that nest and forage in inland habitats and come to the coastal areas during nonbreeding seasons (Schreiber and Burger 2002). In addition, birds that are typically found inland, such as songbirds, may be present flying in large numbers over open ocean areas (particularly over the Gulf of Mexico) during annual spring and fall migration periods.

The area from the beach to about 10 nautical miles (nm) offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports nonbreeding and transient pelagic seabirds. Offshore pelagic waters support nonbreeding and transient pelagic seabirds, loons, gannets, and several tern species (Davis et al. 2000; Hunter et al. 2006b). Pelagic seabirds are generally widely distributed, but they tend to congregate in areas of higher productivity and prey availability (Haney 1986a). Such areas include the Gulf Stream, particularly the western frontal boundary and associated eddies and upwelling; areas with productive live/hard bottom habitats; and large *Sargassum* mats.

Seabirds and migrating birds could be exposed to sounds from sources near the water surface or from airborne sources. While foraging birds will be present near the water surface, migrating birds may fly at various altitudes. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying so high that they are barely visible through binoculars (Lincoln et al. 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m). Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft. (3,050 m), with the bulk of the movements occurring under 3,000 ft. (914 m) (Lincoln et al. 1998).

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving under water). Birds that feed at the surface by surface or aerial dipping with limited to no underwater exposure include petrels, jaegers, and phalaropes. Birds that plunge-dive typically submerge for no more than a few seconds, and any exposure to underwater sound would be very brief. Birds that plunge-dive include albatrosses, some tern species, masked boobies, shearwaters, and tropicbirds. Other birds pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Birds that exhibit this foraging behavior include cormorants, razorbills, petrels, shearwaters, and common murres. Some of these birds may stay underwater for up to several minutes and reach depths between 50 ft. (15 m) and 550 ft. (168 m) (Alderfer 2003; Durant et al. 2003; Jones 2001; Lin 2002; Ronconi 2001). Birds that forage near the surface would be exposed to underwater sound for shorter periods of time, and some exposures may be reduced by phase cancellation near the surface (see Section 3.0.4, Acoustic and Explosives Primer). Sounds generated under water during training and testing would be more likely to impact birds that pursue prey under the surface, although as previously stated, little is known about seabird hearing ability underwater. Birds that forage in the open ocean often forage more actively at night, when prey species are more likely to be near the surface and naval training and testing is more limited.

3.6.3.1.1 Impacts from Sonar and Other Active Acoustic Sources

Sonar and other underwater active non-impulsive acoustic sources could be used throughout the Study Area. Information regarding the impacts from sonar on seabirds and the ability for seabirds to hear underwater is virtually unknown. The exposure to these sounds by seabirds, other than pursuit diving species, is likely to be very limited due to spending a very short time under water (plunge-diving or surface-dipping) or foraging only at the water surface. In addition, acoustic effects near the water's surface may reduce potential sound exposure of shallow diving birds. Pursuit divers may remain under water for minutes, increasing the chance of underwater sound exposure.

A physiological impact, such as hearing loss, would likely only occur if a bird is close to an intense sound source. In general, birds are less susceptible to both temporary and permanent threshold shift than mammals (Saunders and Dooling 1974), so an underwater sound exposure would have to be intense and of a sufficient duration to cause temporary or permanent threshold shift. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater; however, foraging and hunting behaviors could be interrupted. There have been no studies documenting diving seabirds' reactions to sonar.

If seabirds that forage underwater are attracted to the presence of a ship using active acoustic sources, the diving seabirds could be exposed to underwater sound. Some birds commonly follow vessels for

increased potential of foraging success as the propeller wake brings prey to the surface (Dietrich and Melvin 2004; Hamilton III 1958; Hyrenbach 2001, 2006; Melvin et al. 2001). However, most hull-mounted sonars do not project sound aft of ships, so birds diving in ship wakes would not be exposed to sonar. In addition, based on what is known about bird hearing capabilities in air, it is expected that diving birds may have limited or no ability to perceive high-frequency sounds, so it is expected that they would not be impacted by high frequency sources such as those used in mine warfare.

The possibility of an ESA-listed bird species being exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Although Bermuda petrels forage in open ocean areas where sonar training and testing occurs, they would not be exposed to underwater sound because they forage at the surface. Roseate terns forage in coastal shallow waters where they could be exposed to sonar and other active acoustic sources, notably near ports and shipyards where sonar maintenance and testing occur. However, their plunge dives are brief, so any chance of exposure would be minimal. Most other sonar use occurs farther offshore, however, so the chance for an exposure would be low. Piping plovers forage in intertidal areas where they would not be exposed to underwater sound sources.

3.6.3.1.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include activities that produce non-impulsive underwater sound from the use of sonar and other active acoustic sources. These activities could occur throughout the Study Area but would be concentrated Southeast in the U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area. Most activities would occur in the VACAPES, Navy Cherry Point, and Jacksonville (JAX) Range Complexes. The number of events and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Diving birds would be more likely to be exposed to underwater sound in foraging areas. The western front of the Gulf Stream is an area of increased productivity that attracts foraging seabirds, and training would occur in this area. Therefore, seabirds that forage in this area could have a greater chance of underwater sound exposure. Sonar and other active acoustic sources would not be regularly used in nearshore areas that could be used by foraging shorebirds, except during maintenance and for navigation in areas around ports.

Exposures sufficiently intense (i.e., of a certain duration or within a close proximity) to cause physiological impacts are unlikely. Diving birds may not respond to an underwater sound or may not have the hearing range to detect some sources. If a diving seabird does react to an underwater sound source, it is expected to result in a short-term behavioral response, such as a startle or surfacing. Seabirds would avoid any additional exposures during a foraging dive when they surface. It is likely that few seabirds would be affected by sonar and other underwater active acoustic sources because sources are used intermittently during a training event, training events are dispersed in space and time, and seabirds spend only a portion of their time submerged. Due to the limited duration of training events and widespread availability of foraging habitat, any sound exposures would be minimal and would not permanently displace an animal from a foraging area. Occasional short-term, behavioral impacts, if they occur, are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness) to most individuals, therefore, population-level impacts are not expected.

Bermuda petrels, red knots, and piping plovers do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Roseate terns may briefly submerge while foraging, so there is a remote chance that a roseate tern could be exposed to underwater sound sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The number of annual testing activities that produce in-water noise from the use of sonar and other active acoustic sources that fall within the hearing range of birds under the No Action Alternative. These activities could occur throughout the Study Area, typically in the Northeast U.S Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and the Gulf Stream Open Ocean Area. These activities would typically occur in the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; Naval Surface Warfare Center, Panama City Division Testing Range; Naval Undersea Warfare Center Division, Newport Testing Range; and pierside at Navy ports, Navy shipyards, and Navy-contractor shipyards. Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Ocean fronts, including the western front of the Gulf Stream, Gulf Stream eddies, and the front at the intersection of the continental shelf and slope, are areas of increased productivity that could attract seabirds that forage in open ocean areas. Seabirds that forage in these open ocean areas would have a greater chance of underwater sound exposure than birds that forage in coastal areas. Sonar and other active acoustic sources would not be regularly used in nearshore areas that could be used by foraging shorebirds, except during maintenance, navigation, and new ship construction activities in areas around ports.

Exposures sufficiently intense (i.e., of a certain duration or within a close proximity) to cause physiological impacts are unlikely. Diving birds may not respond to an underwater sound or may not have the hearing range to detect some sources. If a diving seabird does react to an underwater sound source, it is expected to result in a short-term behavioral response, such as a startling or surfacing. Seabirds would avoid any additional exposures during a foraging dive when they surface. It is likely that few seabirds would be affected by sonar and other underwater active acoustic sources because sources are used intermittently during a testing event, testing events are dispersed in space and time, and seabirds spend only a portion of their time submerged. Due to the limited duration of testing events and widespread availability of foraging habitat, any sound exposures would be minimal and would not permanently displace an animal from a foraging area. Occasional short-term, behavioral impacts, if they occur, are not expected to result in substantial changes to behavior, growth, survival, annual

reproductive success, lifetime reproductive success (fitness) to most individuals, therefore, population-level impacts are not expected.

Bermuda petrels, red knots, and piping plovers do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Roseate terns may briefly submerge while foraging, so there is a remote chance that a roseate tern could be exposed to underwater sound from sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.1.2 Alternative 1

Training Activities

The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources during training under Alternative 1 would increase compared to the No Action Alternative, plus new sources would be used with the introduction of the Littoral Combat Ship. Similar to the No Action Alternative, impacts could occur throughout the Study Area but would be concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem and in the Gulf Stream Open Ocean Area. These activities would typically occur in the VACAPES, Navy Cherry Point, and JAX Range Complexes. Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Based on the increased activities under Alternative 1 versus the No Action Alternative, more seabirds could be exposed to sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds as described under the No Action Alternative. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Bermuda petrels, red knots, and piping plovers do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Roseate terns may briefly submerge while foraging, so there is a remote chance that a roseate tern could be exposed to underwater sound sonar and other active acoustic sources.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under Alternative 1 that produce in-water noise from the use of sonar and other active non-impulsive acoustic sources that fall within the hearing range of birds would increase compared to the No Action Alternative. These activities could occur throughout the Study Area, typically in the Northeast U.S Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and the Gulf Stream Open Ocean Area. These activities would typically occur in the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; Naval Surface Warfare Center, Panama City Division Testing Range; Naval Undersea Warfare Center Division, Newport Testing Range; the South Florida Ocean Measurement Facility Testing Range; and pierside at Navy ports, Navy shipyards, and Navy-contractor shipyards. The number of events and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

Based on the increased activities under Alternative 1 versus the No Action Alternative and the additional testing locations, more diving seabirds could be exposed to sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population. Similarly, no impacts are expected to Bermuda petrels, red knots, and piping plovers, but there is a remote chance that roseate terns may be exposed while briefly submerging during foraging.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.1.1.2 (Alternative 1).

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources) describes the use of sonar and other underwater active acoustic sources during testing activities under Alternative 2, including relative concentrations and locations within the Study Area. Use of sonar and other active acoustic sources would increase under Alternative 2 versus the No Action Alternative. The proposed testing activities would also increase over Alternative 1 by approximately 10 percent. Sonar and other active acoustic sources would be used in waters throughout the range complexes and testing ranges, in the same locations described under Alternative 1. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population. Similarly, no impacts are expected to Bermuda petrels, red knots, and piping plovers, but there is a remote chance that roseate terns may be exposed while briefly submerging during foraging.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern;*
- *will have no effect on the ESA-listed Bermuda petrel and piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2 Impacts from Explosives and Swimmer Defense Airguns

The potential for birds to be exposed to explosions depends on several factors, including the presence of birds at, beneath, or above the water surface near the detonation; location of the detonation at, below, or above the water surface; size of the explosive; and distance from the detonation. Explosions are

associated with detonations of explosive missiles and projectiles in air; explosive grenades, bombs, missiles, rockets, and projectiles at or near the sea surface; mine neutralization charges on the bottom and in the water column; explosive torpedoes near the surface and in the water column; explosive sonobuoys in the water column; other small charges used at various depths during testing; and ship shock trial detonations 200 ft. (61 m) below the water surface. Section 3.0.4 (Acoustic and Explosives Primer), describes the shock waves and acoustic waves imparted to a surrounding medium by an explosive detonation and how these waves propagate. Because airguns are an impulsive source, with the potential for similar non-traumatic impacts as explosives, they are considered in this section.

Detonations near the water surface or underwater could impact diving birds and birds on the water surface. A seabird close to an explosive detonation could be killed or injured. Blast injuries are usually most evident in the gas-containing organs, such as those of the respiratory and gastrointestinal systems. Blasts can also damage pressure-sensitive components of the auditory system. Most detonations of explosive projectiles near the water surface would release a large portion of the explosive energy into the air rather than into the water column.

Detonations that occur underwater, such as explosive ordnance disposal activities, could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil and St. Ledger 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus on the surface (Yelverton et al. 1973). Detonations are estimated to have lethal impacts on seabirds in water if the impulse exceeds 36 pounds per square inch (psi)–milliseconds (ms) (psi-ms) (248 pascal [Pa]-second [s]) for birds underwater and 100 psi-ms (690 Pa-s) just below the water surface for birds at the water surface (Yelverton et al. 1973). These impulse levels correspond to the level at which 1 percent of animals would not be expected to survive. Exposures to higher impulse levels would have greater likelihoods of mortality. No injuries would be expected for birds underwater at blast pressures below 6 psi-ms (41 Pa-s) and for birds on the surface at blast pressures below 30 psi-ms (207 Pa-s) (Yelverton et al. 1973). Actual ranges to impacts would be based on several factors including charge size, depth of the detonation, and how far the bird is beneath the water surface. Due to surface image interference (Section 3.0.4, Acoustic and Explosive Primer), peak pressures due to underwater explosions may be substantially reduced near the surface, reducing potential for injury to birds on the surface and shallow-diving birds.

Because of the differences in acoustic transmission in water and in air, an effect called the Lloyd mirror reflects underwater sound at the water surface so that it does not pass into the air (Section 3.0.4, Acoustic and Explosives Primer). Sounds generated by most small underwater explosions and airguns, therefore, are unlikely to disturb seabirds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed. Cavitation zones near the surface can also disturb or injure birds at or near the surface (see Section 3.0.4, Acoustic and Explosives Primer).

Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves and acoustic waves that would propagate through both the water and air. However, most pressure release would be into the air and underwater impacts would be reduced.

Detonations in air could also injure birds while either in flight or at the water surface. Experiments that exposed birds to blast waves in air provided a relationship between charge size, distance from detonation, and likelihood of bird injury or mortality (Damon et al. 1974). Table 3.6-4 shows the safe distance from a detonation in air beyond which no injuries to birds would be expected.

Table 3.6-4: Range to No Injury from Detonations in Air for Birds

Explosive Source Class	Sample Munitions	Net Explosive Weight	Range to No Injury[1]
E3	76-mm round	0.6–2 lb.	22 ft. (7 m)
E5	5-in. projectiles	6–10 lb.	22 ft. (10 m)
E7	Rolling Airframe Anti-Air Missile	21–60 lb.	70 ft. (21 m)

ft.: feet; in.: inch; lb.: pound(s); m: meters; mm: millimeter
[1] (Damon et al. 1974)

Detonations in air during anti-air warfare training and testing would typically occur at much higher altitudes (greater than 3,000 ft. [914 m] above sea level) where seabirds and migrating birds are less likely to be present, although some events target incoming missile threats at lower altitudes.

Detonations in either the air or under water are assumed to have the potential to cause a permanent or temporary threshold shift, if a bird is exposed to sufficient energy to cause auditory fatigue. As stated previously, studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in seabirds (e.g., Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders and Dooling 1974). Unlike other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained sound exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999). Auditory fatigue can impair an animal's ability to hear biologically important sounds within the affected frequency range.

An explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or a flight response. The range of impacts could depend on the charge size, distance from the charge, and the bird's life activity at the time of the exposure.

Birds have been observed taking interest in surface objects related to detonation events and subsequently being killed by a detonation (Stemp, R., in Greene et al. 1985). Fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe. However, seabirds could also be attracted to an area to forage if an explosion resulted in a fish kill. This would only be a concern for events that involved multiple explosions in the same area within a single event, such as firing exercises, which involves firing multiple high-explosive 5-in. rounds at a target area; bombing exercises, which could involve multiple bomb drops separated by several minutes; or underwater detonations, such as multiple explosive ordnance disposal charges.

3.6.3.1.2.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative use explosives in air, at the water surface, and underwater. The largest source class used during training under the No Action Alternative would be E12 (651-1,000 pounds [lb.] net explosive weight) at the water surface. The number of training events using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of

Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Most detonations associated with training would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem, Southeast U.S. Continental Shelf Large Marine Ecosystem, and Gulf Stream Open Ocean Area. Explosions at or beneath the water surface would be used in all training range complexes, except Key West Range Complex. Training activities using explosives would not typically occur within approximately 3 nm of shore. In-air explosions during anti-air warfare would typically take place in VACAPES, Navy Cherry Point, and JAX Range Complexes.

Nearshore waters are the primary foraging habitat for many seabird species. With the exception of explosive ordnance disposal training (underwater detonations up to 20 lb. net explosive weight) in the VACAPES, Navy Cherry Point and JAX Range Complexes, birds near shore would not be exposed to explosive detonations associated with the training activities. A limited number of these events occur nearshore (approximately three nm), where they could briefly disturb shorebirds in the vicinity. Some surface detonations could occur near areas with the potential for relatively high concentrations of seabirds near the western frontal boundary of the Gulf Stream (see Figures 3.0-2 and 3.0-3), including firing, bombing, and missile exercises in either VACAPES or Navy Cherry Point Range Complexes. Any impacts on seabirds may be greater in these areas. Most explosions in air would occur at altitudes above those where most birds would be expected to be present, although it is possible that high-altitude migrating birds could be exposed to a detonation. In addition, some airborne detonations targeting threat missiles could impact foraging birds at lower altitudes.

While the impacts of explosions on seabirds under the No Action Alternative cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Detonations of bombs with larger net explosive weights, any event employing static targets that may attract seabirds to the detonation site, or multiple detonations that attract seabirds to possible fish kills could be more likely to cause sea bird moralities or injuries. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because most events would consist of a limited number of detonations, exposures would not occur over long durations, and events occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

ESA-listed birds are known to be present in areas where detonations would occur during training under the No Action Alternative. Bermuda petrels and roseate terns may be present near the Gulf Stream, where detonations could occur, although little is known about Bermuda petrel distribution. Although Bermuda petrel and roseate tern could be present in range complexes where explosives are used, the likelihood of an injurious exposure is expected to be low based on the limited in-air range of injury from explosions and the expected low density of these birds. Piping plovers may be briefly disturbed in the vicinity of nearshore activities; however, they would not forage or migrate in the open ocean areas where other detonations occur.. Red knots could be present during migration over open ocean areas where detonations could occur. If a detonation occurred in the vicinity of migrating red knots, impacts would likely be limited to short-term startle reactions.

Suitability of critical habitat designated in coastal shore areas for piping plover to support roosting, refuge, and feeding would not be affected by explosions offshore or by in-air detonations. Designated

piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems; however, none of these areas overlap with the use of explosives in the Study Area. Two of the primary constituent elements of critical habitat required by piping plover (i.e., sheltering and roosting) are applicable to their terrestrial beach habitats (above the high tide line), which are outside of the Study Area. The other primary constituent element is foraging. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations where explosives are used. Therefore, explosives will not affect piping plover critical habitat.

Pursuant to the ESA, the use of explosives during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern, Bermuda petrel, and piping plover;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under the No Action Alternative use explosives at the water surface and underwater. The largest source class used during testing under the No Action Alternative is E14 (1,741-3,625 lb. net explosive weight). The number of testing activities using explosives and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Explosives at or beneath the water surface would be used in all training range complexes, plus Naval Undersea Warfare Center, Panama City Division Testing Range. Most detonations associated with testing would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and Gulf Stream Open Ocean Area. Testing activities using explosives do not normally occur within 3 nm of shore; the exception would be the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is located nearshore, partially within the surf zone. In addition, small airguns would be used during pierside integrated swimmer defense testing activities at pierside locations at Joint Expeditionary Base Little Creek, Norfolk, Virginia, and at Newport, Rhode Island, as described in Table 2.8-3 and Section 3.0.5.3.1.4 (Swimmer Defense Airguns), and are included here because they produce underwater impulsive sound. In-air explosions are not analyzed for testing under the No Action Alternative.

Nearshore waters are the primary foraging habitat for many seabird species. With the exception of line charge detonations near the surf zone in the Naval Surface Warfare Center, Panama City Division Testing Range, birds near shore would not be exposed to explosive detonations associated with the testing activities. The limited number of these line charge events that occur could briefly disturb shorebirds in the vicinity. Some surface detonations could occur near areas with the potential for relatively higher

concentrations of seabirds near the western frontal boundary of the Gulf Stream (see Figures 3.0-2 and 3.0-3). Any impacts on seabirds may be greater in these areas.

While the impacts of explosions on seabirds under the No Action Alternative cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Detonations of bombs with larger net explosive weights, any event employing static targets that may attract seabirds to the detonation site, or multiple detonations that attract seabirds to possible fish kills could be more likely to cause sea bird moralities or injuries. Airgun detonations may startle diving birds foraging in port areas where underwater airgun detonations would occur. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success would likely be short-term and infrequent. Because most events would consist of a limited number of detonations, exposures would not occur over long durations, and events occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

ESA-listed birds are known to be present in areas where detonations would occur during testing under the No Action Alternative. Bermuda petrels and red knots could be present in the VACAPES Range Complex, where air-to-surface missiles are detonated, although little is known about Bermuda petrel distribution. Migrating roseate terns could also be present over open ocean areas where detonations could occur, and may also forage in nearshore waters such as those near Newport, Rhode Island where airgun detonations would occur. Although Bermuda petrel and roseate tern could be present in range complexes where explosives are used, the likelihood of an injurious exposure is expected to be low based on the limited in-air range of injury from explosions and the expected low density of these birds. In addition, because of the limited number of airgun events and the short duration of roseate tern dives, use of airguns is not expected to impact roseate terns. Piping plovers and red knots may be briefly disturbed in the vicinity of nearshore testing at Naval Surface Warfare Center, Panama City Division Testing Range; however, they would not forage or migrate in the open ocean areas where other detonations occur.

Suitability of critical habitat designated in coastal shore areas for piping plover to support roosting, refuge, and feeding would not be affected by explosions offshore or by in-air detonations. Designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems; however, none of these areas overlap with the use of explosives in the Study Area. Two of the primary constituent elements of critical habitat required by piping plover (i.e., sheltering and roosting) are applicable to their terrestrial beach habitats (above the high tide line), which are outside of the Study Area. The other primary constituent element is foraging. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations where explosives are used. Therefore, explosives will not affect piping plover critical habitat.

Pursuant to the ESA, the use of explosives and swimmer defense airguns during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern, Bermuda petrel, and piping plover;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2.2 Alternative 1

Training Activities

The number of explosive detonations under Alternative 1 would increase over the No Action Alternative. Training would generally occur in the same areas as under the No Action Alternative. The largest source class used during training under Alternative 1 would be E12 (651-1,000 lb. net explosive weight). The number of training events using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Most detonations associated with training would occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area. Explosives at or beneath the water surface would be used in all training range complexes, including activities at the Key West Range Complex. Training activities using explosives would not typically occur within approximately 3 nm of shore. In-air explosions during anti-air warfare activities could take place in all training range complexes.

Although the impacts to birds are expected to increase under Alternative 1 compared to the No Action Alternative due to an increase in training events, the largest source class of net explosive weight would not increase and the expected impacts on any individual bird would remain the same. For the same reasons provided in Section 3.6.3.1.2.1 (No Action Alternative), long-term impacts and potential mortality to a few individuals, and other short-term startle reactions to dispersed training events, are not expected to result in population-level impacts. Potential impacts on ESA-listed or candidate species and critical habitat are expected to be similar to the No Action Alternative.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed piping plover, Bermuda petrel, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The number of testing activities that use explosions under Alternative 1 would increase over the No Action Alternative. The number of events and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources).

The largest source class used during these annually recurring testing events would be E14 (1,741 – 3,625 lb. net explosive weight). Explosives at or beneath the water surface would be used during annually recurring testing in all training range complexes, plus Naval Surface Warfare Center, Panama City Division Testing Range. Testing activities using explosives would not normally occur within 3 nm of shore, except at Naval Surface Warfare Center, Panama City Division Testing Range. The most substantial increase in explosives use would occur during the ship shock trials of three platforms in the VACAPES or JAX Range Complexes - aircraft carrier (one event in five years), destroyer (one event in five years), and Littoral Combat Ship (two events in five years). Aircraft carrier full ship shock trials could use charges up to source class E17 (14,501 – 58,000 lb. net explosive weight). Destroyer and Littoral Combat Ship full ship shock trials could use charges up to source class E16 (7,251 – 14,500 lb. net explosive weight). In-air explosions could occur in the VACAPES, Navy Cherry Point, JAX, and Key West Range Complexes. The number of testing activities using explosives and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives). In addition, small airguns would create underwater impulsive noise during a small number of pierside integrated swimmer defense testing activities at pierside locations at Joint Expeditionary Base Little Creek, Norfolk, Virginia, and at Newport, Rhode Island, and during Stationary Source Testing at Naval Surface Warfare Center, Panama City Division Testing Range, as described in Table 2.8-3 and Section 3.0.5.3.1.4 (Swimmer Defense Airguns), and are included here because they produce underwater impulsive sound.

Nearshore waters are the primary foraging habitat for many seabird species. Birds near shore at Naval Surface Warfare Center, Panama City Division Testing Range could be exposed to noise from explosive detonations associated with the testing activities. Some surface detonations could occur near areas with the potential for relatively higher concentrations of seabirds near the western frontal boundary of the Gulf Stream (see Figures 3.0-2 and 3.0-3). Any impacts on seabirds may be greater in these areas. Most explosions in air would occur at altitudes above those where most birds would be expected to be present, although it is possible that high-altitude migrating birds could be exposed to a detonation. In addition, some airborne detonations targeting threat missiles could impact foraging birds at lower altitudes.

Due to the large charge sizes detonated during ship shock trials, these activities are given extra consideration. Highly productive areas such as water mass boundaries were avoided during the site selection process, reducing the likelihood of the presence of foraging seabirds (U.S. Department of the Navy 2008). No endangered or threatened bird species are expected to be present at or near the Jacksonville location, off the east coast of Florida, however, Bermuda petrels and roseate terns may occur offshore of Norfolk, Virginia. Seabirds resting or feeding at the surface or diving could also be killed or injured by the underwater shock wave. Any seabirds on the water surface or in the air immediately above the ship shock charge detonation point could be killed or stunned by cavitation or by the plume of water ejected into the air (refer to Section 3.0.5.3.1, Acoustic Stressors, for a description of large underwater detonations). This could happen if surface floats or ships attract birds to the detonation point.

Although the impacts to birds are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual bird would remain the same. For the same reasons provided in Section 3.6.3.1.2.1 (No Action Alternative), long-term impacts and potential mortality to a few individuals, and other short-term startle reactions to dispersed testing events, are not expected to result in population-level impacts.

The increase in activities would increase the potential to expose ESA-listed birds to effects from explosions. Bermuda petrels and roseate terns could be present in range complexes where explosives are used, including near the ship shock trial site offshore of Norfolk, Virginia. Although injurious exposures could occur, the likelihood is expected to be low based on the limited in-air range of injury from most explosions and the expected low density of these birds. In addition, because of the limited number of airgun events and the short duration of roseate tern and red knot dives, use of airguns is not expected to impact nearshore roseate terns. Piping plovers may be briefly disturbed in the vicinity of nearshore testing at Naval Surface Warfare Center, Panama City Division Testing Range; however, they would not forage or migrate in the open ocean areas where other detonations occur.

Suitability of critical habitat designated in coastal shore areas for piping plover to support roosting, refuge, and feeding would not be affected by explosions offshore or by in-air detonations. Designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems; however, none of these areas overlap with the use of explosives in the Study Area. Two of the primary constituent elements of critical habitat required by piping plover (i.e., sheltering and roosting) are applicable to their terrestrial beach habitats (above the high tide line), which are outside of the Study Area. The other primary constituent element is foraging. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations where explosives are used. Therefore, explosives will not affect piping plover critical habitat.

Pursuant to the ESA, the use of explosives and swimmer defense airguns during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed piping plover, Bermuda petrel, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives and other impulsive sources during testing activities described under Alternative 1would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.1.2.2 (Alternative 1).

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed piping plover, Bermuda petrel, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The number of annually recurring testing activities that use explosions under Alternative 2 would increase compared to the No Action Alternative. The most substantial increase in explosives use would occur during the ship shock trials of three platforms in the VACAPES or JAX Range Complexes - aircraft carrier (one event in five years), destroyer (one event in five years), and Littoral Combat Ship (two events in five years). Compared to Alternative 1, the number of detonations during annually recurring testing activities would increase by approximately 10 percent. Types of testing activities (both annually recurring activities and ship shock trials), source classes, and locations would be the same as those under Alternative 1. The number of testing activities using explosives and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives). In addition, small airguns would create underwater impulsive noise during a small number of pierside integrated swimmer defense testing activities at pierside locations at Joint Expeditionary Base Little Creek, Norfolk, Virginia, and at Newport, Rhode Island, and during Stationary Source Testing at Naval Surface Warfare Center, Panama City Division Testing Range, as described in Table 2.8-3 and Section 3.0.5.3.1.4 (Swimmer Defense Airguns), and are included here because they produce underwater impulsive sound.

Although the impacts to birds are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual bird would remain the same. For the same reasons provided in Section 3.6.3.1.2.1 (No Action Alternative), long-term impacts and potential mortality to a few individuals, and other short-term startle reactions to dispersed training events, are not expected to result in population-level impacts. Potential impacts to ESA-listed species and critical habitat are expected to be substantially similar to those discussed under Alternative 2.

Pursuant to the ESA, the use of explosives and swimmer defense airguns during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed piping plover, Bermuda petrel, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from explosives and other impulsive sources during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.3 Impacts from Pile Driving

Impact pile driving and vibratory pile removal would occur during construction of an elevated causeway system during Joint Logistics Over-the-Shore training. A separate environmental assessment has been prepared to address impacts due to all activities that occur during Joint Logistics Over-the-Shore training, with the exception of impacts due to in-water noise generated during construction of the elevated causeway. This EIS/OEIS includes analysis of the impact of underwater noise generated by pile driving during elevated causeway construction to facilitate holistic analysis of impacts due to all underwater noise generated during testing and training in the Study Area.

Impact pile driving and vibratory pile removal would create underwater sound in nearshore areas where some birds forage. Birds that forage by going under the water surface, such as by plunge-diving, could be exposed to these sounds. Potential impacts from pile driving are considered in the context of Section 3.0.5.7.1 (Conceptual Framework for Assessing Effects from Sound-Producing Activities). Noises produced during pile driving are discussed in Section 3.0.5.3.1.3 (Pile Driving).

Underwater impulses from the impact hammer are broadband and carry most of their energy in the lower frequencies. The impulses are within the hearing range of most seabirds and can produce a shock wave that is transmitted through the sediment and water column (Section 3.0.5.3.1.3, Pile Driving). Exposure to high sound pressure levels from pile driving can result in barotrauma, or physical injury caused by a difference in pressure between an air space inside the body and the surrounding gas or liquid. In addition, high sound exposure levels could potentially cause a threshold shift, temporarily or permanently affecting hearing sensitivity over the affected frequency range.

It is expected that some birds may exhibit an annoyance reaction and flee from the pile driving location; however, others may continue to forage close to the construction area and be exposed to associated noise. If prey species, such as fish, could be killed or injured as a result of pile driving, they could serve as an attractant and compound the issue of underwater noise exposure of birds that forage underwater. Behavioral responses and displacement from the area are expected to be temporary for the duration of the pile driving and removal activities.

Sound produced from a vibratory hammer is similar in frequency range to that of the impact hammer, except the source levels are much lower. Since the vibrations oscillate at a rate of 1,700 cycles per minute, it is considered a continuous sound source. The potential for injury is considered to be less than that for impact pile driving, and it is considered unlikely that seabirds would be exposed to injurious levels of sound from the vibratory hammer. Any avoidance of the area is expected to be temporary and is expected to occur only while the vibratory hammer is in use. There may be potential for masking of underwater sounds during underwater foraging; however, it is unknown to what extent birds present in the Study Area may rely on underwater sounds during foraging.

3.6.3.1.3.1 No Action Alternative

Training Activities

Under the No Action Alternative, pile driving would not occur during training activities.

Testing Activities

Under the No Action Alternative, pile driving would not occur during testing activities.

3.6.3.1.3.2 Alternative 1

Training Activities

Pile driving would occur during the construction and removal phases of the elevated causeway training activities nearshore and within the surf zone at Joint Expeditionary Base Little Creek–Fort Story, Virginia Beach, Virginia or Marine Corps Base Camp Lejeune, North Carolina. Elevated causeway construction would occur no more than once a year at one location. Training involves the use of an impact hammer to drive the piles into the sediment and a vibratory hammer is used to remove the piles. Construction activity would last about two weeks, with about eight piles driven per day. When training events that use the elevated causeway system are complete, the structure would be removed using vibratory methods over approximately seven to ten days. Crews can remove about 14 piles per day. Piles are driven and removed individually (i.e., not simultaneously).

Diving birds may potentially be exposed to underwater sounds from pile driving. Potentials for injury, hearing loss, or behavioral reactions due to pile driving and removal are expected to be low because individual pile driving and removal occurs over a short period (about 10 minutes per pile) and bird dives are usually brief. Birds that undertake longer dives could have a greater potential to be exposed to injurious levels of sound exposure. If a bird is exposed underwater at a close range, it could be injured or experience impacts to its hearing. Injury could reduce fitness and long-term survival. Impacts to the ability to sense biologically important sounds, such as predators or prey, could also be a long-term consequence, reducing that animal's fitness.

Behavioral reactions to in-water sound are expected to include alert responses, startle responses, or temporary increases in heart rate. Some birds may avoid the area during pile driving activities, which occur intermittently for a two-week period at a site. There may be potential for masking of underwater sounds during underwater foraging; however, it is unknown to what extent birds present in the Study Area may rely on underwater sounds during foraging. Startle reactions and temporary avoidance may disrupt foraging in the vicinity of the pile driving activity, however, these impacts are expected to only occur for the duration of the pile driving activity, which would only occur once per year and for brief periods of time during each construction day. For these reasons, the impact of noise produced by pile driving on birds under Alternative 1 would be short-term and localized, and is not expected to have any population-level impacts.

Bermuda petrels and red knots are highly unlikely to be present in coastal areas where pile driving would occur. Piping plovers and red knots do not submerge while foraging; therefore, they would not be exposed to underwater sound from pile driving. Roseate terns may briefly submerge while foraging, so there is a remote chance that a roseate tern could be exposed to underwater sound from pile driving and may avoid foraging in areas around the pile driving site for the duration of the activity. Pile driving activities would not occur at beaches that are designated as piping plover critical habitat.

Pursuant to the ESA, pile driving during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern and piping plover;*
- *will have no effect on the ESA-listed Bermuda petrel;*
- *will have no effect on the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from pile driving during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 1, pile driving would not occur during testing activities.

3.6.3.1.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.1.3.2 (Alternative 1).

Pursuant to the ESA, pile driving during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed roseate tern and piping plover;*
- *will have no effect on the ESA-listed Bermuda petrel;*
- *will have no effect on the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from pile driving during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 2, pile driving would not occur during testing activities.

3.6.3.1.4 Impacts from Weapons Firing, Launch, and Impact Noise

Navy activities in the Study Area include firing or launching a variety of weapons, including missiles; rockets; and small-, medium-, and large-caliber projectiles. Types of weapons firing activities, the sounds they produce, and areas where weapons firing are most likely to occur are described in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Because most weapons firing activities occur far from shore, seabirds that forage or migrate greater than 3 nm offshore are most likely to hear and respond to weapons firing noise. In addition to noise from weapons firing and launching, birds could be briefly disturbed by the impact of non-explosive practice munitions at the water surface.

Sounds produced by weapons firing (muzzle blast), launch boosters, and projectile travel are potential stressors to birds. Sound generated by a muzzle blast is intense, but very brief. A seabird very close to a large weapons blast could be injured or experience hearing loss due to acoustic trauma or threshold shift. Sound generated by a projectile travelling at speeds greater than the speed of sound can produce

a sonic boom in a narrow area around its flight path. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or physiological responses such as alert responses, startle responses, or temporary increases in heart rate. Once surface weapons firing activities begin, birds would likely disperse away from the area around the ship and the path of projectiles.

Other activities in the general area that precede these activities, such a vessel movement or target setting, potentially would disperse birds away from the area in which weapons-firing noise would occur. Species such as frigatebirds and sooty terns seem to avoid vessels (Borberg et al. 2005; Hyrenbach 2006). Any increased ship activity at a critical time or in an important foraging area could drive these and other species from their natural habitat (Borberg et al. 2005). On the other hand, some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses (Hamilton III 1958; Hyrenbach 2001, 2006). A number of seabird species are attracted to ships because of the increased potential for foraging success (Dietrich and Melvin 2004; Melvin et al. 2001). The propeller wake generated by all ships, but particularly larger ships, disrupts the water column, causing prey to be brought to the surface where it is more easily captured by a greater variety of seabird species. Seabirds that are attracted to ships are more likely to be exposed to weapons firing noise.

Airborne weapons firing at airborne targets typically occur at high altitudes of 15,000 to 25,000 ft. during air-to-air gunnery exercises. Noise generated by firing at such high altitudes is unlikely to generate a strong reaction in birds migrating at lower altitudes or foraging at the surface. The altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) with the majority below 3,000 ft. (914 m) (Lincoln 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m).

3.6.3.1.4.1 No Action Alternative

Training Activities

Weapons firing, launch, and non-explosive impact noise would be associated with small-, medium-, and large-caliber munitions; missiles; and bombs (non-explosive impact) used during training under the No Action Alternative. Activities are spread throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes, as described in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). The types of noise produced are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise).

Exposure of seabirds to weapons firing, launch, and impact noise would be very brief and temporary. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or physiological responses such as alert responses, startle responses, or temporary increases in heart rate. While an individual bird may be exposed to multiple noises during a weapons firing activity, repeated exposures to individual birds over days is extremely unlikely. Both birds and Navy vessels change location frequently, and weapons firing and launch activities occur over short periods of time. Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds (unless they are very close to the muzzle blast). Activities with multiple weapons blasts may cause birds to disperse from the area for the duration of the firing activity. Because weapons firing activities would not occur close to shore where seabird colonies are located, large impacts on breeding seabird populations would not result from weapons-firing noise. For these reasons, the impact on seabirds of noise produced by weapons

firing under the No Action Alternative would be minor and short-term and would not have any population-level impacts.

Because weapon firing occurs at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed or candidate species could be exposed to and temporarily disturbed by weapons firing and associated noise. Birds that migrate or forage in open ocean areas could be exposed to weapons firing, launch, and impact noise, including foraging and migrating Bermuda petrels; migrating roseate terns; and migrating red knots. Temporary disturbance due to weapons noise is not expected to result in major impacts on these ESA-listed or candidate species. Because weapons firing would occur offshore, roseate tern nesting colonies in the Key West Range Complex are unlikely to be disturbed. Piping plovers would not be present in the offshore areas where weapons are fired; additionally, weapons firing noise would not overlap with piping plover critical habitat.

Pursuant to the ESA, weapons firing, launch, and impact noise generated during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Weapons firing, launch, and non-explosive impact noise would be associated with small-, medium-, and large-caliber munitions; missiles; rockets; and bombs (non-explosive impact) used during testing under the No Action Alternative. Activities are spread throughout the Study Area but would be concentrated in VACAPES and JAX Range Complexes, with events in the GOMEX and Northeast Range Complexes, as described in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). The types of noise produced are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise).

Exposure of seabirds to weapons firing, projectile noise, and launch noise would be very brief and temporary. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or physiological responses such as alert responses, startle responses, or temporary increases in heart rate. While an individual bird may be exposed to multiple noises during a weapons-firing activity, repeated exposures to individual birds over days is extremely unlikely. Both birds and Navy vessels change location frequently, and weapons firing and launch activities occur over short periods. Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds (unless they are

very close to the muzzle blast). Activities with multiple weapons blasts may cause birds to disperse from the area for the duration of the firing activity. Because weapons-firing activities would not occur close to shore where seabird colonies are located, large impacts on breeding seabird populations would not result from weapons-firing noise. For these reasons, the impact of noise produced by weapons firing on seabirds under the No Action Alternative would be minor and short-term, and would not have any population-level impacts.

Because weapon firing occurs at varying locations over a short period and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed or candidate species could be exposed to and temporarily disturbed by weapons firing and associated noise. Birds that migrate or forage in open ocean areas could be exposed to weapons firing, launch, and impact noise, including foraging and migrating Bermuda petrels; migrating roseate terns; and migrating red knots. Temporary disturbance due to weapons noise is not expected to result in major impacts on these ESA-listed or candidate species. Because weapons firing would occur offshore, roseate tern nesting colonies in the Key West Range Complex are unlikely to be disturbed. Piping plovers would not be present in the offshore areas where weapons are fired; additionally, weapons firing noise would not overlap with piping plover critical habitat.

Pursuant to the ESA, weapons firing, launch, and impact noise generated during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.4.2 Alternative 1

Training Activities

Weapons firing, launch, and non-explosive impact noise would be associated with small-, medium-, and large-caliber munitions; missiles; and bombs (non-explosive impact) used during training under Alternative 1. Activities are spread throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, JAX, and Gulf of Mexico Range Complexes, as described in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). The types of noise produced are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Due to increased numbers of activities, noise produced by these activities would increase under Alternative 1 compared to the No Action Alternative.

Exposure of seabirds to weapons firing, launch, and impact noise would be very brief and temporary. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or

physiological responses such as alert responses, startle responses, or temporary increases in heart rate. While an individual bird may be exposed to multiple noises during a weapons firing activity, repeated exposures to individual birds over days is extremely unlikely. Both birds and Navy vessels change location frequently, and weapons firing and launch activities occur over short periods. Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds (unless they are very close to the muzzle blast). Activities with multiple weapons blasts may cause birds to disperse from the area for the duration of the firing activity. Because weapons firing activities would not occur close to shore where seabird colonies are located, large impacts on breeding seabird populations would not result from weapons firing noise. For these reasons, the impact of noise produced by weapons firing on seabirds under Alternative 1 would be minor and short-term and would not have any population-level impacts.

Because weapons firing occurs at varying locations over a short time and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed or candidate species could be exposed to and temporarily disturbed by weapons firing and associated noise. Birds that migrate or forage in open ocean areas could be exposed to weapons firing, launch, and impact noise, including foraging and migrating Bermuda petrels; migrating roseate terns; and migrating red knots. Temporary disturbance due to weapons noise is not expected to result in major impacts on these ESA-listed or candidate species. Because weapons firing would occur offshore, roseate tern nesting colonies in the Key West Range Complex are unlikely to be disturbed. Piping plovers would not be present in the offshore areas where weapons are fired; additionally, weapons firing noise would not overlap with piping plover critical habitat.

Pursuant to the ESA, weapons firing, launch, and impact noise generated during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during training activities described under the Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Weapons firing, launch, and non-explosive impact noise would be associated with small-, medium-, and large-caliber munitions; missiles; rockets; and bombs (non-explosive impact) used during testing under Alternative 1. Activities are spread throughout the Study Area but would be concentrated in VACAPES and JAX Range Complexes, with events in the Northeast and GOMEX Range Complexes, as described in Tables 2.8-2 to 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). The types of noise produced are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise

produced by these activities would substantially increase under Alternative 1 compared to the No Action Alternative.

Exposure of seabirds to weapons firing, and launch noise would be very brief and temporary. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or physiological responses such as alert responses, startle responses, or temporary increases in heart rate. While an individual bird may be exposed to multiple noises during a weapons firing activity, repeated exposures to individual birds over days is extremely unlikely. Both birds and Navy vessels change location frequently, and weapons firing and launch activities occur over short periods. Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns such as migrating, breeding, feeding, and sheltering or to result in serious injury to any seabirds (unless they are very close to the muzzle blast). Activities with multiple weapons blasts may cause birds to disperse from the area for the duration of the firing activity. Because weapons firing activities would not occur close to shore where seabird colonies are located, large impacts on breeding seabird populations would not result from weapons firing noise. For these reasons, the impact of noise produced by weapons firing on seabirds under Alternative 1 would be minor and short-term, and are not expected to have any population-level impacts.

Because weapon firing occurs at varying locations over a short period and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed or candidate species could be exposed to and temporarily disturbed by weapons firing and associated noise. Birds that migrate or forage in open ocean areas could be exposed to weapons firing, launch, and impact noise, including foraging and migrating Bermuda petrels; migrating roseate terns; and migrating red knots. Temporary disturbance due to weapons noise is not expected to result in major impacts on these ESA-listed or candidate species. Because weapons firing would occur offshore, roseate tern nesting colonies in the Key West Range Complex are unlikely to be disturbed. Piping plovers would not be present in the offshore areas where weapons are fired; additionally, weapons firing noise would not overlap with piping plover critical habitat.

Pursuant to the ESA, weapons firing, launch, and impact noise generated during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.4.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.1.4.2 (Alternative 1).

Pursuant to the ESA, weapons firing, launch, and impact noise generated during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Weapons firing, launch, and non-explosive impact noise would be associated with small-, medium-, and large-caliber munitions; missiles; rockets; and bombs (non-explosive impact) used during testing under Alternative 2. Activities are spread throughout the Study Area but would be concentrated in VACAPES and JAX Range Complexes, with events in the Northeast and GOMEX Range Complexes, as described in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). The types of noise produced are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise produced by these activities would substantially increase under Alternative 2 compared to the No Action Alternative. The number of testing events producing weapons noise under Alternative 2 would increase by approximately 10 percent over Alternative 1.

Although more birds could be exposed to weapons noise under Alternative 2 than under the No Action Alternative, the types of impacts to individual birds are expected to be the same. Although individual birds may exhibit short-term behavioral reactions, long-term impacts to populations are not expected. In addition, although exposures to weapons noise impacts to ESA-listed Bermuda petrels and roseate terns and ESA-candidate red knots may increase, the types of impacts are not expected to differ from those discussed under Alternative 1.

Pursuant to the ESA, weapons firing launch, and impact noise generated during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from weapons firing, projectile, launch, and impact noise during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5 Impacts from Aircraft and Vessel Noise

Various types of fixed-wing aircraft, helicopters, and vessels are used in most training and testing activities throughout the Study Area. Therefore, seabirds and other migratory birds could be exposed to airborne noise associated with fixed-wing aircraft overflights (subsonic and supersonic), helicopter activities, and vessels throughout the Study Area. See Section 3.0.5.3.1.7 (Aircraft Overflight Noise) for a description of aircraft noise generated during training and testing activities.

Responses to airborne noise could include short-term behavioral or physiological reactions, such as alert response, startle response, or temporary increase in heart rate, which are likely to be more acute for sonic boom exposures. Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 dBA re 20 µPa. While the experiment provided good control on simulated aircraft noise levels, preliminary observations of tern colonies responses to balloon overflights suggest that visual stimulus is likely to be an important component of disturbance from overflights (Brown 1990). Raptor and wading birds have responded minimally to jet (100-110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively (Ellis 1981). Jet flights greater than 1,640 ft. (500 m) distance from raptors were observed to elicit no response (Ellis 1981). However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received sound levels of 101–116 dBA re 20 µPa (Burger 1981). The impacts of low-level military training flights on wading bird colonies in Florida were estimated using colony distributions and turnover rates. There were no demonstrated impacts of military activity on wading bird colony establishment or size (Black et al. 1984). Fixed-winged jet aircraft disturbance did not seem to adversely affect waterfowl observed during a study in coastal North Carolina (Conomy et al. 1998); however, harlequin ducks were observed to show increased agonistic behavior and reduced courtship behavior up to one to two hours after low altitude military jet overflights (Goudie and Jones 2004).

Masking is another potential impact of exposure to aircraft or vessel noise. Aircraft and vessel noise may temporarily interfere with detection of conspecifics, predators, and prey.

Most activities using fixed-wing aircraft occur at distances greater than 12 nm offshore. Birds could be exposed to elevated noise levels while foraging or migrating in these open water environments. Most fixed-wing sorties would occur greater than 3,000 ft. altitude and would be associated with air combat maneuver training, tracking exercises, and aircraft testing. Typical altitudes would range from 5,000 to 30,000 ft., and typical airspeeds would range from very low (less than 100 knots) to high subsonic (less than 600 knots). Sound exposure levels at the sea surface from most air combat maneuver overflights

are expected to be less than 85 dBA re 20 µPa, based on an F/A-18 aircraft flying at an altitude of 5,000 ft. and at a subsonic airspeed of 400 knots. Exceptions include sorties associated with air-to-surface munitions delivery and sonobuoy drops from 500 to 5,000 ft. altitude. Bird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead.

Some air combat maneuver training would involve high altitude, supersonic flight, which would produce sonic booms, but such airspeeds would be infrequent. Boom duration is generally less than 300 milliseconds. Sonic booms would cause birds to startle, but the exposure would be brief, and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or at worst, a flight response. Because most fixed-wing flights are not supersonic and both seabirds and aircraft are transient in any area, exposure of seabirds in the open ocean to sonic booms would be infrequent. It is unlikely that individual seabirds would be repeatedly exposed to sonic booms in the open ocean.

Birds could sensitize or habituate to repeated exposures to sonic booms and aircraft noise. Habituation seems unlikely in the open water portions of the Study Area given the widely dispersed nature of the operations and the relative infrequency of the activities. Repeated exposures could occur to populations that are not transient, such as nesting birds. It is possible that birds could habituate and no longer exhibit behavioral responses, as has been documented for some impulsive noise sources (Ellis 1981; Russel Jr. et al. 1996) and aircraft noise (Conomy et al. 1998). It is also possible that birds could sensitize from routinely flushing when hearing the noise to completely abandoning an area. Near-total failure of sooty tern nesting in the Dry Tortugas in the Key West Range Complex was reported in 1969 during a period when the birds were regularly exposed to sonic booms (Austin et al. 1970). In previous seasons, the birds were reported to react to the occasional sonic booms by rising immediately in a "panic flight," circling over the island, and then usually settling down on their eggs again. Researchers had no evidence that sonic booms caused physical damage to the sooty tern eggs, but hypothesized that the strong booms occurred often enough to disturb the sooty terns' incubating rhythm and cause nest desertion. The 1969 sooty tern nesting failure also prompted additional research to test the hypothesis that sonic booms could cause bird eggs to crack or otherwise affect bird eggs or embryos. However, the findings of the additional research were contrary to this hypothesis (Bowles et al. 1991; Bowles et al. 1994; Teer and Truett 1973; Ting et al. 2002). That same year, the colony also contained approximately 2,500 brown noddies, whose young hatched successfully. While it was impossible to conclusively determine the cause of the 1969 sooty tern nesting failure, actions were taken to curb planes breaking the sound barrier within range of the Tortugas, and much of the excess vegetation was cleared (another hypothesized contributing factor to the nesting failure). Similar nesting failures have not been reported since the 1969 failure.

Currently, the Tortugas Military Operations Area is a unique block of special use airspace above the Dry Tortugas National Park that has special flight rules designed to minimize military aircraft noise. Voluntary flight restrictions include a "no sonic boom" area over the Dry Tortugas and a 5,000-ft. (1.5-km) aboveground level floor for air combat maneuver flights. The "no sonic boom" area, which extends 12 nm and 20,000 ft. (6.1 km) above ground level from the Dry Tortugas, limits aircraft to subsonic speeds within this area. Audible sonic booms within the Dry Tortugas National Park are predicted to be infrequent and at low received levels based on voluntary measures implemented by the Navy to reduce the occurrence of focused sonic booms in the Tortugas Military Operations Area. In addition, initial efforts by Florida Fish and Wildlife Conservation Commission and National Park Service biologists to reestablish a nesting colony of the federally listed roseate tern in the Dry Tortugas have been successful. During this time, Navy use of the Tortugas Military Operations Area and surrounding

Special Use Airspace remained constant. National Park Service staff recorded 25 sonic booms in 2007 and 40 in 2008. Given the increase in nests coincident with air combat maneuver training, the aircraft training following guidelines of the Military Operations Area has likely had minimal impact on nesting roseate terns.

Unlike fixed-wing aircraft, helicopters typically operate below 1,000 ft. altitude and often as low as 75–100 ft. altitude. This low altitude increases the likelihood that birds would respond to noise from helicopter overflights. Helicopters travel at slower speeds (less than 100 knots), which increases durations of noise exposure compared to fixed-wing aircraft. In addition, some studies have suggested that birds respond more to noise from helicopters than from fixed-wing aircraft (Larkin et al. 1996). Helicopter flights are generally limited to locations closer to the coast, unless deployed onboard ships. Helicopter flights, therefore, are more likely to impact the greater numbers of seabirds that forage in coastal areas than those that forage in open ocean areas. Nearshore areas of the coast are the primary foraging habitat for many seabird species. Noise from low-altitude helicopter overflights may elicit short-term behavioral or physiological responses, such as alert responses, startle responses, or temporary increases in heart rate, in exposed birds. Repeated exposure of individual birds or groups of birds is unlikely, based on the dispersed nature of the overflights. The general health of individual birds would not be compromised.

Foraging seabirds as well as most migrating birds would be present below the altitude of fixed-wing flights, but could potentially be exposed to nearby noise from helicopters at lower altitudes. Altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) with the majority below 3,000 ft. (914 m) (Lincoln et al. 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m) (Lincoln et al. 1998).

Naval combat vessels are designed to be quiet to avoid detection; therefore, any disturbance to birds is expected to be due to visual, rather than acoustic, stressors. Other training and testing support vessels, such as rigid hull inflatable boats, use outboard engines that can produce substantially more noise even though they are much smaller than warships. Noise due to watercraft with outboard engines or noise produced by larger vessels operating at high speeds may briefly disturb some birds while foraging or resting at the water surface. However, the responses due to both acoustic and visual exposures are likely related and difficult to distinguish.

3.6.3.1.5.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights and vessel movements throughout the Study Area. The highest concentrations of fixed-wing aircraft noise would be associated with the greater number of flights in the VACAPES and Key West Range Complexes compared to other portions of the Study Area. Most helicopter training would occur adjacent to fleet concentration areas at Naval Station Norfolk (lower Chesapeake Bay and off the coast of Virginia Beach, Virginia) and at Naval Station Mayport, Jacksonville, Florida; in Onslow Bay, North Carolina; and off the coast of Naval Surface Warfare Center, Panama City Division Testing Range. Concentrations of vessel movements throughout the Study Area are discussed in Section 3.0.5.3.3.1 (Vessels).

Birds using wetlands, mud flats, beaches, and other shoreline habitats or shallow coastal foraging areas would be exposed to noise from nearshore helicopter training and aircraft in transit to offshore training

areas. The presence of dense aggregations of sea ducks, other seabirds, and migrating land birds is a potential concern during low-altitude helicopter activities. Although birds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots avoid large flocks of birds to protect aircrews and equipment, thereby reducing disturbance to birds as well.

Navy aircraft training activities over the Atlantic Ocean are concentrated near the outer continental shelf and the Gulf Stream. Pelagic seabirds that forage offshore may have greater presence in these productive areas, so aircraft overflights may cause more behavioral disturbances in these areas. A seabird in the open ocean would be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. Seabirds foraging or migrating through a training area in the open ocean may respond by avoiding areas of concentrated aircraft noise. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the overflights.

Seabirds and migratory birds may be exposed to sonic booms infrequently while flying or foraging in the Study Area or while feeding, perching, or nesting on one of the islands in the Dry Tortugas or the Marquesas Keys in the Key West Range Complex. In the Key West Range Complex, Navy Special Use Airspace surrounds the Tortugas Military Operations Area, and air combat maneuver training occurs regularly in the Special Use Airspace above and beside the Military Operations Area. Consequently, aircraft noise, including sonic boom noise, is sometimes audible in the Dry Tortugas National Park. Wintering piping plovers and nesting roseate terns could be exposed to noise associated with aircraft overflights, including sonic booms, in the vicinity of the Dry Tortugas or the Marquesas Keys. Aircraft overflights are expected to elicit short-term behavioral responses in nesting birds at Dry Tortugas National Park. Chronic stress, nest abandonment, or population-level impacts are not expected to occur. Similarly, aircraft overflights are expected to elicit short-term behavioral responses in birds at Marquesas Keys based on their location on the extreme eastern boundary of W-174E in the Key West Range Complex, where fewer low-altitude overflights occur in comparison to other Special Use Airspace blocks. Based on current airspace usage and bird presence, routine flushing during the nesting season or abandonment of a nesting area would not be expected.

Although noise associated with vessel movements would be produced during most sea-based training activities, the most acute noise exposure would be expected from small craft using outboard engines. Any vessel noise disturbance is expected to be very brief and inconsequential. Any reactions may be due more to visual detection of an approaching vessel than to acoustic disturbance.

Occasional startle or alert reactions to aircraft and vessels are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any seabirds. Helicopter overflights would be more likely to elicit responses than fixed-wing aircraft, but the general health of individual birds would not be compromised. For these reasons, the impact of noise produced by Navy aircraft and vessels on seabirds under the No Action Alternative would be minor and short-term. Short-term impacts on individual birds are not expected to impact seabird populations.

ESA-listed or candidate birds may be exposed to vessel and aircraft noise. Coastal roseate terns, red knots, and piping plovers could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast and vessel noise from nearshore boats. If present in the open water areas where training activities involving aircraft overflights occur, roseate terns, red knots, and Bermuda petrels could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-

term or population-level impacts are expected. Critical habitat for wintering piping plovers is designated in the Marquesas Keys. Although there could be intermittent increases in ambient noise levels, aircraft overflights would not impact the ability of critical habitat designated in the Marquesas Keys to support roosting, refuge, or feeding of wintering piping plovers.

Pursuant to the ESA, aircraft and vessel noise generated during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights and vessel movements throughout the Study Area. Aircraft flights associated with testing are primarily concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes, although aircraft flights associated with testing activities would also be concentrated in the Northeast Range Complexes, including adjacent inland waters, and in the Gulf of Mexico, especially in areas near Naval Surface Warfare Center, Panama City Division Testing Range. Concentrations of vessel movements throughout the Study Area are discussed in Section 3.0.5.3.3.1 (Vessels).

Birds using wetlands, mud flats, beaches, and other shoreline habitats or shallow coastal foraging areas would be exposed to noise from nearshore helicopters and aircraft in transit to offshore areas. The presence of dense aggregations of sea ducks, other seabirds, and migrating land birds is a potential concern during low-altitude helicopter activities. Although birds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots avoid large flocks of birds to protect aircrews and equipment, thereby reducing disturbance to birds.

Navy aircraft testing activities over the Atlantic Ocean are concentrated near the outer continental shelf and the Gulf Stream. Pelagic seabirds that forage offshore may have greater presence in these productive areas, so aircraft overflights may cause more behavioral disturbances in these areas. A seabird in the open ocean would be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. Seabirds foraging or migrating through a testing area in the open ocean may respond by avoiding areas of concentrated aircraft noise. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the overflights. Although noise associated with vessel movements would be produced during most sea-based testing activities, the most acute noise exposure would be expected from small craft using outboard engines. Any vessel noise disturbance is expected to be very brief and inconsequential. Any reactions may be due more to visual detection of an approaching vessel than to acoustic disturbance.

Occasional startle or alert reactions to aircraft and vessels are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Helicopter overflights would be more likely to elicit responses than fixed-wing aircraft, but the

general health of individual birds would not be compromised. For these reasons, the impact of noise produced by Navy aircraft and vessels on seabirds under the No Action Alternative would be minor and short-term. None of these noise exposures are expected to impact bird populations.

If present in the open water areas where testing activities involving aircraft overflights occur, roseate terns and Bermuda petrels could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. Short-term impacts on individual birds are not expected to impact seabird populations.

ESA-listed or candidate birds may be exposed to vessel and aircraft noise. Coastal roseate terns, red knots, and piping plovers could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast and vessel noise from nearshore boats. If present in the open water areas where testing activities involving aircraft overflights occur, roseate terns, red knots, and Bermuda petrels could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-term or population-level impacts are expected. Critical habitat for wintering piping plovers is designated in the Marquesas Keys. Although there could be intermittent increases in ambient noise levels, aircraft overflights would not impact the ability of critical habitat designated in the Marquesas Keys to support roosting, refuge, or feeding of wintering piping plovers.

Pursuant to the ESA, aircraft and vessel noise generated during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5.2 Alternative 1

Training Activities

Training activities proposed under Alternative 1 would increase aircraft flight hours and vessel transits compared to the No Action Alternative. The locations and types of activities are expected to be similar to those under the No Action Alternative.

Although overall aircraft and vessel noise would increase over the No Action Alternative, impacts on individual birds would be similar. Based on the increased activities under Alternative 1, more birds could be exposed to noise; the number of times an individual bird is exposed could also increase. Similar to the No Action Alternative, responses are expected to be short-term behavioral or physiological reactions, but the general health of individual birds is not expected to be compromised. Short-term impacts on individual birds are not expected to impact seabird populations. Although noise due to aircraft flights and vessel transits would increase, impacts on ESA-listed species and critical habitat would be similar as under the No Action Alternative.

Pursuant to the ESA, aircraft and vessel noise generated during training activities under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during training activities described under the Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing Activities proposed under Alternative 1 would increase aircraft flights and vessel transits from the No Action Alternative, leading to an increase in aircraft- and vessel-related noise in some portions of the Study Area. Aircraft flights associated with testing are primarily concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes, although aircraft flights associated with testing activities would also be concentrated in the Northeast Range Complexes, including adjacent inland waters, and in the Gulf of Mexico, especially in areas near Naval Surface Warfare Center, Panama City Division Testing Range, Florida.

Although overall aircraft noise would increase over the No Action Alternative, impacts on individual birds would be similar. Based on the increased activities under Alternative 1, more birds could be exposed to noise; the number of times an individual bird is exposed could also increase. Similar to the No Action Alternative, responses are expected to be short-term behavioral or physiological reactions, but the general health of individual birds is not expected to be compromised. Short-term impacts on individual birds are not expected to impact seabird populations. Although noise due to aircraft flights and vessel transits would increase, impacts on ESA-listed species and critical habitat would be similar as under the No Action Alternative.

Pursuant to the ESA, aircraft and vessel noise generated during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during testing activities described under the Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5.3 Alternative 2 (Preferred Alternative)

Training Activities

Training activities proposed under Alternative 2 would increase aircraft flight hours compared to the No Action Alternative, specifically due to a 20 percent increase in air combat maneuvers in the Key West Range Complex. Other than the increase in noise generated by the increase in flight hours at Key West Range Complex, the number and location of training activities producing aircraft and vessel noise under Alternative 2 are identical to training activities under Alternative 1.

Although overall aircraft and vessel noise would increase over the No Action Alternative, impacts on individual birds would be similar. Based on the increased activities under Alternative 2, more birds could be exposed to noise; the number of times an individual bird is exposed could also increase. Similar to the No Action Alternative, responses are expected to be short-term behavioral or physiological reactions, but the general health of individual birds is not expected to be compromised. Short-term impacts on individual birds are not expected to impact seabird populations. Although noise due to aircraft flights and vessel transits would increase, impacts on ESA-listed species and critical habitat would be similar as under the No Action Alternative.

Pursuant to the ESA, aircraft and vessel noise generated during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing Activities proposed under Alternative 2 would increase aircraft flights and vessel transits compared to both the No Action Alternative and Alternative 1, leading to an increase in aircraft- and vessel-related noise in some portions of the Study Area. Aircraft flights associated with testing are primarily concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes, although aircraft flights associated with testing activities would also be concentrated in the Northeast Range Complexes, including adjacent inland waters, and in the Gulf of Mexico, especially in areas near Naval Surface Warfare Center, Panama City Division Testing Range, Florida.

Although overall aircraft and vessel noise would increase over the No Action Alternative, impacts on individual birds would be similar. Based on the increased operations under Alternative 2, more birds could be exposed to noise; the number of times an individual bird is exposed could also increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions, and the general health of individual birds would not be compromised. Short-term impacts on individual birds are not expected to impact seabird populations. Although noise due to aircraft and vessels would increase over Alternative 1, the types of impacts on Bermuda petrels, piping plovers, red knots, and roseate terns, as well as to piping plover critical habitat, would not differ substantially from those under Alternative 1.

Pursuant to the ESA, aircraft and vessel noise generated during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, and roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft and vessel noise during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from (1) electromagnetic devices, and (2) high energy lasers.

3.6.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. Electromagnetic training and testing activities include an array of magnetic sensors used in mine countermeasure operations in the Study Area. For a discussion of the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.2.1 (Electromagnetic Devices). Aspects of electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

Seabirds are known to use the Earth's magnetic field as a navigational cue during seasonal migrations (Akesson and Hedenstrom 2007; Fisher 1971; Wiltschko and Wiltschko 2005). Birds use numerous other orientation cues to navigate in addition to magnetic fields. These include position of the sun, celestial cues, visual cues, wind direction, and scent (Akesson and Hedenstrom 2007; Fisher 1971; Haftorn et al. 1988; Wiltschko and Wiltschko 2005). It is believed that by using a combination of these cues birds are able to successfully navigate long distances. A magnetite-based (magnetic mineral) receptor mechanism in the upper beak of birds provides information on position and compass direction (Wiltschko and Wiltschko 2005). Some electromagnetic devices such as a vessel radar and radio are devices that could impact birds above the water. Towed electromagnetic device impacts to birds would only occur underwater and would only impact diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

Studies conducted on electromagnetic sensitivity in birds have typically been associated with land, and little information exists specifically on seabird response to electromagnetic changes at sea. Results from a study conducted by Larkin and Sutherland (1977) showed that during nocturnal flights, birds were capable of sensing electromagnetic fields emitted from an antenna in Wisconsin used for the Navy's Project Seafarer. This study suggested that birds react to low intensity electromagnetic fields and changed their flight altitudes more frequently when the antenna was operational. Another study on the impacts of extremely low-frequency electromagnetic fields on breeding and migrating birds around the Navy's extra-low-frequency communication system antenna in Wisconsin found no evidence that bird

distribution or abundance was impacted by electromagnetic fields produced by the antenna (Hanowski et al. 1993).

Possible impacts on birds from electromagnetic fields above water include behavioral responses such as temporary disorientation and change in flight direction (Larkin and Sutherland 1977; Wiltschko and Wiltschko 2005) and flight altitude (Larkin and Sutherland 1977). Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (Akesson 2003; Alerstam et al. 2006). However, ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed (Akesson 2003; Haftorn et al. 1988). For example, Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko and Wiltschko (2005) report that electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether but instead cause the receptors to provide altered information, which in turn causes birds to orient in different directions. However, these impacts were temporary, and the ability of the birds to correctly orient themselves eventually returned.

3.6.3.2.1.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, training activities involving electromagnetic devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Use of electromagnetic devices is concentrated within the VACAPES Range Complex.

The distribution of seabirds in these portions of the Study Area is patchy (Fauchald et al. 2002; Schneider and Duffy 1985). Exposure of birds would be limited to those foraging at or below the surface (e.g., terns, cormorants, loons, petrels, or grebes) because that is where the devices are used. Birds that forage inshore (e.g., piping plover or red knot) would not be exposed to these electromagnetic stressors because electromagnetic devices are not used in areas close to shore and are used only underwater. Also, the electromagnetic fields generated would be distributed over time and location, and any influence on the surrounding environment would be temporary and localized. More importantly, the electromagnetic devices used are typically towed by a helicopter and it is likely that any birds in the vicinity of the approaching helicopter would be dispersed by the sound and disturbance generated by the helicopter (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise) and move away from the device before any exposure could occur.

Designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems; however, none of these areas overlap with the use of electromagnetic devices in the Study Area. Two of the primary constituent elements of critical habitat required by piping plover (i.e., sheltering and roosting) are applicable to their terrestrial beach habitats (above the high tide line), which are outside of the Study Area. The other primary constituent element is foraging. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations where electromagnetic devices are used. Therefore, none of the electromagnetic stressors will affect piping plover critical habitat.

In the unlikely event that a bird is temporarily disoriented by an electromagnetic device, it would still be able to re-orient using its internal magnetic compass to aid in navigation (Wiltschko et al. 2011). Therefore, any temporary disorientation experienced by birds from electromagnetic changes caused by training activities in the Study Area may be considered a short-term impact and would not hinder bird navigation abilities. Disorientation is only one potential effect; physiological effects such as increased body temperature could also result from electromagnetic devices. Other orientation cues may include position of the sun and moon, visual cues, wind direction, infrasound, and scent (Akesson and Hedenstrom 2007; Fisher 1971; Haftorn et al. 1988; Hagstrum 2013; Wiltschko and Wiltschko 2005).

Impacts on birds from potential exposure to electromagnetic devices would be temporary and inconsequential based on the: (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 656 ft. [200 m] from the source), (2) very localized potential impact area, (3) temporary duration of the activities (hours), and (4) occurrence only underwater. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, testing activities involving electromagnetic devices occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Activities using electromagnetic devices are concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range.

Birds that forage inshore (e.g., piping plover or red knot) would not be exposed to these electromagnetic stressors because electromagnetic devices are not used in areas close to shore. For reasons stated in the training activities discussion in Section 3.6.3.2.1.1 (No Action Alternative) above, any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of electromagnetic devices in the Study Area. Therefore, for reasons stated in the training activities, none of the electromagnetic stressors will affect piping plover critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use in the Study Area would increase by less than 2 percent compared to the No Action Alternative. Training activities involving electromagnetic devices would continue to occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within VACAPES, Navy Cherry Point, and JAX Range Complexes. In addition, activities will be introduced within the Gulf of Mexico Large Marine Ecosystem, specifically within the GOMEX Range Complex, as well as in one of the following bays or inland waters: Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas. Electromagnetic device activities will remain concentrated within the VACAPES Range Complex. Bird species that occur in these areas, including all ESA-listed bird species and the ESA-candidate red knot, could be exposed to electromagnetic devices.

The increase in activities in previously identified locations, and introduction of activities in the additional locations as described above, would not measurably increase the probability of birds being exposed to electromagnetic energy as compared to the No Action Alternative. The differences in species overlap and potential impacts of electromagnetic devices on bird groups, ESA-listed species, and the ESA-candidate red knot during training activities would not be discernible from those described for training activities in Section 3.6.3.2.1.1 (No Action Alternative).

For reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of electromagnetic devices in the Study Area. Therefore, for reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), none of the electromagnetic stressors will affect piping plover critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase by approximately 30 percent in the Study Area as compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, activities will be introduced in the South Florida Ocean Measurement Facility Testing Range (Southeast U.S. Continental Shelf Large Marine Ecosystem), and anywhere within the Gulf of Mexico. Activities involving electromagnetic device use will remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. Bird species that occur in these areas, including all ESA-listed bird species and the ESA-candidate red knot, could be exposed to electromagnetic devices.

The increase in activities in previously identified locations, and introduction of activities in the additional locations as described above, would not measurably increase the probability of birds being exposed to electromagnetic energy as compared to the No Action Alternative. The differences in species overlap and potential impacts of electromagnetic devices on bird groups, ESA-listed species, and the ESA-candidate red knot during training activities would not be discernible from those described for testing activities in Section 3.6.3.2.1.1 (No Action Alternative).

For reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of electromagnetic devices in the Study Area. Therefore, for reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), none of the electromagnetic stressors will affect piping plover critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.2.1.2 (Alternative 1).

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, electromagnetic device use would increase by approximately 40 percent in the Study Area as compared to the No Action Alternative, but only increases by approximately 10 percent as compared to Alternative 1. The location of testing activities and species potentially impacted under Alternative 2 are identical to those specified under Alternative 1. Bird species that occur in these areas, including all ESA-listed bird species and the ESA-candidate red knot, could be exposed to electromagnetic devices.

The increase in activities in previously identified locations, and introduction of activities in the additional locations as described above, would not measurably increase the probability of birds being exposed to electromagnetic energy as compared to the No Action Alternative. The differences in species overlap and potential impacts of electromagnetic devices on bird groups, ESA-listed species, and the ESA-candidate red knot during testing activities would not be discernible from those described for training activities in Section 3.6.3.2.1.1 (No Action Alternative).

For reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of electromagnetic devices in the Study Area. Therefore, for reasons stated in Section 3.6.3.2.1.1 (No Action Alternative), none of the electromagnetic stressors will affect piping plover critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.2 Impacts from High Energy Lasers

This section analyzes the potential impacts of high energy lasers on birds. As discussed in Section 3.0.5.3.2.2 (Lasers), high energy laser weapons are designed to disable targets, rendering them immobile. The primary concern is the potential for a bird to be directly struck with the laser beam, which could result in injury or death.

3.6.3.2.2.1 No Action Alternative

Under the No Action Alternative, no high energy laser weapon use is planned during training or testing activities.

3.6.3.2.2.2 Alternatives 1 and 2 (Preferred Alternative)

Training Activities

Under Alternatives 1 and 2, no high energy laser weapon use is planned during training activities.

Testing Activities

Under Alternatives 1 and 2, high energy laser weapons tests are introduced in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area, specifically within the VACAPES Range Complex. Only bird species that occur within the VACAPES Range Complex would potentially be exposed to high energy lasers. Bird species that do not occur within the VACAPES Range Complex, including ESA-listed Bermuda petrel, would not be exposed to high energy lasers. Species that do occur within this area could be exposed, including the ESA-listed piping plover, ESA-listed roseate tern, and ESA-candidate red knot.

Before a laser can be fired, the Navy requires as a standard operating procedure that no persons, wildlife, reflective surfaces, or nontarget obstructions are present within the potentially impacted area between the laser and the target. In addition, as a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike. A bird in flight or at long distance might not be detectable, but the likelihood of a bird crossing the laser beam at the instant the laser is fired is extremely remote but possible.

Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of high energy lasers in the Study Area. However, the range of both the piping plover and roseate terns occur within this area where high energy laser are tested. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations

where high energy laser devices are used. Therefore, none of these activities will affect piping plover critical habitat.

No long-term or population-level impacts are expected. Birds are not likely to be exposed to high energy lasers based on the: (1) relatively low number of activities, (2) very localized potential impact area of the laser beam, (3) temporary duration of potential impact (seconds), and (4) standard operating procedures that include awareness and caution around any birds potentially in the area.

Pursuant to the ESA, the use of high energy lasers during testing activities as described under Alternatives 1 and 2:

- *will have no effect on the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *will have no effect on the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of high energy lasers during testing activities described under Alternatives 1 and 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3 Physical Disturbance and Strike Stressors

This section describes the potential impacts to birds by aircraft and aerial target strikes, vessels (disturbance and strike), and military expended material strike. For a list of Navy activities that involve this stressor refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). Aircraft include fixed-wing and rotary-wing aircraft; vessels include various sizes and classes of ships, submarines, and other boats; towed devices, unmanned surface vehicles, and unmanned underwater vehicles; military expended materials include non-explosive practice munitions, target fragments, parachutes, and other objects.

Physical disturbance and strike risks, primarily from aircraft, have the potential to impact all taxonomic groups found within the Study Area (Table 3.6-2). Impacts of physical disturbance include behavioral responses such as temporary disorientation, change in flight direction, and avoidance response behavior. Physical disturbances (discussed in Section 3.6.3.3.1, Impacts from Aircraft and Aerial Targets) may elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. These disturbances can also result in abnormal behavioral, growth, or reproductive impacts in nesting birds and can cause foraging and nesting birds to flush from or abandon their habitats or nests (Andersen et al. 1989; Komenda-Zehnder et al. 2003). Aircraft strikes often result in bird mortalities or injuries (Dolbeer (2006).

Although birds likely hear and see approaching vessels and aircraft, they cannot avoid all collisions. Nighttime lighting on vessels, specifically high-powered searchlights used for navigation in icy waters off of Greenland, has caused birds to become confused and collide with Navy vessels, cargo vessels, and trawlers (Gehring et al. 2009; Merkel and Johansen 2011; Poot et al. 2008). High-speed collisions with large objects can be fatal to birds. Training and testing activities around concentrated numbers of birds would cause greater disturbance and increase the potential for strikes.

3.6.3.3.1 Impacts from Aircraft and Aerial Targets

Aircraft and aerial target strikes could occur during training and testing activities that use aircraft, particularly in nearshore areas, where birds are more concentrated in the Study Area. Training and testing activities where aircraft are used typically occur further offshore, within the range complexes.

Wildlife aircraft strikes are a serious concern for the Navy because these incidents can result in injury to aircrews as well as damage equipment and injure or kill wildlife (Bies et al. 2006). Since 1981 naval aviators reported 16,550 bird strikes at a cost of $350 million. About 90 percent of wildlife/aircraft collisions involve large birds or large flocks of smaller birds (Federal Aviation Administration 2003), and more than 70 percent involve gulls, waterfowl, or raptors. From 2000 to 2009, the Navy Bird Aircraft Strike Hazard program recorded 5,436 bird strikes with the majority occurring during the fall period from September to November. During the 10-year period, bird strikes were greatest in the year 2007 with 827 strikes, and lowest in the year 2001 with 48. The most strikes (642) occurred at Naval Air Station Corpus Christi (Navy Safety Center 2009). No ESA-listed seabirds have been reported in the aircraft strike database.

Though bird strikes can occur anywhere aircraft are operated, Navy data indicate they occur more often over land, but do occur within the Study Area. Bird strike potential is greatest in foraging or resting areas, in migration corridors, and at low altitudes.

For the majority of fixed-wing activities, flight altitudes would be above 3,000 ft., with the exception of sorties associated with air-to-surface bombing exercises and sonobuoy drops. Typical flight altitudes during air-to-surface bombing exercises are from 500 to 5,000 ft. above ground level. Most fixed-wing aircraft flight hours (greater than 90 percent) occur at distances greater than 12 nm offshore.

Helicopter flights would occur closer to the shoreline where sheltering, roosting, and foraging birds occur. Helicopters can hover and fly low, and would be used to include towed electromagnetic devices as well as for other military activities at sea. This combination would make helicopter bird strikes more likely than for fixed-wing aircraft. Additional details on typical altitudes and characteristics of aircraft used in the Study Area are provided in Section 3.0.5.3.1.7 (Aircraft Overflight Noise) and in Appendix A (Navy Activities Descriptions).

In addition to manned aircraft, aerial targets such as unmanned drones and expendable rocket powered missiles could also incur a bird strike but the probability is low. No data about bird strikes to drones or expendable rocket-powered missiles is available.

Approximately 95 percent of bird flight during migration occurs below 10,000 ft., with the majority below 3,000 ft. (U.S. Geological Survey 2006). Bird and aircraft encounters are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level flight. In a study that examined 38,961 bird and aircraft collisions, Dolbeer (2006) found that the majority (74 percent) of collisions occurred below 500 ft. However, collisions have been recorded at elevations as high as 12,139 ft. (Dove and Goodroe 2008).

In a bird strike study for the U.S. Air Force, vultures were the most hazardous group to aircraft followed by geese, pelicans, and buteo hawks based on the number of bird strikes reported (Zakrajsek and Bissonette 2005). These species groups occur within the Study Area but are generally found in nearshore areas (Mowbray et al. 2002; Shields 2002). The potential for bird strikes to occur in off-shore

areas is relatively low because activities are widely dispersed and occur at relatively high altitudes (above 3,000 ft. for fixed-wing aircraft) where seabird occurrences are generally low.

Bird populations may consist of hundreds or thousands of individuals, ranging across a large geographical area. In this context, the loss of a small number of birds due to physical strikes does not constitute a population-level effect. Bird exposure to strike potential would be relatively brief as an aircraft transits the area. Strike potential is further decreased by Navy aircrafts' active avoidance of large flocks of birds.

3.6.3.3.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions as described in further detail in Table 2.8-1 in Chapter 2 (Description of Proposed Action and Alternatives) and in Section 3.0.5.3.1.7 (Aircraft Overflight Noise). For detailed descriptions of the types of activities that involve aircraft, see Appendix A (Navy Activities Descriptions).

Some bird strikes and associated bird mortalities or injuries could occur as a result of aircraft and aerial target use in the Study Area under the No Action Alternative; however, population-level impacts to birds would not likely result. ESA-listed and ESA-candidate species could be impacted by aircraft disturbance or strikes while in flight in areas where low altitude operations are taking place. However, no ESA-listed bird strikes have been reported during training activities.

Although piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, it does not overlap with fixed-wing aircraft training which would take place further than 1 nm from shore. While aircraft overflights could occur near piping plover critical habitat, the altitudes of their flight paths would be high enough to not pose a direct strike risk to piping plovers while sheltering, roosting, or feeding. Potential impacts from aircraft and aerial targets would have no effect on the primary constituent elements of critical habitat for the piping plover.

Helicopters can hover and fly low as well as out over the open ocean. The combination of helicopters hovering and flying low over the open ocean could result in possible strikes to a piping plover, roseate tern, red knot, or Bermuda petrel. Any disturbance from the noise produced by the aircraft and helicopter overflights in these locations has been discussed in Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise).

Bird exposure to strike potential would be relatively brief as an aircraft quickly passes. Birds actively avoid interaction with aircraft. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the personnel safety risk involved with a potential bird strike. Some bird and aircraft strikes and associated bird mortalities or injuries could occur in the Study Area under the No Action Alternative; however, no long-term or population-level impacts are expected.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges, are used more heavily by Navy aircraft than other portions as described in further detail in Tables 2.8-2 and 2.8-3 in Chapter 2 (Description of Proposed Action and Alternatives) and in Section 3.0.5.3.1.7 (Aircraft Overflight Noise). For detailed descriptions of the types of activities that involve aircraft, See Appendix A (Navy Activities Descriptions). Some bird strikes and associated bird mortalities or injuries could occur as a result of aircraft and aerial target use in the Study Area under the No Action Alternative; however, population-level impacts to birds would not likely result from aircraft strikes. If in the immediate area where aircraft are operating at low altitudes, ESA-listed and ESA-candidate species could be impacted by aircraft disturbance and strike during migration.

For reasons stated in the training activities discussion in this section, disturbance or strike from aircraft or aerial targets are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, potential impacts from aircraft and aerial targets will have no effect on the primary constituent elements of critical habitat for piping plover. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.1.2 Alternative 1

Training Activities

Training activities under Alternative 1 include an increase in aircraft flight hours from the No Action Alternative in the same areas. The types of activities, locations, and types of aircraft would not differ from the No Action Alternative.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, potential impacts from aircraft and aerial targets will have no effect on the primary constituent elements of critical habitat for piping plover (see Section 3.6.3.3.1.1, No Action Alternative). No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under Alternative 1 include an increase in aircraft flight hours from the No Action Alternative. The types of activities, locations, and types of aircraft would not differ from the No Action Alternative.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, potential impacts from aircraft and aerial targets will have no effect on the primary constituent elements of critical habitat for piping plover (Section 3.6.3.3.1.1, No Action Alternative). No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities as described in Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. The only exception to this is the increase of air combat maneuvers over the Key West Range Complex. Air combat maneuvers involve fixed-wing aircraft operating at altitudes in excess of most resident or migratory birds. Therefore, impacts of these activities would also be identical as described in Section 3.6.3.3.1.1 (No Action Alternative).

Pursuant to the ESA, the use of aircraft and aerial targets during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under Alternative 2 include an increase in aircraft flight hours from the No Action Alternative. The types of activities, locations, and types of aircraft would not differ from the No Action Alternative.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, potential impacts from aircraft and aerial targets will have no effect on the primary constituent elements of critical habitat for piping plover (Section 3.6.3.3.1.1, No Action Alternative). No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.2 Impacts from Vessels and In-Water Devices

The majority of the training and testing activities under all the alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used and how many activities would occur under each alternative, see Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices). See Table 3.0-25 for a representative list of Navy vessel types, sizes and speeds; and Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area.

Direct collisions with most Navy vessels are unlikely but do occur, especially at night. Other impacts would be the visual and behavioral disturbance from a vessel. Birds respond to moving vessels in various ways. Some birds, including certain species of gulls, storm petrels, and albatrosses, commonly follow vessels (Favero et al. 2011; Hyrenbach 2001, 2006); while other species such as frigatebirds and sooty terns seem to avoid vessels (Borberg et al. 2005; Hyrenbach 2006). There could be a slightly increased

risk of impacts during the winter, or fall/spring migrations when migratory birds are concentrated in coastal areas. However, despite this concentration, most birds would still be able to avoid collision with a vessel. Vessel movements could elicit short-term behavioral or physiological responses (e.g., alert response, startle response, fleeing the immediate area, temporary increase in heart rate). However, the general health of individual birds would not be compromised.

The possibility of collision with an aircraft carrier or surface combatant vessels (or a vessel's rigging, cables, poles, or masts) could increase at night, especially during inclement weather. Birds can become disoriented at night in the presence of artificial light (Bruderer et al. 1999), and lighting on vessels may attract some birds (Hunter et al. 2006a), increasing the potential for harmful encounters (U.S. Department of the Navy 2007). Lighting on boats and vessels has also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel and Johansen 2011). Other harmful seabird-vessel interactions are commonly associated with commercial fishing vessels because seabirds are attracted to concentrated food sources around these vessels (Dietrich and Melvin 2004; Melvin et al. 2011; Melvin and Parrish 2001). However, these concentrated food sources are not associated with Navy vessels.

Navy aircraft carriers, surface combatant vessels, and amphibious warfare ships are minimally lighted for tactical purposes. For vessels of this type there are two white lights that shine forward and one that shines aft; these lights must be visible for at least 6 nm. A single red and a single green light are located on the port and starboard sides of vessels, respectively. These lights are visible for a minimum of 3 nm. Solid white lighting appears more problematic for birds, especially nocturnal migrants (Gehring et al. 2009; Poot et al. 2008).

In addition to vessels, towed devices and unmanned vehicles are also used; however, no documented instances of birds being struck by in-water devices exist. It would be anticipated that most bird species would move away from an unmanned vehicle or a towed device.

The other type of vessel movements in the Study Area with the potential to strike a bird are those used during amphibious landings. These amphibious warfare vessels have the potential to impact shorebirds and seabirds by disturbing or striking individual animals. Amphibious vessel movements could elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, nest abandonment, and a temporary increase in heart rate. Amphibious vessels have the potential to disturb nesting or foraging shorebirds such as the ESA-listed piping plover, ESA-listed roseate tern, and the ESA-candidate red knot. The general health of individual birds would not be compromised, unless a direct strike occurred. However, it is highly unlikely that a shorebird/seabird would be struck in this scenario because most foraging shorebirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the sound of its approach before it could come close enough to strike a shorebird/seabird (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise).

3.6.3.3.2.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) and Section 3.0.5.3.3.2 (In-Water Devices) provide estimates of relative vessel use and location for each of the alternatives. These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel usage is dependent upon military training requirements, deployment schedules, annual budgets and other unpredictable factors. Training and testing concentrations are most dependent upon locations of Navy shore installations and established training and testing areas. Even with the introduction of the

Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel and in-water device use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade and therefore the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), the majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. See Table 3.0-25 for a representative list of Navy vessel sizes and speeds, Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area, and Figure 3.0-20 provides graphics that illustrate the location for each alternative and the relative use of for training. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and range areas. Navy training vessel traffic would especially be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Naval Station Mayport in Jacksonville, Florida in the Southeast U.S. Continental Shelf Large Marine Ecosystem. There is no seasonal differentiation in Navy vessel use.

Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open-ocean portions of the Study Area because of the concentration of vessel movements in those areas. Even in areas of concentrated vessel use, the probability of bird/vessel interaction is low because of the high mobility of birds.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, and the Gulf of Mexico, as well as the Gulf Stream Open Ocean Area, specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Use of in-water devices is concentrated within the VACAPES Range Complex. The differences in the number of in-water device activities between alternatives increases by less than 2 percent under Alternative 1 and Alternative 2 compared to the No Action Alternative.

Birds would not be exposed to unmanned underwater vehicles or remotely operated vehicles because they are typically used on the seafloor or in the water column. The other in-water devices used are typically towed by a helicopter. As discussed for electromagnetic devices (Section 3.6.3.2.1, Impacts from Electromagnetic Devices), it is likely that any birds in the vicinity of the approaching helicopter would be dispersed by the sound of the helicopter (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise) and move away from the in-water device before any exposure could occur.

Amphibious landings are the primary activity that could potentially impact ESA-listed shorebird species, specifically piping plover, roseate tern, and the ESA-candidate red knot. Up to 46 amphibious landings are planned only at Onslow Beach (Marine Corps Base Camp Lejeune), in the Navy Cherry Point Range Complex. Under Alternative 1 and 2, up to six amphibious landings would occur at Naval Station Mayport, specifically Seminole Beach. The ESA-listed species that would be potentially impacted at this location would be piping plover, roseate tern, and the ESA-candidate red knot.

The locations where amphibious landing activities occur at Onslow Beach and Seminole Beach are not considered optimal habitat for piping plovers (U.S. Fish and Wildlife Service 2009b). Roseate terns and red knots could use these beaches as a resting area and could be found foraging in the waters near the beach. Piping plovers have been documented foraging within the intertidal shoreline at Onslow Beach and Seminole Beach during the winter, spring, and fall migration periods and during the nesting season, although no nests have been found to date (U.S. Fish and Wildlife Service 2009b). While they could be present, it is highly unlikely that a piping plover, roseate tern, or red knot would be struck in this scenario because most foraging or resting shorebirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the sound of its approach before it could come close enough for a collision to take place (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise). Therefore, amphibious assault activities would not cause any potential risk to the ESA-listed piping plover or roseate tern, or the ESA-candidate red knot in the Study Area. Furthermore, Naval Station Mayport and Marine Corps Base Camp Lejeune have specific Integrated Natural Resource Management Plans for addressing ESA-listed bird species, and those plans already include project avoidance and minimization actions that reduce threats from military activities to wintering and migrating piping plovers to a minimal level (U.S. Fish and Wildlife Service 2009b).

There is no overlap of vessels and in-water devices with designated critical habitat for piping plover. Additionally no critical habitat is designated at Onslow Beach or Seminole Beach. However, critical habitat does exist on the opposite (north) side of the St. Johns River from Seminole Beach. This area of critical habitat is outside the boundary of the Study Area. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, roseate tern, or piping plover;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of vessels and in-water devices during training activities described under the No Action Alternative, Alternative 1, and Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), Navy testing vessel traffic would especially be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Naval Station Mayport in Jacksonville, Florida, in the Southeast U.S. Continental Shelf Large Marine Ecosystem.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices occur in the Northeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf of Mexico as well as the Gulf Stream Open Ocean Area, specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes; and Naval Undersea Warfare Center Division, Newport Testing Range; Naval Surface Warfare Center, Panama City Division Testing Range; and South Florida Ocean Measurement Facility Testing Range. The differences in the number of in-water device activities between alternatives increases by approximately 80 percent under Alternative 1 and doubles under Alternative 2 compared to the No Action Alternative.

The potential for interaction with vessels is greater in coastal areas, where Navy vessel use is concentrated, compared to pelagic waters. Even in areas of concentrated vessel use, the probability of bird/vessel interaction is low because of the high mobility of birds and their ability to quickly move away from an oncoming vessel.

Flushing of birds is expected to be greatest with fast-moving, agile vessels (as described in Table 3.0-25). Impacts from Navy vessels would be limited to short-term behavioral responses, which are not expected to have long-term effects. While such flushing or other impacts of vessels on individual birds may occur, none of these temporary impacts are expected to have an adverse effect on birds at the population level.

The relatively low vessel density in pelagic waters in the Study Area, as well as the ability of birds to detect and avoid vessels, reduces the probability that vessel strikes would impact seabird populations under the No Action Alternative, Alternative 1, and Alternative 2. The impacts of vessel movements are expected to be short-term, temporary, and localized disturbances of individual birds in the vicinity. If in the immediate area where vessels or in-water devices are operating, ESA-species could be disturbed, but this would not result in adverse impacts.

For reasons stated in Section 3.6.3.3.2.1 (No Action Alternative, Alternative 1, and Alternative 2 [Preferred Alternative]), disturbance or strike from vessels or in-water devices are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, vessels and in-water devices would not result in impacts to the primary constituent elements of critical habitat for piping plover because there is no overlap of the stressor with designated critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, roseate tern, or piping plover;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of vessels and in-water devices during testing activities described under the No Action Alternative, Alternative 1, and Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3 Impacts from Military Expended Materials

This section analyzes the strike potential to birds of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes). Note that analysis of all potential impacts (disturbance, strike, ingestion, and entanglement) of military expended materials on critical habitat is included in this section.

Exposure of birds to military expended materials during Navy training and testing activities could result in physical injury or behavioral disturbances to birds in air, at the surface, or underwater during foraging dives. Although a quantitative analysis is not possible due to the absence of bird density information in the Study Area, an assessment of the likelihood of exposure to military expended materials was conducted based on general bird distributions in the Study Area.

The number of large-caliber projectiles and other large munitions (e.g., bombs, rockets, missiles) that would be expended in the Study Area annually, coupled with the often patchy distribution of seabirds (Fauchald et al. 2002; Haney 1986b; Schneider and Duffy 1985), suggests that the likelihood of this type of strike for a seabird would be extremely low. The number of small-caliber projectiles that would be expended annually during gunnery exercises is much higher than the number of large-caliber projectiles. However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets.

Human activity such as vessel or boat movement, aircraft overflights, and target setting, could cause birds to flee a target area before the onset of firing, thus avoiding harm. If birds were in the target area, they would likely flee the area prior to the release of military expended materials or just after the initial rounds strike the target area. Additionally, the force of military expended material fragments dissipates quickly once the pieces hit the water, so direct strikes on birds foraging below the surface would not be likely. Also, munitions would not be used in shallow/nearshore areas. Individual birds may be impacted, but munitions strikes would likely have no impact on bird populations.

The probability of strike based on the "footprint" analysis included in Tables 3.3-9 through 3.3-13 indicates that even for an extreme case of all small-caliber projectiles expended in a single gunnery box, the likelihood of any of these items striking a bird is extremely low.

3.6.3.3.3.1 No Action Alternative

Training Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials, most of which are small- and medium-caliber projectiles. The number and location of military expended materials (e.g., bombs, projectiles, missiles, and rockets) are detailed in Tables 3.0-70, 3.0-71, 3.0-72, and 3.0-73. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest number of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Activities using military expended materials are concentrated within the VACAPES and JAX Range Complexes. Bird species that occur in these areas, including all ESA-listed and ESA-candidate bird species, could be exposed to military expended materials.

The potential impact of military expended materials on birds in the Study Area is dependent on the ability of birds to detect and avoid foreign objects through their visual and auditory sensory systems and the relatively fast flying speeds and good maneuverability of most bird species. The vast area over which training activities occur combined with the ability of birds to flee disturbance, would make direct strikes unlikely. Individual birds may be affected, but strikes would have no impact on species or populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a bird would be struck by military expended materials because most birds in the vicinity of the approaching aircraft or vessel, from which the military expended materials are released, would likely be dispersed by the sound of its approach before it could come close enough for a collision to take place (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise). Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed and ESA-candidate birds in the Study Area.

Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap with the use of military expended materials in the Study Area. Therefore, none of the military expended materials will affect piping plover critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of military expended materials for training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of military expended materials during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. The number and location of military expended materials are detailed in Tables 3.0-70, 3.0-71, 3.0-72, and 3.0-73. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area, specifically within the Naval Surface Warfare Center, Panama City Division Testing Range and the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Activities using military expended materials are concentrated within the VACAPES Range Complex. Bird species that occur in these areas, including all ESA-listed and ESA-candidate bird species, could be exposed to military expended materials.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a bird would be struck by military expended materials because most birds in the vicinity of the approaching aircraft or vessel, from

which the military expended materials are released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a shorebird (Section 3.6.3.1.5, Impacts from Aircraft and Vessel Noise). Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed or ESA-candidate bird species in the Study Area.

For reasons stated in the training activities discussion in this section, any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, military expended materials would not result in impacts to critical habitat for piping plover because there is no overlap of the stressor with designated critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of military expended materials for testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), military expended material strikes during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3.2 Alternative 1

Training Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. The number and location of military expended materials are detailed in Tables 3.0-69, 3.0-70, 3.0-71, 3.0-72, and 3.0-73. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is more than twice the amount expended in the No Action Alternative. The activities and type of military expended materials under Alternative 1 would be expended in the same geographic locations as the No Action Alternative in addition to Other AFTT Areas outside the range complexes while vessels are in transit. Activities using military expended materials are concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Bird species that occur in these areas, including all ESA-listed and ESA-candidate bird species, could be exposed to military expended materials.

The differences in species overlap and potential impacts of military expended materials on bird groups, ESA-listed species, and the ESA-candidate red knot during training activities would not be discernible from those described for training activities in Section 3.6.3.3.3.1 (No Action Alternative). For reasons stated in Section 3.6.3.3.3.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, military expended materials would not result in impacts to critical habitat for piping plover because there is no overlap of the stressor with designated critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of military expended materials for training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), military expended material strikes during training activities described under the Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. The number and location of military expended materials are detailed in Tables 3.0-69, 3.0-70, 3.0-71, 3.0-72, and 3.0-73. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is nearly four-times the amount expended in the No Action Alternative. The activities and type of military expended materials under Alternative 1 would be expended in the same geographic locations as the No Action Alternative, with the exception of some activities that could occur throughout the Study Area. Activities using military expended materials are concentrated within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Military expended materials would typically be of the same type listed under the No Action Alternative. Bird species that occur in these areas, including all ESA-listed species, could be exposed to military expended materials.

For reasons stated in Section 3.6.3.3.3.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, military expended materials would not result in impacts to the critical habitat for piping plover because there is no overlap of the stressor with designated critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of military expended materials for testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of military expended materials during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.6.3.3.3.2 (Alternative 1).

Testing Activities

Tables located in Section 3.0.5.3.3.3 (Military Expended Material Strikes) list the activities that involve military expended materials (e.g., bombs, projectiles, missiles, and rockets), most of which are small- and medium-caliber projectiles. The number and location of military expended materials are detailed in Tables 3.0-70, 3.0-71, 3.0-72, and 3.0-73. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2, the total amount of military expended materials is nearly four-times the amount expended in the No Action Alternative, but only increases by approximately 5 percent as compared to Alternative 1. The activities and type of military expended materials under Alternative 2 would be expended in the same geographic locations as the No Action Alternative, with the exception of some activities that could occur throughout the Study Area. Activities using military expended materials are concentrated within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Military expended materials would typically be of the same type listed under the No Action Alternative. Bird species that occur in these areas, including all ESA-listed and ESA-candidate species, could be exposed to military expended materials.

For reasons stated in Section 3.6.3.3.3.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. Similarly, military expended materials would not result in impacts to the critical habitat for piping plover because there is no overlap of the stressor with designated critical habitat. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of military expended materials for testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), military expended material strikes during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4 Ingestion Stressors

This section analyzes the potential impacts of the various types of expended materials used by Navy during training and testing activities within the Study Area. The activities that expend these items and their general distribution are detailed in Section 3.0.5.3.5 (Ingestion Stressors), and aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5 (Conceptual Framework for Assessing Effects from Ingestion).

Birds could potentially ingest expended materials used by the Navy during training and testing activities within the Study Area. The Navy expends the following types of materials that could become ingestion

stressors for birds during training and testing in the Study Area: chaff and flare endcaps/pistons. Ingestion of expended materials by birds could occur in all large marine ecosystems and open ocean areas and would occur either at the surface or just below the surface portion of the water column, depending on the size and buoyancy of the expended object and the feeding behavior of the birds. Floating material of ingestible size could be eaten by birds that feed at or near the water surface, while materials that sink pose a potential risk to diving birds that feed just below the water's surface (Titmus and Hyrenbach 2011). Some items, such as parachutes or sonobuoys are too large to be ingested and will not be discussed further. Also, parachutes sink rapidly to the seafloor.

Foraging depths of most diving birds are generally restricted to shallow depths, so it is highly unlikely that benthic, nearshore, or intertidal foraging would occur in areas of munitions use, and these birds would not encounter any type of munitions or fragments from munitions in nearshore or intertidal areas. Ingestion of military expended materials from munitions is not expected to occur because the solid metal and heavy plastic objects from these munitions sink rapidly to the seafloor, beyond the foraging depth range of most birds. Therefore, the impact of ingestion of munitions used during training and testing activities for all Alternatives will have no effect on ESA-listed or ESA-candidate birds. As a result, the analysis in this section includes the potential ingestion of military expended materials other than munitions, all of which are expended away from nearshore habitats and close to the water surface.

Physiological impacts to birds from ingestion include blocked digestive tracts and subsequent food passage, blockage of digestive enzymes, lowered steroid hormone levels, delayed ovulation (egg maturation), reproductive failure, nutrient dilution (nonnutritive debris displaces nutritious food in the gut), and altered appetite satiation (the sensation of feeling full), which can lead to starvation (Azzarello and Van Vleet 1987). While ingestion of marine debris has been linked to bird mortalities, sublethal impacts are more common (Moser and Lee 1992).

Many species of seabirds are known to ingest floating plastic debris and other foreign matter while feeding on the surface of the ocean (Auman et al. 1997; Yamashita et al. 2011). For example, 21 of 38 seabird species (55 percent) collected off the coast of North Carolina from 1975 to 1989 had ingested plastic particles (Moser and Lee 1992). Some seabirds have used plastic and other marine debris for nest building which may lead to ingestion of that debris (Votier et al. 2011).

Plastic is often mistaken for prey, and the incidence of plastic ingestion appears to be related to a bird's feeding mode and diet (Henry et al. 2011). Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic (Azzarello and Van Vleet 1987). Birds of the order Procellariiformes, which include petrels and shearwaters, tend to accumulate more plastic than other species (Azzarello and Van Vleet 1987; Moser and Lee 1992; Pierce et al. 2004). Some birds, including gulls and terns, commonly regurgitate indigestible parts of their food items such as shell and fish bones. However, the structure of the digestive systems of most Procellariiformes makes it difficult to regurgitate solid material such as plastic (Azzarello and Van Vleet 1987; Moser and Lee 1992; Pierce et al. 2004).

Moser and Lee (1992) found no evidence that seabird health was impacted by the presence of plastic, but other studies have documented negative consequences of plastic ingestion (Carey 2011). As summarized by Pierce et al. (2004), Auman et al. (1997), and Azzarello and Van Vleet (1987), the consequences of plastic ingestion by seabirds that have been documented include blockage of the intestines and ulceration of the stomach, reduction in the functional volume of the gizzard leading to a reduction of digestive capability, and distention of the gizzard leading to a reduction in hunger.

Dehydration has also been documented in seabirds that have ingested plastic (Sievert and Sileo 1993). Studies have also found negative correlations between body weight and plastic load, as well as between body fat (a measure of energy reserves), and the number of pieces of plastic in a seabird's stomach. Pierce et al. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. The examination of a deceased adult northern gannet revealed that a 1.5 in. (3.8 cm) diameter plastic bottle cap lodged in its gizzard blocked the passage of food into the small intestine, which resulted in its death from starvation. Northern gannets are substantially larger, and dive deeper than the ESA-listed birds in the Study Area. Also, since gannets typically utilize flotsam in nest building (Votier et al. 2011), they may be more susceptible to ingesting marine debris than other species as it gathers that material. Dissection of an adult greater shearwater's gizzard revealed that a 1.5 in. by 0.5 in. (3.8 cm by 1.3 cm) fragment of plastic blocked the passage of food in the digestive system, which also resulted in death from starvation.

Species such as storm-petrels, albatrosses, shearwaters, fulmars, and noddies that forage by picking prey from the surface may have a greater potential to ingest any floating plastic debris. Although ingestion of plastic military expended materials by any species from the 10 taxonomic groups found within the Study Area (Table 3.6-2) has the potential to impact individual birds.

Items of concern are those of ingestible size that remain floating at the surface, including lighter items such as plastic end caps from chaff and flares, pistons, and chaff, that may be caught in currents and gyres or snared in floating *Sargassum* before sinking.

Chaff. A general discussion of chaff and chaff end caps as an ingestion stressor is presented in Section 3.0.5.3.5.3 (Military Expended Materials Other than Munitions). It is unlikely that chaff would be selectively ingested (U.S. Department of the Air Force 1997). Ingestion of chaff fibers is not expected to cause substantial damage to a bird's digestive tract based on the fibers' small size (ranging in lengths of 0.25–3 in. [0.63–7.6 cm] with a diameter of about 0.0015 in.) and flexible nature, as well as the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to birds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals. Intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has minor impacts on healthy birds and mammals, and often high concentrations (greater than 1,000 milligrams [mg] per kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Spargo 1999). A bird weighing 2.2 lb. (1 kg) would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg per kg; this analysis was based on chaff consisting of 40 percent aluminum by weight and a 5 oz. (ounces) (141.7 g) chaff canister containing 5 million fibers. As an example, an adult herring gull weighs about 1.8–2.7 lb. (0.8–1.2 kg) (Cornell Lab of Ornithology 2009b). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (i.e., 1.8 fibers per $ft.^2$ for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Flares. A general discussion of flares as an ingestion stressor is presented in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions). Ingestion of flare end caps 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U.S. Department of the Air Force 1997) by birds may result in gastrointestinal obstruction or reproductive complications. Based on the information presented above, if a seabird were to ingest a plastic end-cap or piston, the response would vary based on the species and individual bird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract

blockage leading to starvation). Ingestion of end caps and pistons by species that regularly regurgitate indigestible items would likely have no adverse impacts. However, end caps and pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of plastic end caps and pistons could be lethal to some individual seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (such as Procellariiformes). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual birds.

3.6.3.4.1.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas, specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials other than Munitions), under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes.

Although these fibers are too small for birds to confuse with prey, there is some potential for chaff to be incidentally ingested along with other prey items. If ingested, chaff is not expected to impact birds, due to the low concentration that would be ingested and the small size of the fibers.

The plastic materials associated with flare end caps and pistons sink in saltwater (Spargo 1999), which reduces the likelihood of ingestion by seabirds. However, some of the material could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. As discussed in Section 3.0.5.3.5.3 (Military Expended Materials other than Munitions), the highest density of chaff and flare end caps/pistons would be expended in the Key West Range Complex. Assuming that all end caps and pistons would be evenly dispersed in the Key West Range Complex, the relative end-cap and piston concentration would be very low (2.8 pieces/nm^2/year, based on an area of 25,500 nm^2 and 71,885 end caps/pistons per year). Actual environmental concentrations would vary based on actual release points and dispersion by wind and water currents. The number of end caps and pistons that would remain at the surface in *Sargassum* mats, and would potentially be available to seabirds, is expected to be an extremely small percentage of the total.

Birds could ingest military expended material. However, the concentration of military expended materials in the Study Area is low, and seabirds are unevenly distributed (Fauchald et al. 2002; Haney 1986b; Schneider and Duffy 1985). The overall likelihood that birds would be impacted by ingestion of military expended materials in the Study Area under the No Action Alternative is very low. If foraging in an area where military expended materials are present on the sea surface, roseate terns and Bermuda petrels could be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species. Species that forage outside the specified areas within these range complexes, including the piping plover and red knot, would not be exposed to the ingestible military expended materials. No long-term or population-level impacts are expected.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions for training activities as proposed under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, or roseate tern;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials (including munitions) during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas, specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. In addition, activities that expend target materials would occur at Naval Surface Warfare Center, Panama City Division Testing Range.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

The plastic materials associated with end caps and pistons sink in saltwater (Spargo 1999), which reduces the likelihood of ingestion by seabirds. However, some of the material could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. Actual environmental concentrations would vary based on actual release points and dispersion by wind and water currents. The number of end caps and pistons that would remain at the surface in *Sargassum* mats and would potentially be available to seabirds is expected to be an extremely small percentage of the total.

If foraging in an area where military expended materials are present on the sea surface, roseate terns and Bermuda petrels could be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species. Species occurring outside the specified areas within these range complexes, including the piping plover and red knot, would not be exposed to the ingestible military expended materials.

For reasons stated in Section 3.6.3.4.1.1 (No Action Alternative), any ingestion of military expended materials is not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. No long-term or population-level impacts are expected.

Pursuant to the ESA, the potential for ingestion of military expended materials for testing activities as proposed under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, or roseate tern;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials (including munitions) during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend target-related materials is four-times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Key West Range Complex as well as anywhere in the Study Area, outside the range complexes while vessels are in transit.

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend chaff decreases by approximately 30 percent from the No Action Alternative, while flares increase by approximately 30 percent. The activities using chaff under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

If foraging in an area where military expended materials are present on the sea surface, roseate terns and Bermuda petrels could be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species. Species occurring outside the specified areas within these range complexes, including the piping plover and red knot, would not be exposed to the ingestible military expended materials.

For reasons stated in Section 3.6.3.4.1.1 (No Action Alternative), any ingestion of military expended materials is not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. No long-term or population-level impacts are expected.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions for training activities as proposed under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, or roseate tern;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials (including munitions) during training activities described under the Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend target-related materials of ingestible size is approximately two-times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Key West Range Complex and Gulf of Mexico. In addition, there are testing activities that could expend target-related materials throughout the Study Area.

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend chaff and flares is approximately four-times and three-times greater, respectively, compared to the No Action Alternative. The activities using chaff and flares under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

If foraging in an area where military expended materials are present on the sea surface, roseate terns and Bermuda petrels could be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species. Species occurring outside the specified areas within these range complexes, including the piping plover and red knot, would not be exposed to the ingestible military expended materials.

For reasons stated in Section 3.6.3.4.1.1 (No Action Alternative), any ingestion of military expended materials is not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. No long-term or population-level impacts are expected.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions for testing activities as proposed under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, or roseate tern;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials (including munitions) during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the Section 3.6.3.4.1.1 (No Action Alternative) will also be identical as described in Section 3.6.3.4.1.2 (Alternative 1).

Testing Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 2 the activities will occur in the same geographic locations identified in the No Action Alternative. The number of activities that expend target-related materials is more than 2.5-times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. In addition, target-related materials would also be expended in the Key West Range Complex, Gulf of Mexico, and throughout the Study Area.

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 2, the number of activities that expend chaff is nearly four-times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. Under Alternative 2, the number of activities that expend flares is nearly three-times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. The activities using chaff and flares under Alternative 2 would occur in the same geographic locations as the Section 3.6.3.4.1.1 (No Action Alternative).

If foraging in an area where military expended materials are present on the sea surface, roseate tern and Bermuda petrel could be impacted by ingestion of military expended material, but this would not result in increased risk of impacts on populations of these ESA-listed species. Species occurring outside the specified areas within these range complexes, including the piping plover and red knot, would not be exposed to the ingestible military expended materials.

For reasons stated in Section 3.6.3.4.1.1 (No Action Alternative), any ingestion of military expended materials is not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. No long-term or population-level impacts are expected.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions for testing activities as proposed under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, or roseate tern;*
- *will have no effect on the ESA-listed piping plover; and*
- *will have no effect on the ESA-candidate red knot.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials (including munitions) during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.5 Secondary Stressors

The potential of water and air quality stressors associated with training and testing activities to indirectly affect birds, as a secondary stressor, was analyzed. The assessment of potential water and air quality stressors refers to Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality); the assessment addresses specific activities in local environments that have the potential to impact seabird habitats. At-sea activities that may impact water and air include general emissions.

As noted in Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely affect sediments, water, or air quality, and therefore would not indirectly impact seabirds as secondary stressors. Any physical impacts on seabird habitats (sediments, water, or air quality) would be temporary and localized. These activities would not be expected to indirectly impact birds or bird habitats.

As noted in Section 3.8 (Marine Invertebrates) and Section 3.9 (Fish), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely impact invertebrate or fish prey resources (e.g., crustaceans, bivalves, worms, sand lance, herring, etc.) of birds and therefore would not indirectly impact birds as secondary stressors. Any impacts on seabird prey resources would be

temporary and localized. These activities would not be expected to indirectly impact birds or bird habitats.

Although designated piping plover critical habitat occurs throughout the coastal habitats of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, none of these areas overlap activities that could potentially impact sediments, water, or air quality. Two of the primary constituent elements of critical habitat required by piping plover (i.e., sheltering and roosting) are applicable only to their terrestrial beach habitats, which are outside of the Study Area. The other primary constituent element is foraging. While piping plovers do forage in the intertidal portions of the Study Area, these areas do not overlap with any locations where military activities occur that have any potential to impact sediments, water, or air quality. Therefore, secondary stressors will not affect piping plover critical habitat. Indirect impacts on sediments, water, or air quality under the No Action Alternative, Alternative 1, or Alternative 2 would not affect ESA-listed bird species or ESA-candidate red knot due to: (1) the temporary nature of impacts on sediments, water, or air quality, (2) the distribution of temporary sediments, water, or air quality impacts, (3) the wide distribution of birds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary sediments, water, or air quality impacts. No long-term or population-level impacts are expected.

3.6.3.5.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training and Testing

Pursuant to the ESA, secondary stressors for training and testing activities as proposed under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Bermuda petrel, piping plover, or roseate tern;*
- *may affect but is not likely to adversely affect the ESA-candidate red knot; and*
- *will have no effect on piping plover critical habitat.*

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from secondary stressors during training and testing activities described under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.4 Summary of Potential Impacts on Birds

3.6.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5 (Overall Approach to Analysis), this section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above and summarized in Section 3.6.4.2 (Endangered Species Act Determinations).

There are generally two ways that a bird could be exposed to multiple stressors. The first would be if a bird were exposed to multiple sources of stress from a single activity or activities (e.g., an amphibious landing activity may include an amphibious vessel that would introduce potential acoustic and physical strike stressors). The potential for a combination of these impacts from a single activity would depend on the range of effects to each of the stressors and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely

that if a bird were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercise or composite training unit exercise).

Secondly, an individual bird could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., near ports, testing ranges, and routine activity locations outlined in Table 3.0-8) and in areas that individual birds frequent because it is within the animal's home range, migratory route, breeding area, or foraging area. With the exception of the few concentrated areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual birds would be exposed to stressors from multiple activities. However, animals with a small home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area via a migratory route. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (on the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, birds that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Birds that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors on birds are difficult to predict.

Although potential impacts to certain bird species from the Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Sections 3.6.4.2 (Endangered Species Act Determinations) and 3.6.4.3 (Migratory Bird Treaty Act Determinations) with respect to each regulation applicable to birds.

3.6.4.2 Endangered Species Act Determinations

Table 3.6-5 summarizes the ESA determinations for each substressor analyzed. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with U.S. Fish and Wildlife Service for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative). For all substressors, training and testing activities are not likely to destroy or modify piping plover critical habitat. The consultation is complete and U.S. Fish and Wildlife Service concurred with the Navy's determinations.

3.6.4.3 Migratory Bird Treaty Act Determinations

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

Table 3.6-5: Summary of Endangered Species Act Effects Determinations for Birds for Alternative 2 (Preferred Alternative)

Navy Activities and Stressors		Bermuda petrel	Piping plover	Roseate tern	Red knot
Acoustic Stressors					
Sonar and other Active Acoustic Sources	Training Activities	No effect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	No effect	No effect	May affect not likely to adversely affect	No effect
Explosives	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Swimmer Defense Airguns	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Pile Driving	Training Activities	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect
	Testing Activities	Not applicable	Not applicable	Not applicable	Not applicable
Weapons Firing, Launch, and Impact Noise	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect
Aircraft and Vessel Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Energy Stressors					
Electromagnetic Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
High Energy Lasers	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	No effect	No effect	No effect	No effect

Table 3.6-5: Summary of Endangered Species Act Effects Determinations for Birds for Alternative 2 (Preferred Alternative) (Continued)

Navy Activities and Stressors		Bermuda petrel	Piping plover	Roseate tern	Red knot
Physical Disturbance and Strike Stressors					
Aircraft and Aerial Targets	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Vessels and In-Water Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Military Expended Materials	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Ingestion Stressors					
Military Expended Materials Other than Munitions	Training Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
	Testing Activities	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect	No effect
Secondary Stressors					
Secondary Stressors	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

Note: The scientific names of the listed species are as follows: Bermuda petrel (*Pterodroma cahow*), piping plover (*Charadrius melodus*), roseate tern (*Sterna dougallii*), and red knot (*Calidris canutus rufa)*.

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Atlantic Fleet Training and Testing
Final Environmental Impact Statement / Overseas Environmental Impact Statement

Volume 3
August 2013

Lead Agency
Department of the Navy

Cooperating Agency
National Marine Fisheries Service

Action Proponents
United States Fleet Forces
Naval Air Systems Command
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3.7 MARINE VEGETATION

MARINE VEGETATION SYNOPSIS

The Navy considered all potential stressors and analyzed the following for marine vegetation:

- Acoustic (explosives)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Secondary stressors (sediment and water quality)

Regulatory Determinations for the Preferred Alternative

- Acoustics: Pursuant to the Endangered Species Act (ESA), the use of explosives will have no effect on ESA-listed Johnson's seagrass or its critical habitat.
- Physical Disturbance and Strike: Pursuant to the ESA, the use of vessels, in-water devices, military expended materials, and seafloor devices will have no effect on ESA-listed Johnson's seagrass or its critical habitat.
- Secondary: Pursuant to the ESA, secondary stressors will have no effect on ESA-listed Johnson's seagrass or its critical habitat.
- Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, electromagnetic devices and contaminant stressors associated with training and testing activities will have no adverse impact on marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. Explosives and other impulsive sources, vessel movement, in-water devices, military expended materials, and seafloor devices associated with training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern.

3.7.1 INTRODUCTION

This section analyzes potential impacts on marine vegetation found in the Study Area. The species and taxonomic groups that occur in the Study Area are discussed in Section 3.7.1 (Introduction) and the baseline affected environment is discussed in Section 3.7.2 (Affected Environment). The analysis of environmental consequences is presented in Section 3.7.3 (Environmental Consequences) and the potential impacts of the Proposed Action are summarized in Section 3.7.4 (Summary of Potential Impacts on Vegetation).

For this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), marine vegetation is evaluated as groups of species characterized by their distribution. Training and testing activities of the United States (U.S.) Department of the Navy (Navy) are evaluated for their potential impacts on the one Endangered Species Act (ESA) listed species and six major taxonomic groups of marine vegetation, as appropriate (Table 3.7-1). Marine vegetation, including marine algae and flowering plants, is found throughout the Study Area. Marine vegetation species designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act are

described in the Essential Fish Habitat Assessment (U.S. Department of the Navy 2013), and conclusions from the Essential Fish Habitat Assessment are summarized in each substressor section.

The distribution and condition of abiotic (nonliving) substrate associated with attached macroalgae and the impact of stressors are described in Section 3.3 (Marine Habitats). Additional information on the biology, life history, and conservation of marine vegetation can be found on the websites of the following agencies and groups:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Conservation International
- Algaebase
- National Resources Conservation Service
- National Museum of Natural History

Table 3.7-1: Major Taxonomic Groups of Marine Vegetation in the Study Area

Marine Vegetation Groups		Vertical Distribution within Study Area[1]		
Common Name (Taxonomic Group)	**Description**	**Open Ocean Areas**	**Large Marine Ecosystem**	**Bays, Rivers, Estuaries**
Blue-green algae (phylum Cyanobacteria)	Many cyanobacteria form mats that attach to reefs.	Sea surface	Seafloor	Bottom
Dinoflagellates (phylum Dinophyta)	Most are single-celled, marine species of algae with two whip-like appendages (flagella). Some live inside other organisms, and some produce toxins.	Sea surface	Sea surface	Surface
Green algae (phylum Chlorophyta)	May occur as single-celled algae, filaments, and seaweeds.	Sea surface	Sea surface, seafloor	Surface, bottom
Diatoms, brown and golden-brown algae (phylum Ochrophyta)	Diatoms are single-celled algae. Brown and golden-brown algae are large multi-celled seaweeds.	Sea surface	Sea surface, seafloor	Surface, bottom
Red algae (phylum Rhodophyta)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits.	Sea surface	Sea surface, seafloor	Surface, bottom
Seagrass, cordgrass, and mangroves (phylum Magnoliophyta)	Flowering plants (also called angiosperms) that are adapted to salty marine environments in mudflats and marshes.	None	Seafloor	Bottom

Source: (Bisby et al. 2010) for marine vegetation groups

[1] Vertical distribution in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, Gulf Stream, and North Atlantic Gyre) or by coastal waters of large marine ecosystems (Caribbean Sea, Gulf of Mexico, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, and West Greenland Shelf).

3.7.1.1 Endangered Species Act Species

Johnson's seagrass (*Halophila johnsonii*) is listed as a threatened species under the ESA; it is the only species of marine vegetation listed. It occurs in the Study Area in the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. A discussion of this species is provided in Section 3.7.2.2 (Johnson's Seagrass [*Halophila johnsonii*]). The emphasis on species-specific information in the following sections is on the single ESA-listed species because any threats or potential impacts on Johnson's seagrass are subject to consultation with regulatory agencies.

3.7.1.2 Federally Managed Species

Sargassum fluitans and *Sargassum natans* (brown algae) are federally managed by the South Atlantic Fishery Management Council (Federal Register [FR] 68(192): 57375-57379, October 3, 2003). These species are considered, along with ESA-listed species and other taxonomic groupings, in the analysis of impacts in Section 3.7.3 (Environmental Consequences).

3.7.1.3 Taxonomic Groups

To cover all marine vegetation types represented in the Study Area, the major taxonomic groups are discussed in Section 3.7.2 (Affected Environment). The major taxonomic groups include five groups of marine algae and one group of flowering plants (Table 3.7-1).

3.7.2 AFFECTED ENVIRONMENT

Features that influence the distribution and abundance of marine vegetation in the large marine ecosystems and open ocean areas of the Study Area are the availability of light, water quality, water clarity, salinity level, seafloor type (important for rooted or attached vegetation), currents, tidal schedule, and temperature (Green and Short 2003). Marine ecosystems depend almost entirely on the energy produced by marine vegetation through photosynthesis (Castro and Huber 2000), which is the transformation of the sun's energy into chemical energy. In the lighted surface waters of the open-ocean and coastal waters, marine algae and flowering plants provide oxygen and habitat for many organisms in addition to forming the base of the marine food web (Dawes 1998).

The five major taxonomic groups of algae (dinoflagellates and blue-green, green, brown, and red algae) occur throughout the Study Area (Spalding et al. 2003). Algae distribution is shaped by water temperature differences that are directed by the Loop Current, Gulf Stream, and North Atlantic Gyre Open Ocean Areas (Spalding et al. 2003). The number of species and proportion of red, brown, and green algae vary along the coast of the Study Area. The overall number of species of red and green algae is higher than brown algae in the warmer waters of the Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea Large Marine Ecosystems. Brown algae species are more common in the colder waters of the Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast U.S. Continental Shelf Large Marine Ecosystems (Dawes 1998). Some species of brown algae also occur in the Gulf Stream and North Atlantic Gyre Open Ocean Areas (Gower and King 2008; South Atlantic Fishery Management Council 2002).

The taxonomic group of marine vegetation that includes seagrass, cordgrass, and mangroves has more limited distributions; all of these occur in shallow (less than 26 m) water. The relative distribution of seagrass is influenced by the availability of suitable substrate in low-wave energy areas at depths that allow sufficient light exposure. Seagrass species distribution is influenced by water temperatures of the Loop Current, Florida Current, and Gulf Stream (Spalding et al. 2003). Cordgrasses form dense colonies in salt marshes that develop in temperate areas in protected, low-energy environments, along the intertidal portions of coastal lagoons, tidal creeks or rivers, or estuaries, wherever the sediment is adequate to support plant root development (Mitsch et al. 2009). Mangroves and cordgrasses have similar requirements, but mangroves are not tolerant of freezing temperatures. Their occurrence on the Atlantic coast of the United States is concentrated in tropical and subtropical waters with sufficient freshwater input.

The baseline description for marine vegetation in the Study Area, see Section 3.7.2 (Affected Environment), is based on references from scientific research and information published by regulatory

agencies. In Section 3.7.3 (Environmental Consequences), the alternatives were evaluated based on the potential and the degree to which exposure to training and testing activities could impact marine vegetation.

3.7.2.1 General Threats

Environmental stressors on marine vegetation are products of human activities (industrial, residential, and recreational) and natural occurrences. The impacts of these environmental stressors on marine vegetation and the existing conditions of this resource are important to consider in determining if Navy training and testing activities contribute to these stressors. Species-specific information is discussed where applicable in Sections 3.7.2.2 (Johnson's Seagrass [*Halophila johnsonii*]) through 3.7.2.8 (Seagrasses, Cordgrasses, and Mangroves [Phylum Magnoliophyta]), and the cumulative impacts of these threats are analyzed in Chapter 4 (Cumulative Impacts).

Human-made stressors that act on marine vegetation include excessive nutrient input (pollutants, such as fertilizers), siltation (the addition of fine particles to the ocean), pollution (oil, sewage) (Mearns et al. 2011), climate change (Arnold et al. 2012; Doney et al. 2012; Martinez et al. 2012; Olsen et al. 2012), overfishing (Mitsch et al. 2009; Steneck et al. 2002), shading from structures (National Marine Fisheries Service 2002), habitat degradation from construction and dredging (National Marine Fisheries Service 2002), and invasion by exotic species (Hemminga and Duarte 2000; Spalding et al. 2003). The seagrass, cordgrass, and mangrove taxonomic group is more sensitive to stressors than the algal taxonomic groups. The great diversity of algae makes it difficult to generalize, but overall, they are resilient and are able to colonize disturbed environments created by stressors (Levinton 2009b).

Seagrasses, cordgrasses, and mangroves are all susceptible to the human-made stressors on marine vegetation, and their presence in the Study Area has decreased as a result. Each type of vegetation is sensitive to additional unique stressors. Seagrasses are uprooted by dredging, scarred by boat propellers (Hemminga and Duarte 2000; Spalding et al. 2003), and uprooted and broken by anchors (Francour et al. 1999). Seagrass that is uprooted from dredging or scarred from boat propellers can take years to regrow (Dawes et al. 1997). Sedimentation associated with severe storms can impact some seagrass populations, particularly those located near inlets. Degraded water quality also has the potential to damage seagrass by stimulating algal growth, which results in negative impacts on seagrass habitat such as shading (Thomsen et al. 2012). A review of seagrass from 1879 to 2006 found that global seagrass coverage decreased by 75 percent overall (Waycott et al. 2009). Cordgrasses are damaged by sinking salt marsh habitat; a process known as marsh subsidence. Areal coverage of cordgrasses in U.S. Atlantic and Gulf of Mexico salt marshes has decreased dramatically (Stedman and Dahl 2008). Likewise, the global mangrove resource decreased by 50 percent from aquaculture, changes in hydrology (water movement and distribution), and sea level rise (Feller et al. 2010).

A stressor of particular concern is oil pollution. Runoff from land-based sources, natural seeps, and accidental spills (such as off-shore drilling and oil tanker leaks) are some of the major sources of oil pollution in the marine environment (Levinton 2009a). The type and amount of oil spilled, weather conditions, season, location, oceanographic conditions, and the method used to remove the oil (containment or chemical dispersants) are some of the factors that determine the severity of the impacts. Sensitivity to oil varies among species and within species, depending on the life stage; generally, early life stages are more sensitive than adult stages (Hayes et al. 1992). The tolerance to oil pollutants varies among the types of marine vegetation, but their exposure to sources of oil pollutants makes them all vulnerable.

Oil pollution can impact seagrasses directly by smothering the plants, or indirectly by lowering their ability to combat disease and other stressors (U.S. National Response Team 2010). Seagrasses that are totally submerged are less susceptible to oil spills since they largely escape direct contact with the pollutant. Depending on various factors, oil spills can result in a range of effects from no impact to long-lasting impacts, such as decreases in eelgrass density (Kenworthy et al. 1993; Peterson 2001). Algae are relatively resilient to oil spills, while mangroves are highly sensitive to oil exposure. Contact with oil can cause death, leaf loss, and failure to germinate (Hoff et al. 2002). Salt marshes (e.g., cordgrass) can also be severely impacted by oil spills, and the effects can be long-term (Culbertson et al. 2008).

The following section provides information on the ESA-protected species of marine vegetation and descriptions of the major marine vegetation taxonomic groupings listed in Table 3.7-1. Basic descriptions of each group and their ecosystem services roles, along with examples of representative species within the Study Area are discussed.

The discussion above represents general threats to marine vegetation. Additional threats to individual species within the Study Area are described below in the accounts of those species.

3.7.2.2 Johnson's Seagrass (*Halophila johnsonii*)

3.7.2.2.1 Status and Management

In 1998, Johnson's seagrass was the first marine plant species to be designated as federally threatened under the ESA by NMFS (FR 63(117): 49035-49041, September 14, 1998). In 2000, 10 areas in southeast Florida were designated as critical habitat (FR 65(66): 17786-17804, April 5, 2000); see Figure 3.7-1. The primary constituent elements of the critical habitat areas are "adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance" (FR 65(66): 17786-17804, April 5, 2000). Designated critical habitat areas also fulfill one or more of the following five criteria (FR 65(66): 17786-17804, April 5, 2000):

- Locations with populations that have persisted for 10 years
- Locations with persistent flowering plant populations
- Locations at the northern and southern range limits of the species
- Locations with unique genetic diversity
- Locations with a documented high abundance of Johnson's seagrass compared to other areas in the species' range

3.7.2.2.2 Habitat and Geographic Range

The preferred habitat for Johnson's seagrass is coastal lagoons and bays, from the area covered at high tide to depths of up to 9.8 ft. (3 m) (National Marine Fisheries Service 2002). It is found year-round in sediments of loose sand and silt-clay in beds with other species of seagrass (Creed et al. 2003; Eiseman and McMillan 1980).

The documented geographic range of Johnson's seagrass does not co-occur with the Study Area but occurs near the Study Area in the Southeast U.S. Continental Shelf Large Marine Ecosystem. This species is not found in any other large marine ecosystem or in any open ocean areas. It is reported to occur between Sebastian Inlet (Indian River Lagoon) and Biscayne Bay on the southeast coast of Florida in lagoons and bays (Florida Department of Environmental Protection 2010a; National Marine Fisheries Service 2002). Critical habitat areas occur in parts of the Indian River Lagoon and Biscayne Bay in Florida. A recent study reported Johnson's seagrass north of Sebastian Inlet, which extends the northern limit of

this species by 11.5 nautical miles (nm); the extension is considered temporary and only expected to occur under favorable conditions (Virnstein and Hall 2009).

No training or testing activities are proposed in the lagoons or bays where Johnson's seagrass occurs and they do not overlap with the critical habitat of this species. The Jacksonville (JAX) Operating Area (OPAREA) and the South Florida Ocean Measurement Facility Testing Range are the closest Navy training and testing areas to the distribution of Johnson's seagrass. Taking the northern extension into consideration, the northern limit for Johnson's seagrass is estimated to be 45 nm away from the southern border of the JAX OPAREA. The South Florida Ocean Measurement Facility Testing Range is less than 2 nm away from Johnson's seagrass critical habitat.

3.7.2.2.3 Population and Abundance

There are an estimated 502,000 acres (ac.) (203,155 hectares [ha]) of Johnson's seagrass between Sebastian Inlet and Biscayne Bay, Florida (Florida Department of Environmental Protection 2010a; National Marine Fisheries Service 2002). Population and abundance trends for this species are difficult to approximate due to its fairly recent identification as a distinct species (Eiseman and McMillan 1980), short-lived nature, and rareness of quantitative population data (Creed et al. 2003; National Marine Fisheries Service 2010; Virnstein et al. 2009). Since the 1970s, seagrass species have decreased by approximately 50 percent in the Indian River Lagoon, which constitutes a large part of the range for Johnson's seagrass (Woodward-Clyde Consultants 1994). This decline of seagrasses in the Indian River Lagoon was likely due to human impacts on water quality and marine substrates (Woodward-Clyde Consultants 1994). Compared to other seagrasses within its range in the Indian River area (Hobe Sound, Jupiter Sound, and Ft. Pierce Inlet), Johnson's seagrass is the least abundant (Virnstein and Hall 2009; Virnstein et al. 1997).

3.7.2.2.4 Species-Specific Threats

Johnson's seagrass is vulnerable to the threats to seagrasses discussed in Section 3.7.2.1 (General Threats). This species is especially vulnerable to these threats because of its limited distribution and reproductive capability (no seed production), which result in its limited potential for recovery (National Marine Fisheries Service 2002).

3.7.2.3 Blue-Green Algae (Phylum Cyanobacteria)

Blue-green algae include single-celled and filamentous (fine-threads) forms of photosynthetic (using the sun's energy to produce food) bacteria that inhabit the lighted surface water and seafloor of the world's oceans (Bisby et al. 2010). More than 1,000 species of blue-green algae occur in the Study Area (Castro and Huber 2000). Zooplankton (free-floating organisms) feed on blue-green algae at the sea surface and in the water column, and grazing organisms (e.g., molluscs: chitons and limpets) feed on blue-green algae on the seafloor. Blue-green algae occur in all large marine ecosystems, open ocean areas, and inland waters (e.g., lower Chesapeake Bay, Narragansett Bay, and St. Andrew Bay) of the Study Area. Common species of blue-green algae that occur in the Study Area are *Microcystis aeruginosa* and members of the genus *Synechococcus*.

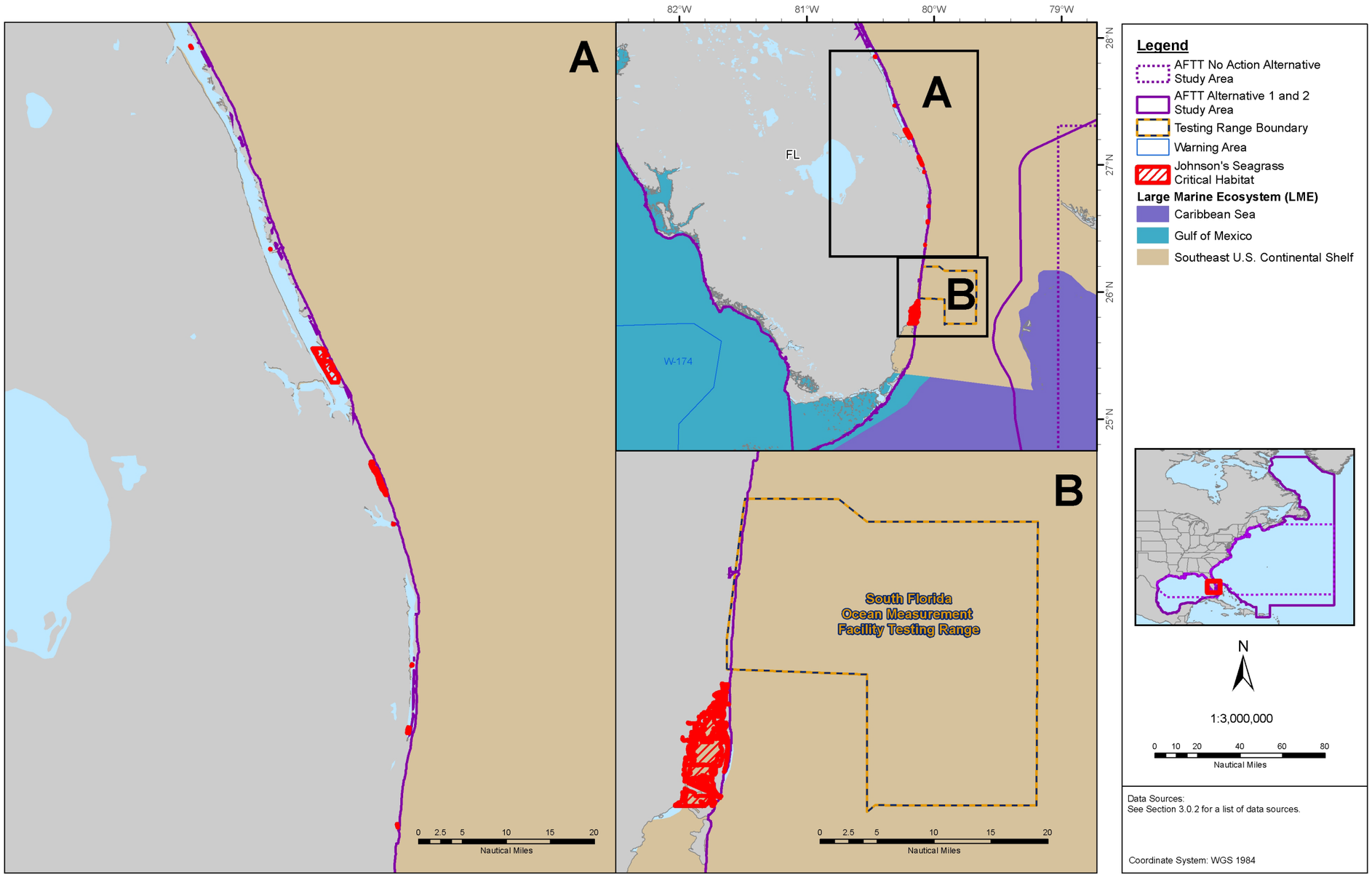

Figure 3.7-1: Critical Habitat Areas for Johnson's Seagrass Adjacent to the Study Area
AFTT: Atlantic Fleet Training and Testing; FL: Florida

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3.7.2.4 Dinoflagellates (Phylum Dinophyta)

Dinoflagellates are single-celled, predominantly marine algae (Bisby et al. 2010). Thousands of species live in the surface waters of the Study Area (Castro and Huber 2000). Most dinoflagellates are photosynthetic, and many can also ingest small food particles. They occur in all large marine ecosystems, open ocean areas, and inland waters of the Study Area. Organisms such as zooplankton feed on dinoflagellates. Dinoflagellates are responsible for some types of harmful algal blooms caused by sudden increases of nutrients (e.g., fertilizers) from land into the ocean or changes in temperature and sunlight (Levinton 2009c). Additional information on harmful algal blooms can be accessed on the Centers for Disease Control and the National Oceanic and Atmospheric Administration websites. Common species of dinoflagellates that occur in the Study Area are *Polysphaeridium zoharyi* and *Tectatodinium pellitum* (Marret and Zonneveld 2003).

3.7.2.5 Green Algae (Phylum Chlorophyta)

Green algae include single-celled and multi-celled types that form sheets or branched structures (Bisby et al. 2010). These multi-celled types of green algae are referred to as macroalgae (National Oceanic and Atmospheric Administration 2011). Hundreds of marine species of green algae are common in well-lit, shallow water. Green macroalgae and some single-celled algae are found attached to the seafloor or in sediments in all of the large marine ecosystems and inland waters of the Study Area (Levinton 2009c). Other types of green single-celled algae are planktonic (float freely in the ocean) and are found in the surface waters of the open ocean areas of the Study Area in addition to the areas where the macroalgae occur. Green algae species are eaten by various organisms, including zooplankton and snails. Some common species of green algae that occur in the Study Area are sea lettuce (*Ulva lactuca*) and members of the genus *Enteromorpha*.

3.7.2.6 Diatoms and Brown Algae (Phylum Ochrophyta)

Diatoms are primarily planktonic, single-celled organisms with cell walls made of silica (Castro and Huber 2000). Approximately 6,000 species of diatoms are marine organisms. Most species are found in the lighted areas, the upper 200 m of the water column (see Figure 3.0-5 in Section 3.0.3.2, Bathymetry), of the sea surface in the open ocean areas of the Study Area. Zooplankton feed on diatoms. Brown algae are predominately marine species with structures varying from fine filaments to thick leathery forms (Castro and Huber 2000). Most species are attached to the seafloor in coastal waters, although a free-floating type of brown algae (*Sargassum*) occurs in the Study Area. Two types of brown macroalgae that occur in the Study Area are kelp (*Laminaria* spp.) and *Sargassum* spp.

Kelp

Kelp is represented by three macroalgae species in the Study Area: *Laminaria saccharina, Laminaria longicruris*, and *Laminaria digitata* (Egan and Yarish 1988). Kelp are anchored to hard surfaces on the seafloor (Levinton 2009b). These kelp species occur from the low tide line out to depths as great as 65 ft. (20 m) depending on the water clarity (Luning 1990; Steneck et al. 2002) along the rocky, northwest Atlantic shores in large subtidal stands where sufficient nutrients are available (Vadas et al. 2004). In the Study Area, *Laminaria* spp. occur from Greenland to Long Island in the Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems, and in the northern part of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Mathieson et al. 2009; Steneck et al. 2002). In Long Island Sound, the most extensive population is in Black Ledge, Groton, Connecticut (Egan and Yarish 1990); this location is also the southern limit for kelp in the Study Area. Organisms such as sea urchins and crustaceans feed on kelp (Steneck et al. 2002).

Sargassum

The dominant open-ocean species of S*argassum* in the Study Area are *Sargassum natans* and *Sargassum fluitans* (hereafter collectively referred to as *Sargassum*). These species float freely on the sea surface and grow in clumps and mats (Coston-Clements et al. 1991). Accumulations of *Sargassum* are vital to some species and economically important to commercial fisheries and other industries. It provides foraging areas and habitat for marine organisms (e.g., sea turtles, birds, and fish) and raw materials for fertilizers and medicines (South Atlantic Fishery Management Council 2002). See Sections 3.5 (Sea Turtles and Other Marine Reptiles), 3.6 (Birds), and 3.9 (Fish) for more information.

Harvesting too much *Sargassum* is a threat to this resource (McHugh 2003; Trono and Tolentino 1993). To maintain this resource, *Sargassum* is managed under the Fishery Management Plan for Pelagic *Sargassum* Habitat of the South Atlantic Region due to its importance as Essential Fish Habitat for numerous species (South Atlantic Fishery Management Council 2002).

In the Study Area, *Sargassum* is widely distributed in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream and North Atlantic Gyre Open Ocean Areas. In the North Atlantic, *Sargassum* occurs mainly within the physical bounds of the North Atlantic Gyre Open Ocean Area, between latitudes 20° N and 40° N, and between longitude 30° W and the western edge of the Gulf Stream—a region known as the Sargasso Sea (Gower et al. 2006; South Atlantic Fishery Management Council 2002). Some exchange occurs among the *Sargassum* populations in the Caribbean Sea, Gulf of Mexico, and the North Atlantic. Recent satellite image evidence suggests that *Sargassum* originates in the northwest Gulf of Mexico every spring and is moved into the Atlantic east of Cape Hatteras in late summer by the Loop Current and Gulf Stream, and later appears northeast of the Bahamas in the beginning of the next year (Gower and King 2008). See Section 3.0.3.3 (Currents, Circulation Patterns, and Water Masses) for more information on the Loop Current and Gulf Stream.

The difficulty of tracking and sampling *Sargassum* makes acquiring information about its distribution and abundance difficult. Estimates based on towed net samples for the North Atlantic range from 4.4 to 12 million U.S. tons (4 to 11 billion kg) (Butler et al. 1983; South Atlantic Fishery Management Council 2002). A more recent estimate based on satellite imaging data puts the average total mass of *Sargassum* at 2 million U.S. tons (1.8 billion kg) in the Gulf of Mexico and the Atlantic (1 million U.S. tons [900 million kg] in each) (Gower and King 2008). Using the low and high abundance estimates (2 million U.S. tons [1.8 billion kg] to 12 million U.S. tons [11 billion kg]) and a conversion factor of 25 grams per square meter of *Sargassum* (Gower et al. 2006), approximately 21,000 nm^2 to 130,000 nm^2 of the Study Area is covered by *Sargassum*. Given the size of the Study Area (approximately 2.6 million nm^2), the relative coverage of *Sargassum* ranges from less than 1 percent to 5 percent of the sea surface.

3.7.2.7 Red Algae (Phylum Rhodophyta)

Red algae are predominately marine, with approximately 4,000 species of microalgae and macroalgae worldwide (Castro and Huber 2000). Red macroalgae species have various forms from fine filaments to thick calcium carbonate crusts and require a surface to attach to such as hard bottom or another plant. Red macroalgae and some microalgae species are found attached to the seafloor or on sediment, respectively, in all of the large marine ecosystems and the inland waters of the Study Area (Adey and Hayek 2011; Levinton 2009b). Planktonic microalgae are present in the surface waters of the open ocean areas of the Study Area in addition to the areas where the macroalgae occur. Some common species of red algae that occur in the Study Area are in the genus *Lithothamnion* (crustose coralline algae). Red algae are a food source for various zooplankton, sea urchins, fishes, and chitons.

3.7.2.8 Seagrasses, Cordgrasses, and Mangroves (Phylum Magnoliophyta)

Seagrasses

The nine species of seagrass that occur within the Study Area are listed in Table 3.7-2 (Spalding et al. 2003). Seagrasses are unique among flowering plants in their ability to grow submerged in shallow marine environments. Seagrasses grow predominantly in shallow, subtidal, or intertidal sediments sheltered from wave action in estuaries, lagoons, and bays (Phillips and Meñez 1988) and can extend over a large area to form seagrass beds (Garrison 2004; Gulf of Mexico Program 2004; Phillips and Meñez 1988). Seagrasses, including ESA-listed Johnson's seagrass, serve as a food source for numerous species (e.g., green sea turtles, West Indian manatees, and various plant-eating fishes) (Heck et al. 2003; National Marine Fisheries Service 2002; National Oceanic and Atmospheric Administration 2001).

Seagrasses occur in all Atlantic and Gulf of Mexico coastal states, except for Georgia and South Carolina (Fonseca et al. 1998). In the Study Area, seagrasses grow at a minimum depth of 0.2 m (0.66 ft.) to a maximum depth of 26.5 m (86.9 ft.) (Ferguson and Wood 1994; Florida Department of Environmental Protection 2010b; Fourqurean et al. 2002). Depth limits for seagrasses in inland portions of the Study Area are 6 m (19.7 ft.) in Narragansett Bay (Narragansett Bay Estuary Program 2010), 1 m (3.2 ft.) in Chesapeake Bay (Orth and Moore 1988), and 2.4 m (7.9 ft.) in St. Andrew Bay (Florida Department of Environmental Protection 2010b). The largest area of seagrass in the Study Area occurs in the Gulf of Mexico Large Marine Ecosystem, followed by the Southeast U.S. Continental Shelf, and the Northeast U.S. Continental Shelf Large Marine Ecosystems (Spalding et al. 2003).

Table 3.7-2: Presence of Seagrass Species within the Study Area

Seagrass Species	Presence in the Study Area[1]
Clover grass (*Halophila baillonii*)	Gulf of Mexico, Caribbean Sea
Eelgrass (*Zostera marina*)	West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf
Engelmann's seagrass (*Halophila engelmannii*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Johnson's seagrass (*Halophila johnsonii*)	Southeast U.S. Continental Shelf, Caribbean Sea
Manatee grass (*Syringodium filiforme*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Paddle grass (*Halophila decipiens*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Shoal grass (*Halodule wrightii*)	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Turtlegrass (*Thalassia testudinum*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Widgeon grass (*Ruppia maritima*)	Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea

Source: (Spalding et al. 2003)

[1] Presence in the Study Area indicates the coastal waters of large marine ecosystems (Gulf of Mexico, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Caribbean Sea, Scotian Shelf, Newfoundland-Labrador Shelf, and West Greenland Shelf) in which the species are found.

Cordgrasses

The most common species of cordgrass in the Study Area is known as smooth or salt-marsh cordgrass (*Spartina alterniflora*) (Mitsch et al. 2009). Cordgrasses and other emergent marsh species are salt-tolerant, moderate-weather (temperate) species and an integral component of salt marsh vegetation. Salt marshes develop in intertidal, protected low-energy environments, usually in coastal lagoons, tidal creeks or rivers, or estuaries (Mitsch et al. 2009).

Salt marsh is the dominant coastal wetland type along much of the Atlantic and gulf coasts of the United States. Cordgrasses occur in salt marshes from Maine to Florida, and along the Gulf of Mexico from Louisiana to Texas (Mitsch et al. 2009). Most salt marsh coverage in the Study Area is concentrated in the Gulf of Mexico Large Marine Ecosystem, covering an estimated 2,498,225 ac. (1,011,000 ha), while an additional 1,653,130 ac. (669,000 ha) of salt marsh occurs in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems (Watzin and Gosselink 1992).

Mangroves

Mangroves are a group of woody plants that have adapted to brackish water environments (where salt water and freshwater mix) (Ruwa 1996). Mangroves inhabit marshes and mudflats in tropical and subtropical areas. Within the Study Area, three mangrove species occur in the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems (Table 3.7-3) (Spalding et al. 2013). Mangroves occur from Cedar Key to Cape Canaveral, Florida (Mitsch et al. 2009). The northern limit for mangroves in Florida is St. Augustine. The largest continuous tract of mangrove forest in the Study Area is found in the Florida Everglades system (U.S. Geological Survey 2003).

Table 3.7-3: Presence of Mangrove Species in the Study Area

Mangrove Species	Presence in the Study Area[1]
Red mangrove (*Rhizophora mangle*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
Black mangrove (*Avicennia germinans*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea
White mangrove (*Laguncularia racemosa*)	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea

Sources: (Ellison et al. 2007a, b, c)

[1] Presence in the Study Area indicates the coastal waters of large marine ecosystems (Gulf of Mexico, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Caribbean Sea, Scotian Shelf, Newfoundland-Labrador Shelf, and West Greenland Shelf) in which the species are found.

3.7.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine vegetation. General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Each marine vegetation stressor is introduced, analyzed by alternative, and analyzed for training and testing activities. Table F-3 in Appendix F (Training and Testing Activities Matrices) shows the warfare areas and associated stressors that were considered for analysis of marine vegetation.

The stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to marine vegetation discussed in Section 3.7.2 (Affected Environment) the stressors applicable to marine vegetation are:

- Acoustic (explosives)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, seafloor devices)
- Secondary stressors (sediment and water quality)

Given that marine vegetation is not susceptible to energy, entanglement, or ingestion stressors they will not be assessed. Only the Navy training and testing activity stressors and their components that occur in the same geographic location as marine vegetation are analyzed in this section. Training and testing

activities pose no direct threat to some types of marine vegetation habitats. For example, mangroves and emergent marsh species, including cordgrass species, border parts of the Study Area and some naval ports and shipyards and transit channels, but do not overlap with Navy training and testing activities. Because the potential for Navy activities to directly impact these marine vegetation types is remote, they are evaluated only for secondary stressors. Although the ESA-listed species, Johnson's seagrass, does not occur in any of the Study Area locations where training and testing activities occur (see Section 3.7.2.2.2, Habitat and Geographic Range), given the proximity of its critical habitat to the South Florida Ocean Measurement Facility Testing Range, potential impacts to this species are considered in the analysis. Details of all training and testing activities, stressors, components that cause the stressor, and geographic occurrence within the Study Area, are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.7.3.1 Acoustic Stressors

This section analyzes the potential impacts of acoustic stressors that may occur during Navy training and testing activities on marine vegetation within the Study Area. The acoustic stressors that may impact marine vegetation include explosives that are detonated on or near the surface of the water, or underwater; therefore, only these types of explosions are discussed in this section.

3.7.3.1.1 Impacts from Explosives

There are various types of explosives that are used during training and testing activities. A discussion of the type, number, and location of activities that use explosives under each alternative is presented in Section 3.0.5.3.1.2 (Explosives). Explosive sources are the only acoustic stressor applicable to this resource because of the potential for explosives to result in physical damage to marine vegetation.

In areas where marine vegetation overlaps with locations for explosions, the vegetation that may be impacted occurs on the surface of the water, in the water column, or rooted in the seafloor. Single-celled algae may overlap with underwater and sea surface explosion locations. If single-celled algae are in the immediate vicinity of an explosion, only a small number of them are likely to be impacted relative to their total population level. The low number of explosions on or near the bottom relative to the amount of single-celled algae in the Study Area also decreases the potential for impacts. The impact on single-celled algae would not be detectable; therefore, it will not be discussed further.

Macroalgae attached to the seafloor, floating *Sargassum,* and seagrasses may all occur in locations where explosions are conducted and may be adversely impacted for different reasons. Attached macroalgae grow quickly and are resilient to high levels of wave action (Mach et al. 2007), which may aid in their ability to recover from and withstand wave action caused by underwater explosions near them on the seafloor. Floating *Sargassum* is more resilient to physical disturbance than seagrass, but there are more explosions on or near the surface where they co-occur. Seagrasses, including ESA-listed Johnson's seagrass, take longer to recover from physical disturbance than macroalgae, despite the relatively low number of explosions on or near the bottom where they co-occur. For these reasons, only attached macroalgae, *Sargassum,* and seagrasses are analyzed further for potential impacts of explosions. Neither the ESA-listed species Johnson's seagrass, nor its critical habitat, overlap with the Study Area; however, an analysis of potential impacts is included due to its proximity to training and testing activity areas.

The potential for impacts to marine vegetation from explosions would depend on the presence and amount of vegetation, the depth of the explosion, the number of explosives used, and their net explosive weight. Attached macroalgae need hard or artificial substrate in order to grow. The

distribution of attached macroalgae is inferred by the presence of hard or artificial substrate that occurs at depths of less than 200 m throughout the Study Area; see Section 3.3.2.6 (Hard Bottoms) for information regarding the distribution of hard substrate in the Study Area. If attached macroalgae are in the immediate vicinity of an explosion, only a small number of them are likely to be impacted relative to their total population level.

Sargassum distribution is difficult to predict (Gower and King 2008; South Atlantic Fishery Management Council 2002) and it may overlap with any of the locations where sea surface and underwater explosions are conducted. In the Study Area, the relative coverage of *Sargassum* is very low ranging from less than 1 percent to 5 percent of the sea surface; see Section 3.7.2.6 (Diatoms and Brown Algae [Phylum Ochrophyta]) for details. *Sargassum* may be impacted by surface disturbances from underwater or sea surface explosions, although *Sargassum* is resilient to natural conditions caused by wind, wave action, and severe weather that may break apart pieces of the mat or cause the mats to sink. In the unlikely situation that a *Sargassum* mat is broken by an explosion, the broken pieces may develop into new *Sargassum* mats because *Sargassum* reproduces by vegetative fragmentation (new plants develop from pieces of the parent plant) (South Atlantic Fishery Management Council 1998). Impacts to *Sargassum* from underwater explosions may potentially collapse the pneumatocysts (air sacs) that keep the mats floating at the surface. Evidence suggests that *Sargassum* will remain floating even when up to 80 percent of the pneumatocysts are removed (Zaitsev 1971). So even if an explosion caused the collapse of most of a *Sargassum* mat's pneumatocysts, it may not cause it to sink. Since the occurrence of *Sargassum* is an indicator of marine mammal and sea turtle presence, some mitigation measures designed to reduce impacts on these resources may indirectly reduce impacts on *Sargassum;* see Section 5.3.2.1.2 (Explosives and Impulsive Sound). Explosions could cause injury to the organisms that inhabit *Sargassum*. See Sections 3.4 (Marine Mammals), 3.5 (Sea Turtles and Other Marine Reptiles), 3.8 (Marine Invertebrates), and 3.9 (Fish) for the assessment of impacts from explosions on these resources.

The potential for seagrass to overlap with underwater and surface explosions is limited to the Key West Range Complex based on relevant mapping data, see Figure 3.7-2 (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012). Seagrasses may potentially be uprooted or damaged by sea surface or underwater explosions. They are much less resilient to disturbance relative to *Sargassum*; regrowth after uprooting can take up to 10 years (Dawes et al. 1997). Explosions may also temporarily increase the turbidity (sediment suspended in the water) of nearby waters, but the sediment would settle to pre-explosion conditions within a number of days. Sustained high levels of turbidity may reduce the amount of light that reaches vegetation which it needs to survive. This scenario is not likely given the low number of explosions planned in areas with seagrass. It should be noted that seagrasses generally grow in waters that are sheltered from wave action, such as estuaries, lagoons, and bays (Phillips and Meñez 1988) where most activities are not conducted.

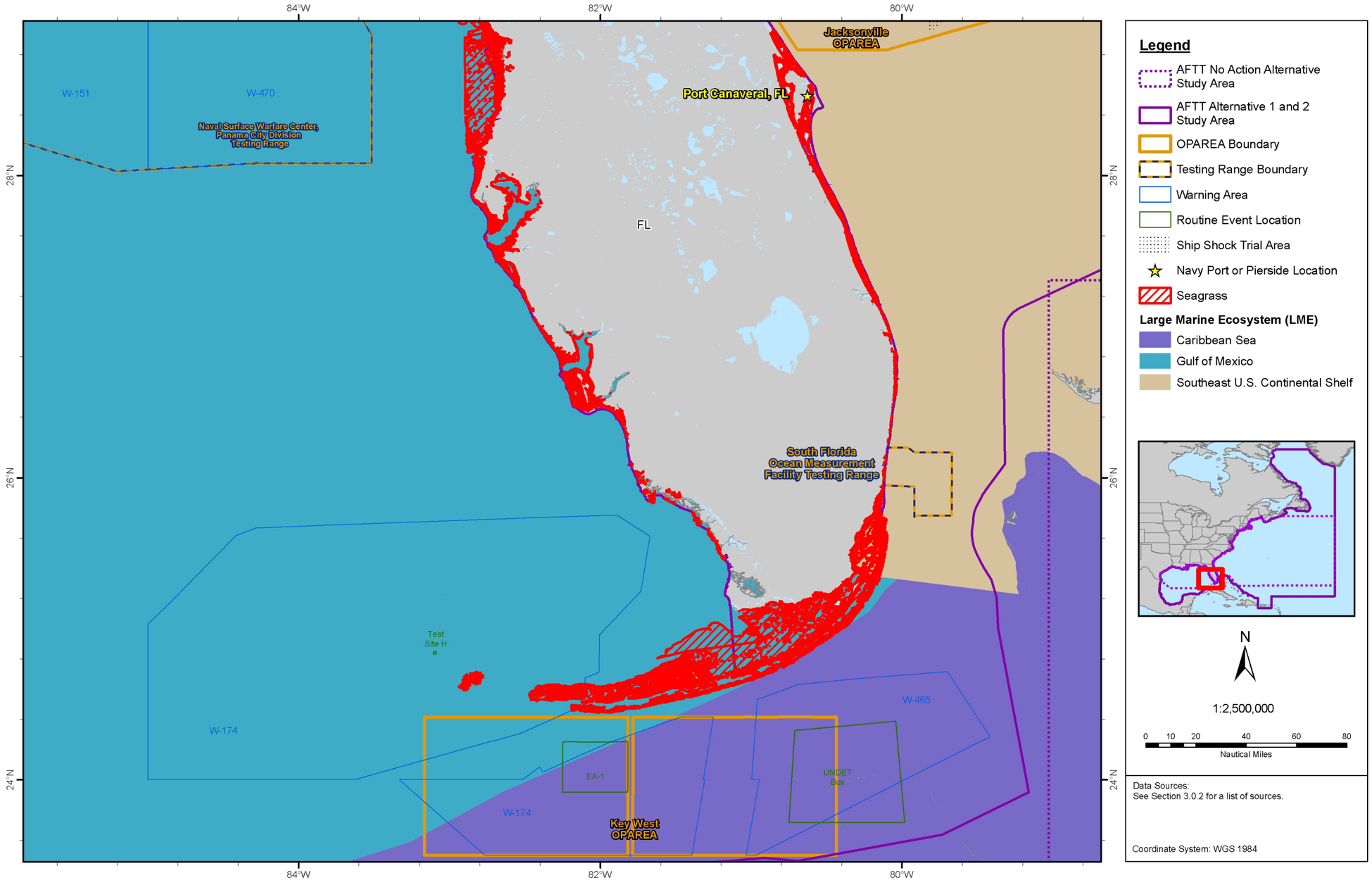

Figure 3.7-2: Seagrass Occurrence in South Florida

AFTT: Atlantic Fleet Training and Testing; FL: Florida; OPAREA: Operating Area; UNDET: Underwater Detonation

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3.7.3.1.1.1 No Action Alternative

Training Activities

Section 3.0.5.3.1.2 (Explosives) contains information regarding the location and number of explosives detonated in the Study Area. Under the No Action Alternative, underwater and surface explosions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems. The majority of training activities involving explosions would be conducted in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the Virginia Capes (VACAPES) Range Complex. Explosions would also be conducted in the JAX, Navy Cherry Point, Gulf of Mexico (GOMEX), and Northeast Range Complexes, and Other AFTT Areas. Training activities using explosions generally do not occur within 3 nm of shore. In addition, the majority of underwater explosions in the Study Area would likely occur over unvegetated seafloor because it is the predominant bottom-type in the areas proposed for these activities. However, marine vegetation such as attached macroalgae and *Sargassum* may overlap with underwater explosions (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012; U.S. Fish and Wildlife Service 2012). The total population of attached macroalgae is high relative to the small number likely to be impacted by underwater explosions. *Sargassum* distribution is patchy and difficult to predict (Gower and King 2008; South Atlantic Fishery Management Council 2002), but it may overlap with some of the training locations identified under the No Action Alternative where surface explosions may occur, see Table 3.0-13. However, the estimated distribution of *Sargassum* in the Study Area ranges from 21,000 nm^2 to 130,000 nm^2.

Under the No Action Alternative, seagrasses are absent from all of the locations for underwater and surface explosions based on marine vegetation maps (National Coastal Data Development Center and National Oceanic and Atmospheric Administration 2012; North Carolina Department of Environmental and Natural Resources 2012).

There is no overlap of underwater or surface explosions with designated critical habitat for Johnson's seagrass. Primary constituent elements may occur in locations that have not been designated as critical habitat but Johnson's seagrass critical habitat must meet at least one of five additional criteria (Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, underwater and sea surface explosions will not affect Johnson's seagrass critical habitat.

Underwater and surface explosions conducted for training activities are not expected to cause any risk to *Sargassum,* attached macroalgae or seagrass because: (1) the large distribution of *Sargassum* in the Study Area, (2) new growth may result from *Sargassum* exposure to explosives, (3) only a small number of attached macroalgae would be impacted, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts to *Sargassum* and attached macroalgae from surface explosions are not expected to result in detectable changes to their growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts to seagrass.

Pursuant to the ESA, the use of explosives during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Section 3.0.5.3.1.2 (Explosives) contains information regarding the location and number of explosives detonated in the Study Area. Under the No Action Alternative, underwater and surface explosions occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex; JAX Range Complex; Panama City OPAREA; and Naval Surface Warfare Center, Panama City Division Testing Range. Testing activities using explosions generally do not occur within 3 nm of shore. In addition, the majority of underwater explosions in the Study Area would likely occur over unvegetated seafloor because it is the predominant bottom-type in the areas proposed for these activities; however, some types of marine vegetation may overlap with underwater explosions.

Sargassum distribution is patchy and difficult to predict, but it may overlap with some of the testing locations identified under the No Action Alternative where surface explosions may occur (see Table 3.0-13). As discussed under the No Action Alternative for training activities, attached macroalgae may occur in testing locations and the estimated distribution of *Sargassum* in the Study Area is relatively wide.

Seagrasses are absent from all of the testing locations for underwater and surface explosions based on the general practice of excluding explosions from areas where seagrasses predominantly grow (e.g., bays, rivers, and estuaries) (Section 3.7.2.8, Seagrasses, Cordgrasses, and Mangroves [Phylum Magnoliophyta]), and relevant marine vegetation maps (National Coastal Data Development Center and National Oceanic and Atmospheric Administration 2012; North Carolina Department of Environmental and Natural Resources 2012).

There is no overlap of underwater or surface explosions with designated critical habitat for Johnson's seagrass. Primary constituent elements may occur in locations that have not been designated as critical habitat but Johnson's seagrass critical habitat must meet at least one of five additional criteria (Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, underwater and surface explosions will not affect Johnson's seagrass critical habitat.

Underwater and surface explosions conducted for testing activities are not expected to cause any risk to *Sargassum,* attached macroalgae, or seagrass because: (1) the large distribution of *Sargassum* in the Study Area, (2) new growth may result from *Sargassum* exposure to explosives, (3) only a small number of attached macroalgae would be impacted, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts to *Sargassum* and attached macroalgae from surface explosions are not expected to result in detectable changes to their growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts to seagrass.

Pursuant to the ESA, the use of explosives during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, underwater and surface explosions conducted in the Study Area would increase by two-fold over the No Action Alternative (Section 3.0.5.3.1.2, Explosives). As under the No Action Alternative, training activities would continue to occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems. Also, most underwater explosions would be conducted in the VACAPES Range Complex in the Northeast U.S. Continental Shelf Large Marine Ecosystem. Under Alternative 1, activities would be introduced in the Key West Range Complex in the Gulf of Mexico Large Marine Ecosystem.

The potential impacts on *Sargassum* and attached macroalgae from exposure to surface explosions are as described in Section 3.7.3.1.1.1 (No Action Alternative). As discussed, the expected impact is small relative to the distribution of *Sargassum* and attached macroalgae in the Study Area.

Under Alternative 1, seagrasses in the Key West Range Complex could potentially be exposed to underwater and surface explosions from only six charges. The overlap of seagrass with this stressor is as described in Section 3.7.3.1.1 (Impacts from Explosives) and does not include ESA-listed Johnson's seagrass, see Figure 3.7-2. The impact footprint of the planned underwater explosions on bottom habitats in the Key West Range Complex is 0.00019 nm^2, see Table 3.3-5. This is a small area relative to the gross estimation of 130 nm^2 of seagrass in the range complex. Underwater explosions conducted for training activities are not expected to cause any risk to seagrass because: (1) the impact area of underwater explosions is very small relative to seagrass distribution, (2) the low number of charges reduces the potential for impacts, and (3) disturbance would be temporary. Underwater and surface explosions are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk of *Sargassum* and attached macroalgae to exposure from surface explosions. It should be noted that the majority of the difference is due to the increase in medium-caliber projectiles, which are the smallest type of explosive described in Section 3.0.5.3.1.2 (Explosives). The differences in overlap with *Sargassum* and seafloor macroalgae and the potential impacts of surface explosions on them during training activities would not be discernible from those described in Section 3.7.3.1.1.1 (No Action Alternative). For the same reasons as stated in Section 3.7.3.1.1.1 (No Action Alternative) for *Sargassum* and attached macroalgae, surface explosions are not expected to result in detectable changes to their growth, survival, or propagation, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Under Alternative 1, underwater and surface explosions conducted in the Study Area would increase by three-fold compared to the No Action Alternative (Section 3.0.5.3.1.2, Explosives). As under the No Action Alternative, testing activities would continue to occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, specifically within the VACAPES Range Complex; JAX Range Complex; Panama City OPAREA; and Naval Surface Warfare Center, Panama City Division Testing Range. The majority of the explosions would occur in VACAPES and JAX

Range Complexes. Under Alternative 1, activities would be introduced in the Key West Range Complex in the Gulf of Mexico Large Marine Ecosystem.

The general conditions described for testing activities, the overlap with *Sargassum* and attached macroalgae, and the potential impacts on *Sargassum* and attached macroalgae from exposure to surface explosions are as described in Section 3.7.3.1.1.1 (No Action Alternative).

Seagrasses are absent from all of the Alternative 1 testing locations for underwater and surface explosions based on the general practice of excluding explosions from areas where seagrasses predominantly grow (e.g., bays, rivers, and estuaries) (Section 3.7.2.8, Seagrasses, Cordgrasses, and Mangroves [Phylum Magnoliophyta]), and relevant marine vegetation maps (National Coastal Data Development Center and National Oceanic and Atmospheric Administration 2012; North Carolina Department of Environmental and Natural Resources 2012). For example, underwater explosions introduced under Alternative 1 from ship shock activities in the VACAPES or JAX Range Complexes only occur in waters that exceed 3,000 m (9,842.5 ft.) in depth which is beyond the depth limit of seagrasses (26.5 m [86.9 ft.]).

In comparison to the No Action Alternative, the three-fold increase in activities presented in Alternative 1 may increase the risk of *Sargassum* and attached macroalgae from exposure to underwater and surface explosions. It should be noted that the majority of the difference is due to the increase in medium-caliber projectiles, which are the smallest type of explosive described in Section 3.0.5.3.1.2 (Explosives). The differences in *Sargassum* and attached macroalgae overlap, and potential impacts of surface explosions on *Sargassum* and attached macroalgae during training activities would not be discernible from those described in Section 3.7.3.1.1.1 (No Action Alternative). Surface explosions are not expected to result in detectable changes to *Sargassum* or attached macroalgae growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts to seagrass. Similarly, underwater and surface explosions are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.1.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.7.3.1.1.2 (Alternative 1).

Testing Activities

Under Alternative 2, underwater and surface explosion use in the Study Area would increase by four-fold compared to the No Action Alternative but this is only a 31 percent increase compared to Alternative 1 (Section 3.0.5.3.1.2, Explosives). The locations of testing activities under Alternative 2 are identical to testing activities under Alternative 1.

The four-fold increase in surface explosions over the No Action Alternative and 31 percent increase in explosions over Alternative 1 may increase the risk of *Sargassum* and attached macroalgae exposure to

surface explosions under Alternative 2. However, the differences in *Sargassum* and attached macroalgae overlap, and potential impacts of surface explosions on *Sargassum* and attached macroalgae during testing activities would not be discernible from those described in Section 3.7.3.1.1.1 (No Action Alternative).

For the same reasons as stated in Section 3.7.3.1.1.2 (Alternative 1), surface explosions are not expected to result in detectable changes to *Sargassum* or attached macroalgae growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts to seagrass. Similarly, underwater and surface explosions are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.1.1.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that the impact on attached macroalgae is determined to be minimal and temporary to short-term throughout the Study Area (U.S. Department of the Navy 2013). The impact on floating macroalgae is determined to be minimal and short-term throughout the Study Area (U.S. Department of the Navy 2013). Given the available information, the impact on submerged rooted vegetation beds is determined to be minimal and long-term (U.S. Department of the Navy 2013).

3.7.3.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors used by the Navy during training and testing activities within the Study Area. For a list of Navy activities that involve this stressor refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). The physical disturbance and strike stressors that may impact marine vegetation include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

The evaluation of impacts to marine vegetation from physical disturbance or strike stressors focuses on proposed activities that may cause vegetation to be damaged by an object moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., military expended materials), or devices deployed on the seafloor (e.g., mine shapes and anchors). Not all activities are proposed throughout the Study Area. Wherever appropriate, specific geographic areas (i.e., large marine ecosystems and OPAREAs) of potential impact are identified (Section 3.0.5.3.3, Physical Disturbance and Strike Stressors).

Single-celled algae may overlap with physical disturbance or strike stressors, but the impact would be minimal relative to their total population level; therefore, they will not be discussed further. Seagrasses and macroalgae on the seafloor and *Sargassum* on the sea surface are the only types of marine vegetation that occur in locations where physical disturbance or strike stressors may be encountered. Therefore, only seagrasses, macroalgae, and *Sargassum* are analyzed further for potential impacts of

physical disturbance or strike stressors. Since the occurrence of *Sargassum* is an indicator of marine mammal and sea turtle presence, some mitigation measures designed to reduce impacts on these resources may indirectly reduce impacts on *Sargassum* (see Section 5.3.2.2, Physical Strike and Disturbance).

3.7.3.2.1 Impacts from Vessels and In-Water Devices

The majority of the training and testing activities under all the alternatives involves vessels, and some activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many activities would occur under each alternative (see Section 3.0.5.3.3 Physical Disturbance and Strike Stressors). For a list of Navy activities that involve vessel movement and in-water devices, refer to Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), respectively. In-water devices such as unmanned underwater vehicles are typically propeller driven and operate within the water column and would not intersect with marine vegetation and, therefore, will not be discussed further. Towed in-water devices are operated either on the sea surface or below it.

Physical disturbances and strikes by vessels, in-water devices, and towed in-water devices on seafloor vegetation such as seagrass and attached macroalgae are not considered since these types of occurrences would involve contact with the seafloor. Interaction of vessels, in-water devices, and towed in-water devices with the seafloor is avoided due to the potential for damage to equipment. Amphibious vehicles are an exception to this given that they are designed to come into contact with the seafloor in the surf zone (area of wave action). However, attached macroalgae and seagrass do not overlap with amphibious combat vehicle activities based on relevant literature and resource maps (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012; North Carolina Department of Environmental and Natural Resources 2012). Macroalgae floating in the area may be disturbed by amphibious combat vehicle activities but the impact would not be detectable given the low number of activities (see Table 2.8-1) and will not be considered further.

The only type of marine vegetation that may potentially be disturbed by vessels and in-water devices is *Sargassum*. *Sargassum* distribution is difficult to predict (Gower and King 2008; South Atlantic Fishery Management Council 2002) and it may overlap with any of the locations where vessels and in-water devices are used. In the Study Area, the relative coverage of *Sargassum* is very low ranging from less than 1 percent to 5 percent of the sea surface; see Section 3.7.2.6 (Diatoms and Brown Algae [Phylum Ochrophyta]) for details. *Sargassum* may be impacted by vessels and in-water devices, although *Sargassum* is resilient to natural conditions caused by wind, wave action, and severe weather that may break apart pieces of the mat or cause the mats to sink. In the unlikely situation that a *Sargassum* mat is broken by a vessel or in-water device, the broken pieces may develop into new *Sargassum* mats because *Sargassum* reproduces by vegetative fragmentation (new plants develop from pieces of the parent plant) (South Atlantic Fishery Management Council 1998). Impacts to *Sargassum* from vessels and in-water devices may potentially collapse the pneumatocysts that keep the mats floating at the surface. Evidence suggests that *Sargassum* will remain floating even when up to 80 percent of the pneumatocysts are removed (Zaitsev 1971). Even if a vessel or in-water device strike results in the collapse of most of a *Sargassum* mat's pneumatocysts, it may not cause it to sink.

Standard operating procedures involving towed devices reduce the devices' impact on *Sargassum*. Prior to deploying a towed device, there is a standard operating procedure to search the intended path of the device for any floating debris (i.e., driftwood) or other potential obstructions (i.e., *Sargassum* concentrations and animals), since they have the potential to cause damage to the device. This practice

reduces the potential for towed devices to strike *Sargassum*. Vessels and in-water devices could cause injury to the organisms that inhabit *Sargassum*. See Sections 3.4 (Marine Mammals), 3.5 (Sea Turtles and Other Marine Reptiles), 3.8 (Marine Invertebrates), and 3.9 (Fish) for the assessment of impacts from vessels and in-water devices on these resources.

3.7.3.2.1.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) and Section 3.0.5.3.3.2 (In-Water Devices) provide estimates of relative vessel use and location for each of the alternatives. These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel usage is dependent upon military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Training and testing concentrations are most dependent upon locations of Navy shore installations and established training and testing areas. Even with the introduction of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel and in-water device use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade and, therefore, the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5, Standard Operating Procedures, Mitigation Measures and Monitoring. The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), the majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. See Section 3.0.5.3.3.1 (Vessels) for a representative list of Navy vessel sizes and speeds and the number and location of activities including vessels and Section 3.0.5.3.3.2 (In-Water Devices) for the types, sizes, and speeds of Navy in-water devices used in the Study Area and the number and location of activities including in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers, and range areas. Navy training vessel traffic would be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Naval Station Mayport in Jacksonville, Florida in the Southeast U.S. Continental Shelf Large Marine Ecosystem. There is no seasonal differentiation in Navy vessel use. Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open-ocean portions of the Study Area because of the concentration of vessel movements in those areas.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices occur in the Gulf of Mexico, Northeast U.S. Continental Shelf, and Southeast U.S. Continental Shelf Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area, specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Use of in-water devices is concentrated within the VACAPES Range Complex. The number of in-water device activities increases by approximately 80 percent under Alternative 1 and Alternative 2 compared to the No Action Alternative.

There is no overlap of vessels or in-water devices with designated critical habitat for Johnson's seagrass. In addition to primary constituent elements, Johnson's seagrass critical habitat must meet at least one of five criteria (see Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, neither vessels nor in-water devices will affect Johnson's seagrass critical habitat.

Vessel and in-water devices used in training activities would not cause a detectable impact on *Sargassum* because: (1) the relative coverage of *Sargassum* in the Study Area is low, (2) new growth may result from *Sargassum* exposure to vessels and in-water devices, and (3) standard operating procedures reduce the potential for impacts caused by in-water devices. Based on these factors, potential impacts to *Sargassum* from vessels and in-water devices are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), Navy testing vessel traffic would be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Naval Station Mayport in Jacksonville, Florida in the Southeast U.S. Continental Shelf Large Marine Ecosystem.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices occur in the Gulf of Mexico and Northeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the Northeast and VACAPES Range Complexes and Naval Surface Warfare Center, Panama City Division Testing Range. The differences in the number of in-water device activities between alternatives increases by approximately twofold under Alternative 1 and Alternative 2 compared to the No Action Alternative.

Propulsion testing activities, also referred to as high speed vessel trials, occur infrequently but pose a higher strike risk because of the high-speeds at which the vessels need to transit to complete the testing activity. These activities would most often occur in the Gulf of Mexico Large Marine Ecosystem in the GOMEX Range Complex, but may also occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the Northeast Range Complexes, the Gulf Stream Open Ocean Area, and the North Atlantic Gyre Open Ocean Area in the VACAPES and JAX Range Complexes. However, there are just a few of these activities proposed per year so the increased risk is nominal compared to all vessel use in the Proposed Action. While there are just a few of these activities proposed per year, the high speed nature of the test may increase the likelihood of disturbance to *Sargassum*.

In-water device use would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, specifically in the Northeast Range Complexes; VACAPES Range Complex; and Naval Surface Warfare Center, Panama City Division Testing Range (see Section 3.0.5.3.3.2, In-Water Devices).

There is no overlap of vessels or in-water devices with designated critical habitat for Johnson's seagrass. In addition to primary constituent elements, Johnson's seagrass critical habitat must meet at least one of five criteria (Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, neither vessels nor in-water devices will affect Johnson's seagrass critical habitat.

Vessel and in-water devices used in testing activities would not cause a detectable impact on *Sargassum* because: (1) the relative coverage of *Sargassum* in the Study Area is low, (2) new growth may result from *Sargassum* exposure to vessels and in-water devices, and (3) standard operating procedures reduce the potential for impacts caused by in-water devices. Based on these factors, potential impacts to *Sargassum* from vessels and in-water devices are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass; and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.1.2 Substressor Impact on Marine Vegetation as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training and testing activities would have no impact on attached macroalgae or submerged rooted vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The use of vessels and in-water devices during training and testing activities may have an adverse effect by reducing the quality and quantity of floating macroalgae that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that any impacts to *Sargassum* incurred by vessel movements and in-water devices would be minimal and short-term in duration (U.S. Department of the Navy 2013).

3.7.3.2.2 Impacts from Military Expended Materials

This section analyzes the strike potential to marine vegetation of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes).

In areas where marine vegetation and locations for military expended materials overlap, vegetation that occurs on the surface of the water, in the water column, or rooted in the seafloor may be impacted. Attached macroalgae and single-celled algae may overlap with military expended material locations. If these vegetation types are in the immediate vicinity of military expended materials, only a small number of individuals are likely to be impacted relative to their total population level (see Section 3.0.5.3.3.3, Military Expended Material Strikes). The low number of military expended materials relative to the total amount of attached macroalgae and single-celled algae in the Study Area also decreases the potential for impacts to these vegetation types.

Some types of attached macroalgae such as kelp only occur in a very small part of the Study Area in the Northeast U.S. Continental Shelf Large Marine Ecosystem, specifically in the Northeast Range Complexes, where less than 2 percent of the activities that involve military expended materials are conducted, greatly limiting kelp exposure to this stressor (Section 3.7.2.6, Diatoms and Brown Algae [Phylum Ochrophyta] and Section 3.0.5.3.3.3, Military Expended Material Strikes). Based on these factors, the impact on these types of marine vegetation would not be detectable and they will not be discussed further. Seagrasses on the seafloor and *Sargassum* on the sea surface are the types of marine vegetation that may potentially be impacted by military expended materials. Neither the ESA-listed species Johnson's seagrass, nor its critical habitat, overlap with the Study Area; however, an analysis of potential impacts is included due to its proximity to training and testing activity areas.

The potential for impacts to marine vegetation from military expended materials would depend on the presence and amount of vegetation, and the size and number of military expended materials. *Sargassum* distribution is difficult to predict (Gower and King 2008; South Atlantic Fishery Management Council 2002) and it may intersect with any of the locations where military materials are expended on the sea surface. Most deposition of military expended materials occurs within the confines of established training and testing areas. These areas are largely away from the coastline on the continental shelf and slope.

In the Study Area, the relative coverage of *Sargassum* is very low, ranging from less than 1 percent to 5 percent of the sea surface. Section 3.7.2.6, Diatoms and Brown Algae (Phylum Ochrophyta) contains additional detail. *Sargassum* may be impacted by military expended materials, although *Sargassum* is resilient to natural conditions caused by wind, wave action, and severe weather that may break apart pieces of the mat or cause the mats to sink. In the unlikely situation that a *Sargassum* mat is broken by military expended materials, the broken pieces may develop into new *Sargassum* mats because *Sargassum* reproduces by vegetative fragmentation (new plants develop from pieces of the parent plant) (South Atlantic Fishery Management Council 1998). Impacts to *Sargassum* from military expended materials may potentially collapse the pneumatocysts that keep the mats floating at the surface. Evidence suggests that *Sargassum* will remain floating even when up to 80 percent of the pneumatocysts are removed (Zaitsev 1971). Even if a military expended material's strike results in the collapse of most of a *Sargassum* mat's pneumatocysts, it may not cause it to sink. In addition, if enough military expended materials are deposited on *Sargassum*, the mats can potentially sink, but sinking occurs as a natural part of the aging process of *Sargassum* (Schoener and Rowe 1970). Strikes could cause injury to the organisms that inhabit *Sargassum.* See Sections 3.4 (Marine Mammals), 3.5 (Sea Turtles and Other Marine Reptiles), 3.8 (Marine Invertebrates), and 3.9 (Fish) for the assessment of military expended materials on these resources.

Military expended materials can potentially impact seagrass on the seafloor by disturbing, crushing, or shading which may interfere with photosynthesis. In the event that seagrass is not able to photosynthesize its ability to produce energy is compromised. However, the intersection of seagrasses and military expended materials is limited. The only area where military expended materials may overlap with seagrasses is in the Key West Range Complex based on relevant mapping data, see Figure 3.7-2 (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012). Otherwise, seagrasses generally grow in waters that are sheltered from wave action such as estuaries, lagoons and bays (Phillips and Meñez 1988). Locations for the majority of Navy training and testing activities where military materials are expended do not provide this type of habitat. The potential for detectable impacts on seagrasses from expended materials would be low given the small size (e.g., countermeasures) of the majority of the materials, low velocity at deployment (e.g.,

countermeasures), and the decrease in speed as they hit the sea surface. Falling materials could cause bottom sediments to be suspended. Resuspension of the sediment could impact water quality and decrease light exposure but since it would be short-term (hours), stressors from military expended materials would not likely impact the general health of seagrasses.

The following are descriptions of the types of military expended materials that can potentially impact *Sargassum* and seagrass. *Sargassum* may potentially overlap with military expended materials anywhere in the Study Area. The Key West Range Complex is the only location where these materials may overlap with seagrasses. Tables 3.3-9 through 3.3-13 present the number and location of activities that involve military expended materials that are proposed for use during training and testing activities by location and alternative.

Small-, Medium-, and Large-Caliber Projectiles. Small-, medium-, and large-caliber non-explosive practice munitions, or fragments from high-explosive projectiles expended during training and testing activities rapidly sink to the seafloor. The majority of these projectiles would be expended in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the VACAPES Range Complex. Due to the small size of projectiles and their casings, damage to marine vegetation is unlikely. Large-caliber projectiles are primarily used offshore (at depths greater than 26 m [86.9 ft.]) while small- and medium-caliber projectiles may be expended in both offshore and coastal areas (at depths less than 26 m [86.9 ft.]). *Sargassum* could occur where these materials are expended but seagrasses generally do not because these activities do not normally occur in water that is shallow enough for seagrass to grow (26 m [86.9 ft.]).

Bombs, Missiles, and Rockets. Bombs, missiles, and rockets, or their fragments (if high-explosive) are expended offshore (depths greater than 26 m [86.9 ft.]) during training and testing activities and rapidly sink to the seafloor. *Sargassum* could occur where these materials are expended but seagrass generally does not because of water depth limitations for activities that expend these materials.

Parachutes. Parachutes of varying sizes are used during training and testing activities. For a discussion of the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities will occur under each alternative, see Section 3.0.5.3.4.2 (Parachutes). Seagrass may overlap with the use of some types of parachutes in the Gulf of Mexico Large Marine Ecosystem in the Key West Range Complex. *Sargassum* could occur in any of the locations that these materials are expended.

Targets. Many training and testing activities require the use of targets. Once targets are hit by munitions they could be broken into fragments. Target fragments vary in size and type, but most fragments are expected to sink. Pieces of targets that are designed to float are recovered when possible. *Sargassum* and seagrass could occur where these materials are expended.

Vessel Hulk. Vessel hulks are notable items of military expended materials due to their size. They are expended at sea during sinking exercises. Sinking exercises involve the use of a target (vessel hulk) against which live high-explosive or non-explosive munitions are fired; these exercises are conducted in a manner that results in the sinking of the target. Sinking exercises would only be conducted in designated areas with depths greater than 3,000 m (9,842 ft.) (see Section 3.0.3.1.4, Northeast U.S. Continental Shelf Large Marine Ecosystem). *Sargassum* could occur where these materials are expended but seagrass could not.

Countermeasures. Defensive countermeasures such as chaff and flares are used to protect against missile and torpedo attack. Chaff is made of aluminum-coated glass fibers and flares are pyrotechnic devices. Chaff, chaff canisters, and flare end caps are expended materials. Chaff and flares are dispensed from aircraft or fired from ships. Seagrass may overlap with chaff and flares expended in the Gulf of Mexico Large Marine Ecosystem in the Key West Range Complex. *Sargassum* could occur in any of the locations that these materials are expended.

3.7.3.2.2.1 No Action Alternative

Training Activities

Section 3.0.5.3.3.3 (Military Expended Material Strikes) contains information regarding the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-9. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest numbers of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes, and in the Other AFTT Areas while vessels are in transit. Activities using military expended materials are concentrated within the VACAPES Range Complex. See Section 3.0.5.3.3.3 (Military Expended Material Strikes) for information regarding the number of military expended materials (e.g., bombs, projectiles, missiles, rockets, and vessel hulks) that are expended under the No Action Alternative.

Sargassum distribution is patchy and difficult to predict but it may overlap with any of the training locations for the No Action Alternative. The total impact area of military expended materials under the No Action Alternative is 0.13 nm^2 (see Table 3.3-9). This impact area is small relative to the distribution of *Sargassum* (21,000 nm^2 to 130,000 nm^2) in the Study Area.

Based on relevant mapping data (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012), military expended materials may overlap with seagrass only in the Key West Range Complex, see Figure 3.7-2. Under the No Action Alternative, only medium-caliber projectiles and items associated with chaff and flares are expended in the Key West Range Complex, although activities expending these items do not normally occur in water that is shallow enough for seagrass to grow (26 m [85.3 ft.]). The total impact area of military expended materials in the Key West Range Complex is less than 0.001 nm^2 (see Table 3.3-9); this is a small area relative to the gross estimation of 130 nm^2 of seagrass in the range complex.

There is no overlap of military expended materials with designated critical habitat for Johnson's seagrass. Primary constituent elements may occur in locations that have not been designated as critical habitat but Johnson's seagrass critical habitat must meet at least one of five additional criteria; see Section 3.7.2.2.1, Status and Management. The Study Area does not meet any of the additional criteria; therefore, military expended materials will not affect Johnson's seagrass critical habitat.

Military expended materials associated with training activities are not expected to cause any risk to *Sargassum* or seagrass because: (1) the relative coverage of *Sargassum* in the Study Area is low, (2) new growth may result from *Sargassum* exposure to military expended materials, (3) the impact area of military expended materials is very small relative to *Sargassum* distribution, and (4) seagrass overlap with areas where the stressor occurs is very limited. Based on these factors, potential impacts to *Sargassum* and seagrass from military expended materials are not expected to result in detectable

changes to their growth, survival, or propagation, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of military expended materials associated with training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Section 3.0.5.3.3.3 (Military Expended Material Strikes) contains information regarding the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-10. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest numbers of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area, specifically within the Naval Surface Warfare Center, Panama City Division Testing Range; the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; and in the Other AFTT Areas while vessels are in transit. Activities using military expended materials are concentrated within the VACAPES Range Complex. See Section 3.0.5.3.3.3 (Military Expended Material Strikes) for information regarding the number of military expended materials (e.g., bombs, projectiles, missiles, rockets, and vessel hulks) that are expended under the No Action Alternative.

Sargassum distribution is patchy and difficult to predict but it may overlap with any of the testing locations for the No Action Alternative. The total impact area of military expended materials under the No Action Alternative is less than 0.02 nm^2 (see Table 3.3-10). This impact area is small relative to the distribution of *Sargassum* (21,000 nm^2 to 130,000 nm^2) in the Study Area. Seagrass does not overlap with military expended materials under the No Action Alternative.

There is no overlap of military expended materials with designated critical habitat for Johnson's seagrass. Primary constituent elements may occur in locations that have not been designated as critical habitat but Johnson's seagrass critical habitat must meet at least one of five additional criteria (see Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, military expended materials will not affect Johnson's seagrass critical habitat.

Military expended materials associated with testing activities are not expected to cause any risk to *Sargassum* or seagrass because: (1) the relative coverage of *Sargassum* in the Study Area is low, (2) new growth may result from *Sargassum* exposure to military expended materials, (3) the impact area of military expended materials is very small relative to *Sargassum* distribution, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts to *Sargassum* from military expended materials are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts to seagrass.

Pursuant to the ESA, the use of military expended materials associated with testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.2.2 Alternative 1

Training Activities

Section 3.0.5.3.3.3 (Military Expended Material Strikes) contains information regarding the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-11. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total number of military expended materials is more than twice the number expended in the No Action Alternative. The types of activities and military expended materials occurring in Alternative 1 would be the same as those in the No Action Alternative. Furthermore, the activities would occur in the same geographic locations. Activities using military expended materials are concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes. See Section 3.0.5.3.3.3 (Military Expended Material Strikes) for information regarding the number of military expended materials (e.g., bombs, projectiles, missiles, rockets, and vessel hulks) that are expended under Alternative 1.

The potential impacts on *Sargassum* and seagrass from military expended materials is as described in Section 3.7.3.2.2 (Impacts from Military Expended Materials). *Sargassum* distribution may overlap with any of the training locations for the No Action Alternative. The total impact area of military expended materials under Alternative 1 is 0.07 nm^2 (see Table 3.3-11). This impact area is small relative to the distribution of *Sargassum* (21,000 nm^2 to 130,000 nm^2) in the Study Area. Based on relevant mapping data (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012), military expended materials may overlap with seagrass only in the Key West Range Complex, see Figure 3.7-2. Under Alternative 1, in addition to the types of items expended under the No Action Alternative, large-caliber projectiles, anchor blocks, and parachutes are also expended in the Key West Range Complex, although activities expending these materials do not normally occur in water that is shallow enough for seagrass to grow (26 m [85.3 ft.]). The total impact area of these materials in the Key West Range Complex is less than 0.001 nm^2 (see Table 3.3-11); this is a small area relative to the gross estimation of 130 nm^2 of seagrass in the range complex.

In comparison to the No Action Alternative, the increase in the number of activities presented in Alternative 1 may increase the risk of *Sargassum* and seagrass of exposure to military expended materials. However, the differences in species overlap and potential impacts of surface explosions on *Sargassum* and seagrass during training activities would not be discernible from those described in Section 3.7.3.2.2.1 (No Action Alternative). For the same reasons as stated in Section 3.7.3.2.2.1 (No Action Alternative), the use of military expended materials are not expected to result in detectable changes to *Sargassum* or seagrass growth, survival, or propagation, and are not expected to result in population-level impacts. Similarly, military expended materials are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of military expended materials associated with training activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Section 3.0.5.3.3.3 (Military Expended Material Strikes) contains information regarding the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-12. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total number of military expended materials is nearly four-times the number expended in the No Action Alternative. The types of activities and military expended materials occurring in Alternative 1 would be the same as those in the No Action Alternative. Furthermore, the activities would occur in the same geographic locations. Activities using military expended materials are concentrated within the VACAPES Range Complex. Military expended materials would typically be of the same type listed under the No Action Alternative. See Section 3.0.5.3.3.3 (Military Expended Material Strikes) for information regarding the number of military expended materials (e.g., bombs, projectiles, missiles, rockets, and vessel hulks) that are expended under Alternative 1.

The potential impacts on *Sargassum* and seagrass from military expended materials are as described in Section 3.7.3.2.2 (Impacts from Military Expended Materials). *Sargassum* distribution may overlap with any of the testing locations for the No Action Alternative. The total impact area of military expended materials under Alternative 1 is 0.03 nm^2 (Table 3.3-12). This impact area is small relative to the distribution of *Sargassum* (21,000 nm^2 to 130,000 nm^2) in the Study Area. Under Alternative 1, seagrass may potentially overlap with military expended materials. Based on relevant mapping data (Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute 2012), military expended materials may overlap with seagrass only in the Key West Range Complex, see Figure 3.7-2. Under Alternative 1, medium- and large-caliber projectiles, missiles, sonobuoys, parachutes, and aircraft stores are expended in the Key West Range Complex, although activities expending these materials do not normally occur in water that is shallow enough for seagrass to grow (26 m [85.3 ft.]). The total impact area of these materials in the Key West Range Complex is less than 0.002 nm^2; this is a small area relative to the gross estimation of 130 nm^2 of seagrass in the range complex.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk of *Sargassum* and seagrass exposure to military expended materials. However, the differences in species overlap and potential impacts of surface explosions on *Sargassum* and seagrass during testing activities would not be discernible from those described in Section 3.7.3.2.2.1 (No Action Alternative). Military expended materials used for testing activities are not expected to cause any risk to seagrass because the overlap with areas where the stressor occurs is very limited. For the same reasons as stated in Section 3.7.3.2.2.2 (Alternative 1) for *Sargassum*, and here for seagrass, the use of military expended materials is not expected to result in detectable changes to *Sargassum* or seagrass growth, survival, or propagation, and is not expected to result in population-level impacts. Similarly, military expended materials are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of military expended materials associated with testing activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will be identical as described in Section 3.7.3.2.2.2 (Alternative 1).

Testing Activities

Section 3.0.5.3.3.3 (Military Expended Material Strikes) contains information regarding the number and location of military expended materials, most of which are small and medium caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-13. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2, the total amount of military expended materials is more than four times the amount expended in the No Action Alternative, but only increases by 5 percent as compared to Alternative 1. The types of activities and military expended materials occurring in Alternative 1 would be the same as those in the No Action Alternative. Furthermore, the activities would occur in the same geographic locations. Activities using military expended materials are concentrated within the VACAPES Range Complex. Military expended materials would typically be of the same type listed under the No Action Alternative. See Section 3.0.5.3.3.3 (Military Expended Material Strikes) for information regarding the number of military expended materials (e.g., bombs, projectiles, missiles, rockets, and vessel hulks) that are expended under Alternative 2.

The potential impacts on *Sargassum* and seagrass from military expended materials are as described in Section 3.7.3.2.2 (Impacts from Military Expended Materials). *Sargassum* distribution may overlap with any of the testing locations for Alternative 2. The total impact area of military expended materials under Alternative 2 is 0.03 nm^2 (See Table 3.3-13). This impact area is small relative to the distribution of *Sargassum* (21,000 nm^2 to 130,000 nm^2) in the Study Area. Under Alternative 2, the total impact area of military expended materials in the Key West Range Complex is less than 0.002 nm^2; this is a small area relative to the gross estimation of 130 nm^2 of seagrass in the range complex (see Table 3.3-13).

In comparison to the No Action Alternative, the overall increase in activities presented in Alternative 2 may increase the risk of *Sargassum* and seagrass exposure to military expended materials. However, the differences in species overlap and potential impacts of surface explosions on *Sargassum* and seagrass during testing activities would not be discernible from those described in Section 3.7.3.2.2.1 (No Action Alternative). For the same reasons as stated in Section 3.7.3.2.2.1 (No Action Alternative) for *Sargassum* and seagrass, the use of military expended materials is not expected to result in detectable changes to *Sargassum* or seagrass growth, survival, or propagation, and is not expected to result in population-level impacts. Similarly, military expended materials are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of military expended materials associated with testing activities as described under Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.2.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, military expended materials associated with training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment states that any impacts to attached macroalgae or submerged rooted vegetation incurred by military expended materials would be minimal and long-term in duration; and any impacts to floating macroalgae would be minimal and short-term in duration (U.S. Department of the Navy 2013).

3.7.3.2.3 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.4, Seafloor Devices. These include items that are placed on, dropped on, or moved along the seafloor such as anchors, anchor blocks, mine shapes, bottom-placed instruments, bottom-placed targets that are recovered (not expended), and bottom-crawling unmanned underwater vehicles.

Only marine vegetation that is attached to the seafloor such as attached macroalgae and seagrasses may be impacted by activities involving seafloor devices. If a seafloor device is placed directly on attached macroalgae, only a miniscule portion of the total population would likely be impacted given its wide distribution throughout the Study Area. The low number of seafloor devices relative to the amount of attached macroalgae in the Study Area also decreases its potential for impacts.

The use of anchors for precision anchoring training exercises involves the release of anchors in designated locations. These training activities typically occur within predetermined shallow water anchorage locations near ports with seafloors consisting of soft bottom substrate in areas that do not typically support seagrass. Mine shapes are used in a variety of activities and are normally deployed over soft sediments and are recovered within 7 to 30 days following completion of the training event. Neither of these activities takes place in areas where attached macroalgae or seagrasses are expected to occur, and they will not be discussed further.

Seafloor device operation, installation, or removal can potentially impact seagrass by physically removing vegetation (e.g., uprooting), crushing, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass which may interfere with photosynthesis. In the event that seagrass is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of seagrasses and seafloor devices is limited and suspended sediments would settle in a few hours. The only seafloor devices that may potentially overlap with seagrass in the Study Area are bottom-crawling unmanned underwater vehicles used in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the Naval Undersea Warfare Center Division, Newport Testing Range, Narragansett Bay; and in the Gulf of Mexico Large Marine Ecosystem in the Naval Surface Warfare Center, Panama City Division Testing Range, St. Andrew Bay.

In addition to the potential impacts of seafloor devices on seagrass, in soft substrates, crawlers may leave a track-line of depressed sediments 24 in. (62 cm) wide (the width of the device) in their wake. However, since these crawlers can operate in shallow water (less than 24.6 m), any disturbed sediments would be redistributed by wave and tidal action shortly (a few days) following the disturbance.

3.7.3.2.3.1 No Action Alternative

Training Activities

Section 3.0.5.3.3.4 (Seafloor Devices) contains information regarding the number of seafloor devices and locations where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area, specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

Under the No Action Alternative, training activities do not involve the operation of bottom-crawling unmanned underwater vehicles in areas where seagrasses occur; see Section 3.0.5.3.3.4 (Seafloor Devices). Therefore, seafloor devices are not expected to cause any risk to seagrass.

There is no overlap of seafloor devices with designated critical habitat for Johnson's seagrass. Primary constituent elements may occur in locations that have not been designated as critical habitat but Johnson's seagrass critical habitat must meet at least one of five additional criteria (see Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, seafloor devices will not affect Johnson's seagrass critical habitat.

Pursuant to the ESA, the use of seafloor devices during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) contains information regarding the number of seafloor devices and locations where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices are used in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area, specifically within the Northeast and VACAPES Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; and Naval Surface Warfare Center, Panama City Division Testing Range.

Under the No Action Alternative, one testing activity that involves the operation of bottom-crawling unmanned underwater vehicles would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem in Narragansett Bay, and in the Gulf of Mexico Large Marine Ecosystem in the Naval Surface Warfare Center, Panama City Division Testing Range; see Section 3.0.5.3.3.4 (Seafloor Devices). The use of bottom-crawling unmanned underwater vehicles in Narragansett Bay may potentially overlap with seagrass. This activity may occur in St. Andrew Bay or another part of the Naval Surface Warfare Center, Panama City Division Testing Range, however, St. Andrew Bay is the only part of the testing range where seagrass occurs. Only one event is planned for unmanned underwater vehicle demonstrations at each location under the No Action Alternative. Seagrass is typically avoided during activities involving the use

of bottom-crawling unmanned underwater vehicles but impacts on seagrass may occur, although the chances are small.

Seafloor devices used for testing activities are not expected to cause any risk to seagrass because: (1) seagrass overlap with the stressor is very limited, (2) seagrass is typically avoided, (3) the number of activities involving the stressor is low, and (4) disturbance from re-suspended sediment is temporary. Based on these factors, potential impacts to seagrass from seafloor devices are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.3.2 Alternative 1

Training Activities

Section 3.0.5.3.3.4 (Seafloor Devices) contains information regarding the number of seafloor devices and locations where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices is a 44 percent increase over the number of activities in the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic locations as the No Action Alternative with the addition of one event that may occur in the Northeast Range Complexes.

As under the No Action Alternative, training activities under Alternative 1 do not involve the operation of bottom-crawling, unmanned, underwater vehicles in areas where seagrasses occur (see Section 3.0.5.3.3.4, Seafloor Devices). Therefore, seafloor devices are not expected to cause any risk to seagrass. Similarly, seafloor devices are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) contains information regarding the number of seafloor devices and locations where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices is approximately two times higher than that of the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic locations as those in Section 3.7.3.2.3.1 (No Action Alternative), in addition to new locations in the Northeast and Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems, and the Gulf Stream Open Ocean Area. Specifically, under Alternative 1, seafloor devices would be introduced in the Naval Undersea Warfare Center Division, Newport Testing Range; Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes; South Florida Ocean Measurement Facility Testing Range; Naval Surface Warfare Center, Panama City Division Testing Range; and the Gulf of

Mexico. Seagrass does not occur in any of the new locations introduced under Alternative 1. Seagrass grows in the inland waters of the South Florida Ocean Measurement Facility Testing Range but the inland waters are not part of the Study Area. The only locations where seagrass and this stressor may potentially overlap are Narragansett Bay (part of Naval Undersea Warfare Center Division, Newport Testing Range) and St. Andrew Bay (part of the Naval Surface Warfare Center, Panama City Division Testing Range).

Under Alternative 1, the number of locations that use bottom-crawling unmanned underwater vehicles increases, but not in areas where there is potential overlap with seagrass. Activities in Narragansett Bay involving the use of bottom-crawling unmanned underwater vehicles are the same as under the No Action Alternative. In St. Andrew Bay, the number of activities that use bottom-crawling unmanned underwater vehicles increases from one (i.e., unmanned underwater vehicle demonstrations) under the No Action Alternative to two (i.e., unmanned underwater vehicle demonstrations and testing) under Alternative 1. Under Alternative 1, there would be 70 unmanned underwater vehicle testing events per year. Although the number of events increases under Alternative 1, the differences in species overlap and potential impacts of seafloor devices on seagrass during testing activities would not be discernible from those described in Section 3.7.3.2.3.1 (No Action Alternative). Therefore, the potential impacts from seafloor devices would be identical to those associated with the No Action Alternative.

It should be noted that bottom-crawling unmanned underwater vehicles would be operated at the South Florida Ocean Measurement Facility Testing Range, which is the closest testing range to Johnson's seagrass critical habitat (Section 3.7.2.2.2, Habitat and Geographic Range). However, there is no overlap of seafloor devices with designated critical habitat for Johnson's seagrass. Primary constituent elements of Johnson's seagrass critical habitat may occur in locations that have not been designated as critical habitat, but Johnson's seagrass critical habitat must meet at least one of five additional criteria (Section 3.7.2.2.1, Status and Management). The Study Area does not meet any of the additional criteria; therefore, seafloor devices will not affect Johnson's seagrass critical habitat.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.7.3.2.3.2 (Alternative 1).

Testing Activities

Section 3.0.5.3.3.4 (Seafloor Devices) contains information regarding the number of seafloor devices and locations where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2, the number of activities using seafloor devices is about twice that of those described in Section 3.7.3.2.3.1 (No Action Alternative). The activities using seafloor devices under Alternative 2 would occur in the same geographic locations as those under Alternative 1.

Under Alternative 2, the number of locations that use bottom-crawling unmanned underwater vehicles increases, but not in areas where there is potential overlap with seagrass. Activities in Narragansett Bay

involving the use of bottom-crawling unmanned underwater vehicles do not change compared to the No Action Alternative. In St. Andrew Bay, the number of activities that use bottom-crawling unmanned underwater vehicles increases from one (i.e., unmanned underwater vehicle demonstrations) under the No Action Alternative to two (i.e., unmanned underwater vehicle demonstrations and testing) under Alternative 2. Under Alternative 2, there would be 88 unmanned underwater vehicle testing events per year. Although the number of events increases under Alternative 2, the differences in species overlap and potential impacts of seafloor devices on seagrass during testing activities would not be discernible from those described in Section 3.7.3.2.3.1 (No Action Alternative). Therefore, the potential impacts from seafloor devices would be identical to those associated with the No Action Alternative. As stated in Alternative 1, seafloor devices are not anticipated to affect any primary constituent elements or areas that meet critical habitat criteria for Johnson's seagrass.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.2.3.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training and testing activities would have no effect on floating macroalgae that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The use of seafloor devices during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality or quantity of attached macroalgae and submerged rooted vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that any impacts to attached macroalgae or submerged rooted vegetation incurred by seafloor devices would be minimal and short-term in duration (U.S. Department of the Navy 2013).

3.7.3.3 Secondary Stressors

This section analyzes potential impacts to marine vegetation exposed to stressors indirectly through impacts on their habitat (i.e., sediment and water quality). Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality from explosives and explosion by-products, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that neither state or federal standards or guidelines for sediments nor water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Given these conditions, the possibility of population-level impacts to marine vegetation (including *Sargassum* and seagrasses) is likely to be inconsequential and not detectable. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, there would be no indirect impacts anticipated on marine vegetation from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

3.7.3.3.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training

Pursuant to the ESA, secondary stressors resulting from training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.3.3.2 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Testing

Pursuant to the ESA, secondary stressors resulting from testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *will have no effect on ESA-listed Johnson's seagrass and*
- *will have no effect on Johnson's seagrass critical habitat.*

3.7.4 SUMMARY OF POTENTIAL IMPACTS ON VEGETATION

3.7.4.1 Combined Impacts of All Stressors

Activities described in this EIS/OEIS that have potential impacts on marine vegetation are widely dispersed, and not all stressors would occur simultaneously in a given location. The stressors that have potential impacts on marine vegetation include acoustic (underwater and surface explosions) and physical disturbances or strikes (vessel and in-water devices, military expended materials, and seafloor devices). Unlike mobile organisms, vegetation cannot flee from stressors once exposed. *Sargassum* is the type of marine vegetation most likely to be exposed to multiple stressors in combination because it occurs in large expanses. Discrete areas of the Study Area (mainly within off-shore areas with depths greater than 26 m [85.3 ft.] in portions of range complexes and testing ranges) could experience higher levels of activity involving multiple stressors, which could result in a higher potential risk for impacts on *Sargassum* within those areas. The potential for seagrasses and attached macroalgae to be exposed to multiple stressors would be low because activities are not concentrated in areas with depths less than 26 m (85.3 ft.). The combined impacts of all stressors would not be expected to impact marine vegetation populations because: (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, and (3) activities are generally scheduled where previous activities have occurred. The aggregate effect on marine vegetation would not observably differ from existing conditions.

3.7.4.2 Endangered Species Act Determinations

Navy training and testing activities would have no effect on Johnson's seagrass because the proposed training and testing activities would not overlap with populations of Johnson's seagrass. Consequently, the Proposed Action would have no effect on Johnson's seagrass critical habitat.

3.7.4.3 Essential Fish Habitat Determinations

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of metal, chemical, and other material contaminants during training and testing activities will have no adverse impact on marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The use of explosives and other impulsive sources, vessel movement, in-water devices, military expended materials, and seafloor devices during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of marine vegetation that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment report states that individual stressor impacts to marine vegetation were all either no effect or minimal, and ranged in duration from temporary to long-term, depending on the habitat impacted (U.S. Department of the Navy 2013).

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3.8 MARINE INVERTEBRATES

MARINE INVERTEBRATES SYNOPSIS

The Navy considered all potential stressors and analyzed the following for marine invertebrates:

- Acoustic (sonar and other non-impulsive acoustic sources, and explosives and other impulsive acoustic sources)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance and strikes (vessels and in-water devices, military expended materials, and seafloor devices)
- Entanglement (fiber optic cables, guidance wires, and parachutes)
- Ingestion (military expended materials)
- Secondary (explosives and byproducts, metals, chemicals, and other materials)

Preferred Alternative

- Acoustics: Pursuant to the Endangered Species Act (ESA), the use of all non-impulsive and impulsive acoustic sources will have no effect on ESA-listed or proposed coral species. The use of all non-impulsive and impulsive acoustic sources will have no effect on elkhorn and staghorn critical habitat.
- Energy: Pursuant to the ESA, the use of electromagnetic devices and high energy lasers will have no effect on ESA-listed or proposed coral species. The use of electromagnetic devices and high energy lasers will have no effect on critical habitat.
- Physical Disturbance and Strikes: Pursuant to the ESA, the use of vessels and in-water devices will have no effect on ESA-listed or proposed coral species. The use of military expended materials and seafloor devices may affect but is not likely to adversely affect ESA-listed or proposed coral species. The use of vessels, in-water devices, and seafloor devices would have no effect on critical habitat. The use of military expended materials may affect but is not likely to adversely affect critical habitat.
- Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires and parachutes will have no effect on ESA-listed or proposed coral species.
- Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials will have no effect on ESA-listed or proposed coral species.
- Secondary: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed or proposed coral species and may affect but are not likely to adversely affect critical habitat.
- Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other acoustic sources, vessel noise, swimmer defense airguns, weapons firing noise, electromagnetic sources, high energy lasers, vessel movement, in-water devices, and metal, chemical, or other material contaminants will have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. The use of electromagnetic sources will have minimal and temporary adverse impact to invertebrates occupying water column Essential Fish Habitat or Habitat Areas of Particular Concern. The use of explosives, pile driving, military expended materials, seafloor devices, and explosives and explosion byproduct contaminants may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern.

3.8.1 INTRODUCTION

In this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), marine invertebrates are evaluated based on their distribution and life history relative to the stressor or activity being considered. Activities are evaluated for their potential impact on marine invertebrates in general and are evaluated separately by taxonomic and regulatory groupings as appropriate.

Invertebrates are animals without backbones, and marine invertebrates are a large and diverse group of at least 50,000 species (Brusca and Brusca 2003). Many of these species are important to humans ecologically and economically, providing essential ecosystem services (coastal protection) and income from tourism and commercial and recreational fisheries (Spalding et al. 2001). Because marine invertebrates occur in all habitats, activities that interact with the water column or the seafloor have the potential to impact numerous zooplankton (invertebrates not generally visible to the naked eye), eggs, larvae, larger invertebrates living in the water column, and benthic invertebrates that live on or in the seafloor. The greatest densities of marine invertebrates are usually on the seafloor (Sanders 1968); therefore, activities that contact the seafloor have greater potential for impact.

The following subsections provide brief introductions to the Endangered Species Act (ESA) listed species, federally managed species, habitat types, and major taxonomic groups of marine invertebrates that occur in the Study Area. Federally managed marine invertebrate species regulated under the Magnuson-Stevens Fishery Conservation and Management Act are described in Section 3.8.1.2 (Federally Managed Species), as well as in the Atlantic Fleet Training and Testing (AFTT) Essential Fish Habitat Assessment (U.S. Department of the Navy 2013). The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), Office of Protected Resources maintains a website that provides additional information on the biology, life history, species distribution (including maps), and conservation of invertebrates.

3.8.1.1 Endangered Species Act Species

Eleven invertebrate species in the Study Area are listed as threatened, proposed endangered, proposed threatened, or species of concern under the ESA (National Oceanic and Atmospheric Administration 2010c)(Table 3.8-1). Two threatened coral species proposed for reclassification from threatened to endangered and seven other coral species proposed for listing as threatened or endangered under the ESA are discussed in Sections 3.8.2.3 (Elkhorn Coral [*Acropora palmata*]) through Section 3.8.2.11 (Lamarck's Sheet Coral [*Agaricia lamarcki*]). In addition, one species (queen conch) is included as a candidate for listing under the ESA as discussed in Section 3.8.2.12, Queen Conch (*Lobatus gigas*). Species of concern are those for which NMFS has some concern regarding status and threats but insufficient information is available to indicate a need to list them under the ESA. The one species of concern within the Study Area is discussed in Section 3.8.2.15.2 (Deep-Water Corals). Emphasis on species-specific information in the following species descriptions is placed on the nine ESA-listed or proposed species because any threats to or potential impacts on those species are subject to consultation with regulatory agencies.

Table 3.8-1: Status and Presence of Endangered Species Act Listed, Candidate, and Species of Concern Invertebrate Species in the Study Area

Species Name and Regulatory Status[1]			Location in Study Area[2]		
Common Name	**Scientific Name**	**Endangered Species Act Listing**	**Open Ocean**	**Coastal Waters**	**Bays, Rivers, and Estuaries**
Elkhorn coral	*Acropora palmata*	Threatened, Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Staghorn coral	*Acropora cervicornis*	Threatened, Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Boulder star coral	*Montastraea annularis*	Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Mountainous star coral	*Montastraea faveolata*	Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Pillar coral	*Dendrogyra cylindrus*	Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Rough cactus coral	*Mycetophyllia ferox*	Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Biscayne Bay
Star coral	*Montastraea franksi*	Proposed Endangered	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Elliptical star coral	*Dichocoenia stokesii*	Proposed Threatened	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Lamarck's sheet coral	*Agaricia lamarcki*	Proposed Threatened	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Biscayne Bay
Queen conch	*Lobatus gigas*	Candidate species	North Atlantic Gyre[3]	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	Florida Bay and Biscayne Bay
Ivory tree coral	*Oculina varicosa*	Species of Concern	None	Gulf of Mexico, Southeast U.S. Continental Shelf, Caribbean Sea	None

[1] ESA listing status (National Oceanic and Atmospheric Administration 2010c).
[2] Presence in the Study Area is characterized by biogeographic units: open-ocean oceanographic features (Labrador Current, Gulf Stream, and North Atlantic Gyre) or by coastal waters of large marine ecosystems (Caribbean Sea, Gulf of Mexico, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, and West Greenland Shelf) in the Study Area.
[3] Presence in the North Atlantic Gyre is limited to portions of Puerto Rico and the U.S. Virgin Islands.

3.8.1.2 Federally Managed Species

Federally managed species of marine invertebrates are listed in Table 3.8-2. In the context of federally managed species, the term "fishery" applies to any biologically generated object extracted from the ocean (e.g., there is a lobster "fishery" even though the animals are not fish). Assessments in Section 3.8.3 (Environmental Consequences) combine federally managed species with the rest of their taxonomic group (e.g., the Atlantic sea scallop [*Placopecten magellanicus*] is assessed in combination with phylum Mollusca) unless impacts or differential effects warrant separate treatment. Analysis of impacts on commercial and recreational fisheries is provided in Section 3.11 (Socioeconomic Resources).

Table 3.8-2: Federally Managed Marine Invertebrate Species with Essential Fish Habitat within the Study Area, Covered under Each Fishery Management Plan

New England Fishery Management Council[1]	
Atlantic Sea Scallop Fishery Management Plan	
Common Name	**Species**
Atlantic sea scallop	*Placopecten magellanicus*
Red Crab Fishery Management Plan	
Common Name	**Species**
Deep-sea red crab	*Chaceon quinquedens*
Mid-Atlantic Fishery Management Council[1]	
Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan	
Common Name	**Species**
Short-finned squid	*Ilex illecebrosus*
Long-finned squid	*Loligo pealei*
Atlantic Surf Clam and Ocean Quahog Fishery Management Plan	
Common Name	**Species**
Atlantic surf clam	*Spisula solidissima*
Ocean quahog	*Arctica islandica*
South Atlantic Fishery Management Council[2]	
Coral, Coral Reefs and Live/Hard Bottom Habitats of the South Atlantic Region Fishery Management Plan	
Common Name	**Species**
Black corals	Numerous species within coral groups[3]
Fire corals	
Hydrocorals	
Octocorals	
Stony corals	

[1] Jurisdiction overlaps with the northern half of the Northeast U.S. Continental Shelf Large Marine Ecosystem and a portion of the Gulf Stream Open Ocean Area.

[2] Jurisdiction overlaps with the southernmost portion of the Northeast Continental Shelf Large Marine Ecosystem, the Southeast Continental Shelf Large Marine Ecosystem, the northernmost portion of the Caribbean Sea Large Marine Ecosystem, the easternmost portion of the Gulf of Mexico Large Marine Ecosystem, and portions of the Gulf Stream Open Ocean Area.

[3] For a complete list of species in the Corals, Coral Reefs, and Hard/Live Bottom Fishery Management Plans, see the website maintained by the South Atlantic Fishery Management Council.

Table 3.8-2: Federally Managed Marine Invertebrate Species with Essential Fish Habitat within the Study Area, Covered under Each Fishery Management Plan (Continued)

South Atlantic Fishery Management Council[2] (Continued)	
South Atlantic Golden Crab Fishery Management Plan	
Common Name	**Species**
Golden crab	*Chaceon fenneri*
Jonah crab	*Cancer borealis*
Red crab	*Chaceon quinquedens*
South Atlantic Shrimp Fishery Management Plan	
Common Name	**Species**
Pink shrimp	*Farfantepenaeus duorarum*
Brown shrimp	*Farfantepenaeus aztecus*
Rock shrimp	*Sicyonia brevirostris*
Royal red shrimp	*Pleoticus robustus*
White shrimp	*Litopenaeus setiferus*
Gulf of Mexico/South Atlantic Spiny Lobster Fishery Management Plan[4]	
Common Name	**Species**
Spiny lobster	*Panulirus argus*
Gulf of Mexico Shrimp Fishery Management Plan	
Common Name	**Species**
Brown shrimp	*Farfantepenaeus aztecus*
Pink shrimp	*Farfantepenaeus duorarum*
Royal red shrimp	*Pleoticus robustus*
White shrimp	*Litopenaeus setiferus*
Coral and Coral Reefs of the Gulf of Mexico Fishery Management Plan	
Common Name	**Species**
Black corals	Multiple species within coral groups[5]
Fire corals	
Hydrocorals	
Octocorals	
Stony corals	

[2] Jurisdiction overlaps with the southernmost portion of the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, the northernmost portion of the Caribbean Sea Large Marine Ecosystem, the easternmost portion of the Gulf of Mexico Large Marine Ecosystem, and portions of the Gulf Stream Open Ocean Area.

[4] Jurisdiction overlaps with the Gulf of Mexico Large Marine Ecosystem and the northernmost portion of the Caribbean Sea Large Marine Ecosystem.

[5] For a complete list of species in the Corals and Coral Reefs Fishery Management Plan, see the website maintained by the Gulf of Mexico Fishery Management Council.

Table 3.8-2: Federally Managed Marine Invertebrate Species with Essential Fish Habitat within the Study Area, Covered under Each Fishery Management Plan (Continued)

South Atlantic Fishery Management Council[2] (Continued)	
Caribbean Fishery Management Council[6]	
Caribbean Spiny Lobster Fishery Management Plan	
Common Name	**Species**
Caribbean spiny lobster	*Panulirus argus*
Caribbean Queen Conch Fishery Management Plan	
Common Name	**Species**
Queen conch	*Lobatus gigas* (formerly named *Strombus gigas*)
Caribbean Corals & Reef Associated Plants and Invertebrates Fishery Management Plan	
All coral and sea grass[7]	
Innumerable aquarium trade species are listed for data collection purposes only[7]	

[2] Jurisdiction overlaps with the southernmost portion of the Northeast U.S. Continental Shelf Large Marine Ecosystem, the Southeast U.S. Continental Shelf Large Marine Ecosystem, the northernmost portion of the Caribbean Sea Large Marine Ecosystem, the easternmost portion of the Gulf of Mexico Large Marine Ecosystem, and portions of the Gulf Stream Open Ocean Area.

[6] Jurisdiction overlaps with a portion of the Caribbean Sea Large Marine Ecosystem and a portion of the North Atlantic Gyre Open Ocean Area.

[7] For a complete list of species in the Caribbean Corals and Reef Associated Invertebrates Fishery Management Plan, see the website maintained by the Caribbean Fishery Management Council.

3.8.1.3 Taxonomic Groups

All marine invertebrate taxonomic groups are represented in the Study Area. Major invertebrate phyla (taxonomic rank)—those with greater than 1,000 species (Appeltans et al. 2010)—and the general zones they inhabit in the Study Area are listed in Table 3.8-3. Throughout the marine invertebrate section, organisms will often be referred to by their phylum name, or more generally, as marine invertebrates.

Table 3.8-3: Major Taxonomic Groups of Marine Invertebrates in the Study Area

Major Invertebrate Groups[1]		Vertical Distribution Within the Study Area[2]		
Common Name (Taxonomic Group)	**Description**	**Open Ocean Areas**	**Large Marine Ecosystems**	**Bays, Rivers, and Estuaries**
Kingdom Protozoa[3] (phyla Foraminifera, Sarcodina, Ciliophora)	Bottom-dwelling and pelagic single-celled organism; shells typically made of calcium carbonate or silica.	Water column, bottom	Water column, bottom	Water column, bottom
Sponges (phylum Porifera)	Bottom-dwelling animals; large species have calcium carbonate or silica structures embedded in cells to provide structural support.	Bottom	Bottom	Bottom
Corals, hydroids, jellyfish (phylum Cnidaria)	Bottom-dwelling and pelagic animals with stinging cells.	Water column, bottom	Water column, bottom	Water column, bottom
Flatworms (phylum Platyhelminthes)	Mostly bottom-dwelling; simplest form of marine worm with a flattened body.	Water column, bottom	Water column, bottom	Water column, bottom
Ribbon worms (phylum Nemertea)	Bottom-dwelling marine worms with a long extension from the mouth (proboscis) that helps capture food.	Bottom	Bottom	Bottom
Round worms (phylum Nematoda)	Small bottom-dwelling marine worms; many live in close association with other animals (typically as parasites).	Water column, bottom	Water column, bottom	Water column, bottom
Segmented worms (phylum Annelida)	Mostly bottom-dwelling, highly mobile marine worms; many tube-dwelling species.	Bottom	Bottom	Bottom
Bryozoans (phylum Ectoprocta)	Lace-like animals that exist as filter-feeding colonies attached to the seafloor.	Bottom	Bottom	Bottom
Squid, bivalves, clams, quahog, sea snails, chitons, conchs (phylum Mollusca)	Molluscs are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Molluscs such as squid are active swimmers and predators, while others such as sea snails are predators or grazers and clams are filter feeders.	Water column, bottom	Water column, bottom	Water column, bottom
Shrimp, crab, lobster, barnacles, copepods (phylum Arthropoda)	Bottom-dwelling or pelagic; some are immobile; with an external skeleton; all feeding modes from predator to filter feeder.	Water column, bottom	Water column, bottom	Water column, bottom
Sea stars, sea urchins, sea cucumbers (phylum Echinodermata)	Bottom-dwelling predators and filter feeders with tube feet.	Bottom	Bottom	Bottom

[1] Major taxonomic groups (those with more than 1,000 species) are based on the *World Register of Marine Species* (Appeltans et al. 2010) and *Catalogue of Life* (Bisby et al. 2010).
[2] Distribution is listed for adult stages. Except for flatworms and roundworms, most members of invertebrate phyla have free-swimming planktonic larval stages.
[3] Classification schemes for Protozoa are unstable, and these phyla represent some of the conventional protozoan groupings.

3.8.2 AFFECTED ENVIRONMENT

Marine invertebrates occur in the world's oceans from warm shallow waters to cold deep waters. They inhabit the seafloor and water column in all the large marine ecosystems (West Greenland, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast United States (U.S.) Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea) and open ocean areas (Labrador Current, Gulf Stream, and North Atlantic Gyre) in the Study Area (Section 3.0, Introduction, and the Study Area/large marine ecosystem map [Figure 3.0-1]) (Brusca and Brusca 2003). The Study Area extends from the seafloor up to the mean high tide line (often termed mean high water in literature).

Marine invertebrate distribution in the Study Area is influenced by habitat and physical and chemical aspects of the water (e.g., depth, temperature, salinity, nutrient concentrations, and ocean currents) (Levinton 2009). Distribution of invertebrates in the Atlantic portion of the Study Area is also influenced by their distance from the equator (latitude) (Macpherson 2002); in general, the number of marine invertebrate species increases toward the equator (Macpherson 2002). The higher number of species (diversity) and abundance of marine invertebrates in coastal water habitats, compared with the open ocean, is a result of the food and protection that coastal water habitats provide (Levinton 2009).

Marine invertebrates are the dominant animals in all habitats of the Study Area. The diversity and abundance of Arthropoda (e.g., crabs, lobsters, and barnacles) and Mollusca (e.g., snails and clams) is highest on the seafloor over the continental shelf due to high productivity and complex habitats relative to typical soft bottom habitat of the deep ocean (Karleskint et al. 2006). They are important in the marine food web as prey for many higher organisms (e.g., fish and whales), as scavengers and recyclers of nutrients, and as habitat-forming organisms. Every sessile invertebrate is habitat-forming; in a strict sense, even many motile marine invertebrates are habitat-forming. The principal habitat-forming invertebrates are Porifera (e.g., sponges), Cnidaria (e.g., corals), Annelida (e.g., tube worms), and Mollusca (e.g., oysters). Section 3.3 (Marine Habitats) lists the types of habitats in relation to biogeographic units, modified from the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). The description of habitats in this section is limited to marine invertebrates that are used to define the habitat type or are habitat-forming. The abiotic (nonliving) components of all habitat types are addressed in Section 3.3 (Marine Habitats), and key marine vegetation components are discussed in Section 3.7 (Marine Vegetation).

Marine invertebrates also occur in open ocean areas. The highly migratory short-finned squid (*Ilex illecebrosus*) occurs seasonally around the Gulf Stream Open Ocean Area (Hendrickson 2006), and the North Atlantic Gyre Open Ocean Area is home to reef-building corals in the islands of Bermuda (Aronson et al. 2008c, e). The existence of these reefs outside the general boundaries for coral reefs is due to the warm water the Gulf Stream carries to Bermuda (Spalding et al. 2001). Also, deep-water coral communities occur in the Study Area. Several hard coral species make up these reefs, but only the two dominant species are federally managed (i.e., ivory tree coral [*Oculina varicosa*] and *Lophelia pertusa*). *Oculina varicosa* reefs are most abundant off the southeast coast of the United States, but *Lophelia pertusa* is found throughout the Study Area at depths of 650–2,600 feet (ft.) (200–800 meters [m]), with the exception of the West Greenland Shelf Large Marine Ecosystem and the Labrador Current Open Ocean Area (although Freiwald et al. (2004) suggested that this is not a true absence but rather reflects insufficient survey intensity) (National Oceanic and Atmospheric Administration 2010a; National Oceanic and Atmospheric Administration and U.S. Department of Commerce 2010; Reed et al. 2006) (Section 3.8.2.15.2 [Deep-Water Corals] for a discussion of deep-water coral habitat).

3.8.2.1 Invertebrate Hearing and Vocalization

Very little is known about sound detection and use of sound by aquatic invertebrates (Budelmann 1992a, b; Montgomery et al. 2006; Popper et al. 2001). Organisms may detect sound by sensing either the particle motion or pressure component of sound, or both (Section 3.0.4, Acoustic and Explosives Primer). Aquatic invertebrates probably do not detect pressure since many are generally the same density as water and few, if any, have air cavities that would function like the fish swim bladder in responding to pressure (Budelmann 1992b; Popper et al. 2001). Many aquatic invertebrates, however, have ciliated "hair" cells that may be sensitive to water movements, such as those caused by currents or water particle motion very close to a sound source (Budelmann 1992a, b; Mackie and Singla 2003). This may allow sensing of nearby prey or predators or help with local navigation.

Aquatic invertebrates that can sense local water movements with ciliated cells include cnidarians, flatworms, segmented worms, urochordates (tunicates), molluscs, and arthropods (Budelmann 1992a, b; Popper et al. 2001). The sensory capabilities of corals are largely limited to detecting water movement using receptors on their tentacles (Gochfeld 2004), and the exterior cilia of coral larvae likely help them detect nearby water movements (Vermeij et al. 2010). Some aquatic invertebrates have specialized organs called statocysts for determination of equilibrium and, in some cases, linear or angular acceleration. Statocysts allow an animal to sense movement and may enable some species, such as cephalopods and crustaceans, to be sensitive to water particle movements associated with sound (Hu et al. 2009; Kaifu et al. 2008; Montgomery et al. 2006; Popper et al. 2001). Because any acoustic sensory capabilities, if present at all, are limited to detecting water motion, and water particle motion near a sound source falls off rapidly with distance, aquatic invertebrates are probably limited to detecting nearby sound sources rather than sound caused by pressure waves from distant sources.

Both behavioral and auditory brainstem response studies suggest that crustaceans may sense sounds up to 3 kilohertz (kHz), but best sensitivity is likely below 200 Hertz (Hz) (Goodall et al. 1990; Lovell et al. 2005; Lovell et al. 2006). Most cephalopods (e.g., octopus and squid) likely sense low-frequency sound below 1,000 Hz, with best sensitivities at lower frequencies (Budelmann 1992b; Mooney et al. 2010; Packard et al. 1990). A few may sense higher frequencies up to 1,500 Hz (Hu et al. 2009). Squid did not respond to toothed whale ultrasonic echolocation clicks at sound pressure levels ranging from 199 to 226 decibels (dB) referenced to (re) 1 µ (micro) Pascal (Pa) peak-to-peak, likely because these clicks were outside of squid hearing range (Wilson et al. 2007). However, squid exhibited alarm responses when exposed to broadband sound from an approaching seismic airgun with received levels exceeding 156 to 161 dB re 1 µPa root mean square (McCauley et al. 2000b).

Aquatic invertebrates may produce and use sound in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Popper et al. 2001). Some crustaceans produce sound by rubbing or closing hard body parts together, such as lobsters (Au and Banks 1998; Latha et al. 2005; Patek and Caldwell 2006). The snapping shrimp chorus makes up a significant portion of the ambient noise in many locales (Au and Banks 1998; Cato and Bell 1992). Each click is up to 215 dB re 1 µPa, with a peak around 2 to 5 kHz (Au and Banks 1998; Heberholz and Schmitz 2001). Other crustaceans make low-frequency rasping or rumbling noises, perhaps used in defense or territorial display, that may be obscured by high levels of ambient noise at ranges greater than 1 m from the source (Patek and Caldwell 2006; Patek et al. 2009).

Reef sounds, such as fish pops and grunts, sea urchin grazing (around 1.0 kHz to 1.2 kHz), and snapping shrimp clicks (around 5 kHz) (Radford et al. 2010), may be used as cues by some aquatic invertebrates. Nearby reef sounds were observed to affect movements and settlement behavior of coral and crab

larvae (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010). Larvae of other crustacean species, including pelagic and nocturnally emergent species that benefit from avoiding predators associated with coral reefs, appear to avoid reef sounds (Simpson et al. 2011). Detection of reef sounds is likely limited to short distances (less than 330 ft. [100 m]) (Vermeij et al. 2010).

3.8.2.2 General Threats

General threats to marine invertebrates include overexploitation and destructive fishing practices (Halpern et al. 2008; Jackson et al. 2001; Kaiser et al. 2002; Miloslavich et al. 2011; Pandolfi et al. 2003), habitat degradation by pollution and coastal development (Cortes and Risk 1985; Downs et al. 2009; Mearns et al. 2011), and invasive species (Bryant et al. 1998; Galloway et al. 2009; Wilkinson 2002). These threats are compounded by global threats to all marine life, including increasing temperature and decreasing pH of the ocean linked to global climate change (Canning-Clode et al. 2011; Cohen et al. 2009; Doney et al. 2012; Miloslavich et al. 2011).

The health and abundance of marine invertebrates is vital to the marine ecosystem, the sustainability of the world's commercial fisheries (Pauly et al. 2002), and to U.S. obligations to conserve biodiversity at national and international levels (Mengerink et al. 2009). Marine invertebrates are harvested for food and for the aquarium trade. Economically important invertebrate groups that are commercially fished for food in the United States are crustaceans (e.g., shrimps, lobsters, and crabs), bivalves (e.g., scallops, clams, and oysters), and cephalopods (e.g., squid and octopuses) (Gulf of Mexico Fishery Management Council 2005; Hendrickson 2006; South Atlantic Fishery Management Council 1998a, b). These fisheries are a key part of the commercial fisheries industry in the United States (Food and Agriculture Organization of the United Nations 2005). Global threats to crustaceans, bivalves, and cephalopods are largely the result of overfishing, destructive fishing techniques (e.g., trawling) and habitat modification (Morgan and Chuenpagdee 2003; Pauly et al. 2002). A relatively new threat to invertebrates is bioprospecting, the collection of organisms for the purpose of finding new compounds for pharmaceutical products. A review by Hunt and Vincent (2006) reveals that coastal waters of the entire Study Area are subject to intense bioprospecting. In the Study Area, marine invertebrates that are managed to ensure their sustainability have delineated Essential Fish Habitat, which is designated by NMFS and regional fishery management councils (see Table 3.8-2 for a list of marine invertebrates managed by regional fishery management councils).

Exposure to oil runoff from land, natural seepage, or spills from offshore drilling or tankers is an additional threat that can impact marine invertebrates (White et al. 2012). Factors such as the oil type, quantity, exposure time, and season can affect organism toxicity levels. Even closely related organisms can be affected differently. For example, the ESA-listed elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*) corals are less resistant to oil than other types of coral (National Oceanic and Atmospheric Administration 2001). Reproductive and early life stages are especially sensitive to oil exposure. Overall, the impact of oil spills on marine invertebrates is poorly documented, but experiments using corals indicate that oil exposure can result in death, delayed reproduction, altered development and growth, and altered behavior (National Oceanic and Atmospheric Administration 2001; White et al. 2012). Additional information on the biology, life history, and conservation of marine invertebrates can be found on the websites maintained by the following organizations:

- NMFS, particularly for ESA-listed species, ESA-proposed species, species of concern, and candidate species
- U.S. Coral Reef Task Force
- MarineBio Conservation Society

In the Study Area, nine coral and one mollusc species are endangered, threatened, proposed, or candidate species under the ESA. The following sections include the descriptions of the ESA species and descriptions of the major marine invertebrate taxonomic groups that occur in the Study Area. These taxonomic group descriptions include descriptions of key habitat-forming invertebrates, including reef-forming sponges, shallow-water corals, two groups of key deep-water corals that form Essential Fish Habitat, corals and other organisms that define live hard bottom, reef-building worms, and reef-building molluscs (e.g., oysters).

The ESA listing process for 82 species of reef-building corals petitioned by the Center for Biological Diversity (Sakashita and Wolf 2009) is the broadest and most complex listing process undertaken by NMFS (Brainard et al. 2011). A rigorous threat evaluation was developed for these corals by Brainard et al. (2011) and used by NMFS in their ESA determinations. Nineteen key threats were selected as the most important factors influencing the potential extinction of candidate coral species before 2100 (Table 3.8-4). However, NMFS used only nine of these threats in determining if ESA listing was warranted (FR *77*(236): 73219 – 73262, December 7, 2012). Because most of these threats are also known to affect marine invertebrate groups, generally, the information is presented here in General Threats rather than within a subsequent subsection.

Table 3.8-4: Summary of Proximate Threats and Their Relative Importance to Extinction Risk for Coral Species

Proximate Threat[1]	Importance to Extinction Risk	Used by NMFS in Coral ESA Determinations
Ocean Warming	High	✓
Disease	High	✓
Ocean Acidification	Med-High	✓
Reef Fishing—Trophic Effects	Medium	✓
Sedimentation	Low-Medium	✓
Nutrients	Low-Medium	✓
Sea-Level Rise	Low-Medium	✓
Toxins	Low	
Changing Ocean Circulation	Low	
Changing Storm Tracks/Intensities	Low	
Predation	Low	✓
Reef Fishing—Habitat Impacts/Destructive Fishing Practices	Low	
Ornamental Trade	Low	✓
Natural Physical Damage	Low	
Human-Induced Physical Damage	Negligible-Low	
Aquatic Invasive Species	Negligible-Low	
Salinity	Negligible	
African/Asian Dust	Negligible	
Changes in Incoming Solar Radiation	Probably Negligible	

ESA: Endangered Species Act; NMFS: National Marine Fisheries Service

[1] As summarized by Brainard et al. (2011). The authors note that excepting “natural physical damage” and “changes in incoming solar radiation,” the ultimate factor for all of the proximate threats is growth in human population and consumption of natural resources.

3.8.2.3 Elkhorn Coral (*Acropora palmata*)

3.8.2.3.1 Status and Management

Elkhorn coral is designated as a threatened species under the ESA (National Marine Fisheries Service 2010) and is proposed as an endangered species (FR *77*(236): 73219 – 73262, December 7, 2012). The critical habitat designation for threatened elkhorn and staghorn corals identifies the physical or biological features essential to their conservation as "substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments." For purposes of this definition, "substrate of suitable quality and availability" means natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover (FR *73*(229): 72210-72241, November 26, 2008). This definition applies to depths from mean low water to 30 m (FR *73*(229): 72210-72241, November 26, 2008). No other primary constituent elements were sufficiently definable. While most shallow-water coral habitat in the Study Area falls within the definition of critical habitat for elkhorn and staghorn, the United States contains only 10 percent, approximately, of all potential critical habitat in the Caribbean (Bryant et al. 1998).

The species' four areas of critical habitat (FR *73*(229): 72210-72241, November 26, 2008) are the Florida area (1,003 square nautical miles [nm^2]), the Puerto Rico area (1,123 nm^2), the St. John/St. Thomas area (91 nm^2), and the St. Croix area (95 nm^2); see Figure 3.8-1. All these areas of critical habitat are within U.S. waters of the Study Area. Although areas adjacent to the Naval Air Station Key West and within the footprint of the South Florida Ocean Measurement Facility Testing Range include areas that meet the definition of elkhorn critical habitat, areas within 0.02 nm of Naval Air Station Key West and a small portion of the nearshore footprint of the South Florida Ocean Measurement Facility Testing Range have been exempted from the critical habitat designation (FR *73*(229): 72210-72241, November 26, 2008).

3.8.2.3.2 Habitat and Geographic Range

Elkhorn coral is found in outer reef crests and slopes with exposure to wave action at depths of less than 3–66 ft. (1–20 m), although it has been reported as deep as 30 m (Aronson et al. 2008b; Boulon et al. 2005). The optimal water temperature for elkhorn coral is 77 degrees Fahrenheit (°F) to 84°F (25 degrees Celsius [°C] to 29°C), and it requires a salinity range of 34–37 parts per thousand (Aronson et al. 2008b; Boulon et al. 2005; Goreau and Wells 1967). Elkhorn coral inhabits shallow waters with high oxygen content and low nutrient levels (Spalding et al. 2001). Clear, shallow water allows the coral sufficient sunlight exposure to support zooxanthellae (symbiotic photosynthetic organisms; analogous to plants living inside the animals). Elkhorn coral primarily inhabits the seaward margins of reefs where the previously mentioned conditions are more likely to occur (Ginsburg and Shinn 1964).

Elkhorn coral distribution in the Study Area extends from southeastern Florida through the Florida Keys, and surrounds Puerto Rico and the U.S. Virgin Islands (Aronson et al. 2008b). Recently, a new colony of elkhorn coral was discovered in the Flower Garden Banks National Marine Sanctuary in the Gulf of Mexico (Zimmer et al. 2006), although this is not currently included in elkhorn critical habitat (FR *73*(229): 72210-72241, November 26, 2008). Elkhorn coral is known to occur in portions of the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), the Key West Range Complex, and the Puerto Rico/St. Croix Operating Area.

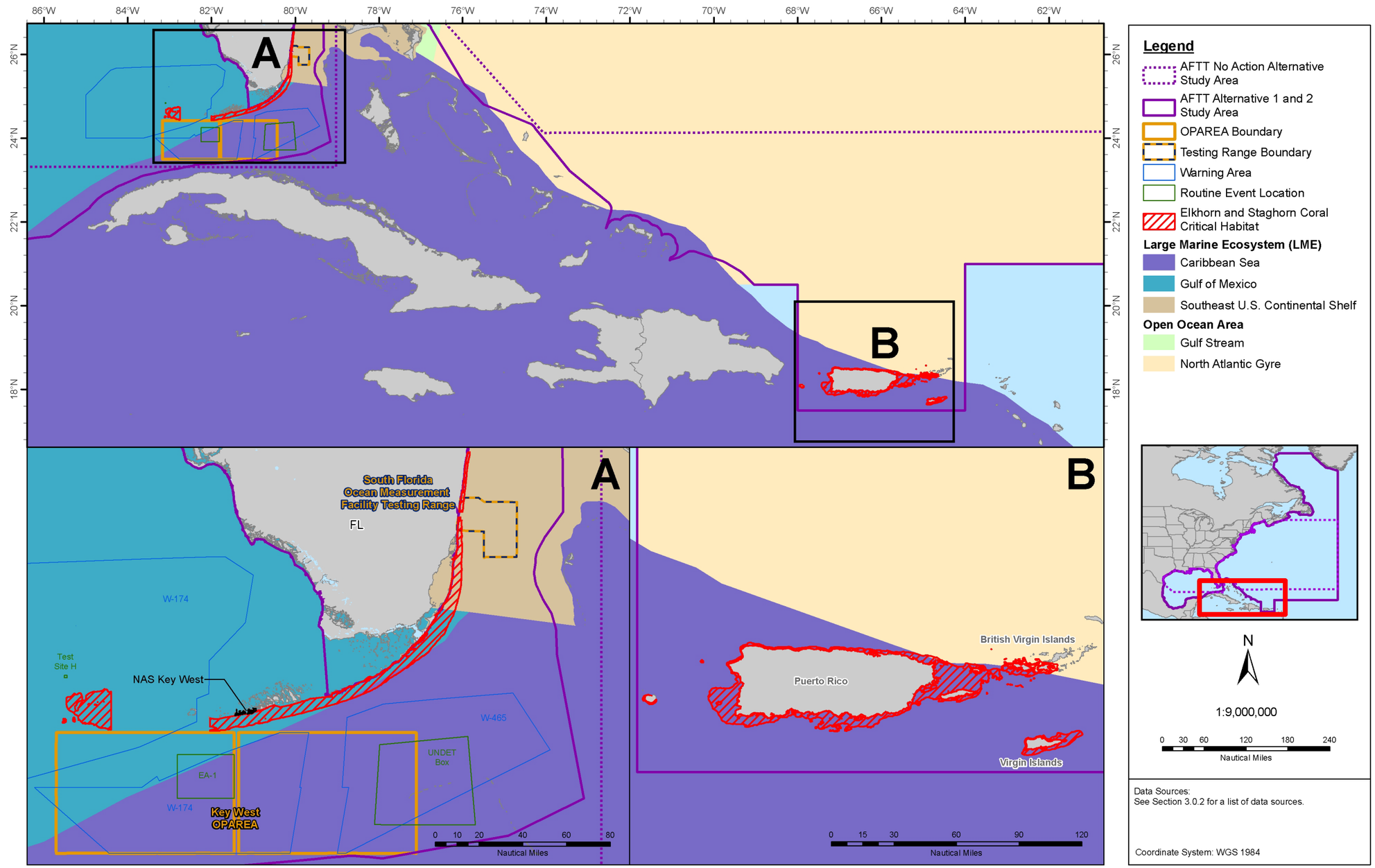

Figure 3.8-1: Critical Habitat Areas for Elkhorn and Staghorn Coral within the Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; NAS: Naval Air Station; OPAREA: Operating Area; UNDET: Underwater Detonation

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Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems; and North Atlantic Gyre Open Ocean Area. Within the Study Area, elkhorn corals are typically found in the southeastern part of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Elkhorn coral also occurs in the southwestern-most fragments of the North Atlantic Gyre Open Ocean Area adjacent to Puerto Rico and the U.S. Virgin Islands.

3.8.2.3.3 Population and Abundance

Elkhorn coral is in the Acroporidae family of corals. A review of quantitative data of Acroporidae in the wider Caribbean area, including the Florida Keys and Dry Tortugas, indicates a greater than 97 percent reduction of Acroporidae coverage since the 1970s with peak declines in the 1980s (Boulon et al. 2005). The absence of recovery of the Florida Key reefs implies they may no longer be resilient to various stressors (Somerfield et al. 2008). The current range of Acroporidae is considered to be the same as the historical range, despite the more than 97 percent reduction of individuals (Boulon et al. 2005; Bruckner 2003; Rothenberger et al. 2008).

Research on the population status of elkhorn coral indicates a drastic decline. Surveys of Carysfort Reef (1974–1982) and Molasses Reef (1981 and 1986) revealed slight declines or stable colonies (Dustan and Halas 1987; Jaap et al. 1988). It was not until the observation of a 93 percent decrease of coral in Looe Key (1983–2000) that the elkhorn coral populations mirrored the substantial decline of staghorn coral (Miller et al. 2002). Continued long-term monitoring in the Florida Keys and the U.S. Virgin Islands has found that elkhorn coral remains at less than 1 percent of all corals on reefs (Boulon et al. 2005; Rothenberger et al. 2008), and the species' continued decline since 2004 is attributed principally to fragmentation, disease, and predation (Williams and Miller 2011). Since the 2006 decision to list elkhorn coral as threatened the population has continued to decline by 50 percent or more, recruitment failure has been observed, and genetic studies have shown that approximately half of all colonies are clones—reducing the effective number of genetic individuals (Williams and Miller 2011).

Elkhorn coral can reproduce by spawning annually in August or September (Boulon et al. 2005), or asexually by fragmentation (National Marine Fisheries Service 2010). Although fragmentation of adult colonies helps maintain high growth rates, from 1.6 to 4.3 inches (in.) (4 to 11 centimeters [cm]) per year, fragmentation reduces the reproductive potential of elkhorn coral by delaying the production of eggs and sperm for 4 years after the damage occurs (Lirman 2000). Furthermore, only larger colonies are fertile and capable of sexual reproduction (i.e., those with surface areas greater than 9–39 square inches [$in.^2$] (60–250 square centimeters [cm^2]) (Soong and Lang 1992). Eggs and sperm immediately float to the sea surface where multiple embryos can develop from the fragmentation of a single embryo (Marshall 2012). Developing larvae travel at or near the sea surface for up to several weeks (Boulon et al. 2005) before actively seeking specific micro-habitats suitable for growth (Suzuki et al. 2012). Maturity is reached between 3 and 8 years, the average generation time is 10 years, and longevity is likely longer than 10 years based on average growth rates and size (Wallace 1999). Combined with a severely reduced population, these factors restrict the species' capacity for recovery.

3.8.2.3.4 Predator-Prey Interactions

Predators of corals include sea stars, snails, and fishes (e.g., parrotfish and damselfish) (Boulon et al. 2005; Roff et al. 2011). The marine snail, *Coralliophila abbreviata* (Grober-Dunsmore et al. 2006), and the fireworm, *Hermodice carunculata* (Boulon et al. 2005), are the primary predators on elkhorn coral.

Corals feed on zooplankton, which are small organisms that inhabit the ocean water column. Corals capture prey with tentacles armed with stinging cells that surround the mouth or by employing a mucus-net to catch suspended prey (Brusca and Brusca 2003). In addition to capturing prey, corals possess another unique method of acquiring essential nutrients through their symbiotic relationship with zooxanthellae that benefits both organisms. The coral host provides nitrogen in the form of waste to the zooxanthellae, and the zooxanthellae provide organic compounds produced by photosynthesis (the conversion of sunlight into food) to its host (Brusca and Brusca 2003; Schuhmacher and Zibrowius 1985). Zooxanthellae also provide corals with their characteristic color.

3.8.2.3.5 Species-Specific Threats

Elkhorn coral is more susceptible to disease than many other Caribbean corals (Pandolfi et al. 2003; Patterson et al. 2002; Porter et al. 2001). In particular, elkhorn coral is susceptible to a disease named "white pox" or "acroporid serratiosis" caused by a human fecal bacterium (*Serratia marcescens*). The bacterium is present in other coral species, but causes disease only in elkhorn coral (Sutherland et al. 2011). Additionally, it is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats). Contributing to the proposed reclassification of elkhorn coral from threatened to endangered were findings during the status review that the 2006 listing determination "…underestimated the global climate change-associated impacts to *A. palmata* and *A. cervicornis*…" (FR 77(236): 73219 – 73262, December 7, 2012).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (FR *77*(236): 73219 – 73262, December 7, 2012) (Brainard et al. 2011). Elements that contribute to elkhorn coral's proposed endangered status are: high vulnerability to ocean warming, ocean acidification and disease, high vulnerability to sedimentation and nutrient over-enrichment, uncommon abundance, decreasing trend in abundance, low relative recruitment rate, narrow overall distribution, restriction to the Caribbean, and inadequacy of regulatory mechanisms.

3.8.2.4 Staghorn Coral (*Acropora cervicornis*)

3.8.2.4.1 Status and Management

Staghorn coral is designated as a threatened species under the ESA (FR 71 (89): 26852-26872, May 9, 2006) and is proposed to be listed as endangered (FR *77*(236): 73219 – 73262, December 7, 2012). Staghorn coral shares the four areas of critical habitat with elkhorn coral and two exemptions to critical habitat at U.S. Department of the Navy (Navy) facilities (FR *73*(229): 72210-72241, November 26, 2008) (refer to Section 3.8.2.3.1, Status and Management, for critical habitat information and map [Figure 3.8-1], and general management information).

3.8.2.4.2 Habitat and Geographic Range

Staghorn coral is commonly found in lagoons and the upper to mid-reef slopes, at depths of 3–66 ft. (1–20 m), and requires a salinity range of 34–37 parts per thousand (Aronson et al. 2008a; Boulon et al. 2005) (refer to Section 3.8.2.3.2, Habitat and Geographic Range, as habitat information provided for elkhorn coral applies to staghorn as well). Staghorn coral is known to occur in portions of the Key West Range Complex and the Puerto Rico/St. Croix Operating Area (FR *77*(236): 73219 – 73262, December 7, 2012).

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems; and North Atlantic Gyre Open Ocean Area. In the Study Area, staghorn distribution extends south from

Palm Beach, Florida and along the east coast to the Florida Keys and Dry Tortugas (Boulon et al. 2005; Jaap 1984), in the southern part of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Staghorn coral also occurs in the southwestern-most fragments of the North Atlantic Gyre Open Ocean Area adjacent to Puerto Rico and the U.S. Virgin Islands.

3.8.2.4.3 Population and Abundance

Most population monitoring of shallow-water corals is focused on the Florida Keys, which straddle three large marine ecosystems: Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico. Because the Florida Keys are an ecological subregion unto themselves, most reports categorize coral data as Floridian versus Caribbean rather than parse out populations on one side of these arbitrary borders. Research on the population status of staghorn coral indicates a drastic decline throughout the Caribbean that peaked in the 1980s. At four long-monitored reefs in the Florida Keys, staghorn coral cover decreased:

- 18 percent on Carysfort Reef (1974–1982) (Dustan and Halas 1987)
- 96 percent on Molasses Reef (1981–1986) (Jaap et al. 1988)
- 98 percent on Looe Key (1983–2000) (Causey et al. 2002)
- 80–98 percent in the Dry Tortugas (Davis 1982)

Continued long-term monitoring in the Florida Keys and the U.S. Virgin Islands has found that staghorn coral remains at two percent or less of all corals on reefs, a fraction of its former abundance (Boulon et al. 2005; Rothenberger et al. 2008). Relatively recent reports found that staghorn coral was infrequently abundant in isolated patches, which suggests that staghorn recovery is somewhat more likely than elkhorn recovery (Bruckner 2003; Rothenberger et al. 2008) (refer to Section 3.8.2.3.3, Population and Abundance, for general population and abundance information regarding acroporid corals). Staghorn coral grown in 'nurseries' to assist recovery programs had substantially higher survival rates after the catastrophic cold-water bleaching event of 2010, suggesting that intervention has multiple benefits (Lirman et al. 2011; Schopmeyer et al. 2011). This same 2010 cold-water event killed an average of 15 percent of staghorn colonies at monitored reefs in the Florida Keys, a substantial decline in this remnant population (Lirman et al. 2011; National Oceanic and Atmospheric Administration 2012c). Since the 2006 decision to list staghorn coral as threatened some populations have continued to decline by 50 percent or more, and reliance on asexual fragmentation as a source of new colonies is not sufficient to prevent extinction (FR *77*(236): 73219 – 73262, December 7, 2012).

Growth rates for this species range from 1.2 to 4.5 in. (3 to 11.5 cm) per year (Boulon et al. 2005). Reproductive strategies and characteristics are not materially different from elkhorn coral (Section 3.8.2.3.3, Population and Abundance).

3.8.2.4.4 Predator-Prey Interactions

Predators of corals include sea stars, snails, and fishes (e.g., parrotfish and damselfish) (Boulon et al. 2005; Roff et al. 2011). The marine snail, *Coralliophila abbreviata* (Grober-Dunsmore et al. 2006), and the fireworm, *Hermodice carunculata* (Boulon et al. 2005), are the primary predators on staghorn coral. Staghorn coral feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral [*Acropora palmata*]).

3.8.2.4.5 Species-Specific Threats

Staghorn coral has no species-specific threats. It is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats), although it is more susceptible to disease (Pandolfi et al. 2003; Patterson et al. 2002; Porter et al. 2001). Contributing to the proposed reclassification of staghorn coral from threatened to endangered were findings during the status review that the 2006 listing determination "…underestimated the global climate change-associated impacts to *A. palmata* and *A. cervicornis*…" (FR *77*(236): 73219 – 73262, December 7, 2012).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to staghorn coral's proposed endangered status are: high vulnerability to ocean warming, ocean acidification and disease, high vulnerability to sedimentation and nutrient over-enrichment, uncommon abundance, decreasing trend in abundance, low relative recruitment rate, narrow overall distribution, restriction to the Caribbean, and inadequacy of regulatory mechanisms.

3.8.2.5 Boulder Star Coral (*Montastraea annularis*)

3.8.2.5.1 Status and Management

The three species of *Montastraea* proposed for listing as endangered under the ESA (*Montastraea annularis, Montastraea faveolata, Montastraea franksi*) have partially overlapping morphological characteristics, particularly in northern sections of their range, making identification a less-certain process than for most other Caribbean corals. While there now is reasonable acceptance that these are three separate and valid species, decades of taxonomic uncertainty and difficult field identification have led many to consider these a single species complex. Consequently, many long-term monitoring data sets and previous ecological studies did not distinguish among them, instead pooling them together as "*M. annularis* complex" or "*M. annularis* sensu lato" (Brainard et al. 2011; Jaap et al. 2002; National Oceanic and Atmospheric Administration 2012b; Somerfield et al. 2008). The so-called common names are not commonly used for these species; when they are identified in literature and by enthusiasts they are almost invariably called by their scientific names.

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for boulder star coral (*Montastraea annularis*) as endangered (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

3.8.2.5.2 Habitat and Geographic Range

Montastraea species are known to occur from depths of 0.5 to 20 m (1.64 to 65.6 ft.) (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). It occurs in most reef habitat types, though it is less common on the reef flat and in the shallow zones formerly dominated by elkhorn coral (Brainard et al. 2011; Goreau 1959; National Oceanic and Atmospheric Administration 2012b). It is

known throughout the Caribbean, Bahamas, and the Flower Garden Banks, but is uncommon or possibly absent from Bermuda.

Boulder star coral range coincides with the Study Area in most areas that shallow-water coral reefs occur. The principal areas of coincidence between boulder star coral habitat and the Study Area are near Puerto Rico and south Florida. Boulder star coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to the Naval Air Station Key West, Key West and Gulf of Mexico Range Complexes, and the Puerto Rico/St. Croix Operating Area. However, some of this geographic range information is based on ecological studies that identified the *M. annularis* complex rather than specifying *M. annularis* in particular.

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and North Atlantic Gyre Open Ocean Area. Within the Study Area, boulder star coral is typically found in the southern and southeastern parts of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Boulder star coral also occurs in the fragments of the North Atlantic Gyre Open Ocean Area that coincide with coral reef habitat.

3.8.2.5.3 Population and Abundance

Boulder star coral in the U.S. Virgin Islands declined 72 percent during the years from 1988 to 1999 (Edmunds and Elahi 2007). Declines between 40 and 60 percent were recorded in Puerto Rico, and 80 to 95 percent declines were observed in Florida between the late 1970s and 2003 (Aronson et al. 2008d; Brainard et al. 2011). However, because many studies in Puerto Rico and Florida did not reliably distinguish between the three sister-species of the *M. annularis* complex, these changes in abundance should be assumed to apply generally to the *M. annularis* species complex (Brainard et al. 2011). In addition to these declines, the remnant population of *M. annularis* in the Florida Keys was decimated by the 2010 cold-water bleaching event that killed about 56 percent of all *M. annularis* colonies at monitored reefs (Lirman et al. 2011).

All three of the *M. annularis* complex species are hermaphroditic, spawning 4–8 nights after the late summer full moon (typically September and October) (Brainard et al. 2011; Caribbean Marine Biological Institute 2011). Buoyant gametes are fertilized at the surface, larval development is typically 3–8 days and larvae are relatively small (Brainard et al. 2011; Caribbean Marine Biological Institute 2011). Fertilization success is low and recruitment rates are extremely low, on the order of one per 10 square meters (m^2) every 10 years (Brainard et al. 2011). Asexual reproduction by fragmentation is occasionally successful, but in general reproduction rates of this species are extremely low (Aronson et al. 2008d; Brainard et al. 2011). Genetic studies of boulder star coral found that populations in the eastern and western Caribbean are relatively genetically distinct, suggesting that regional differences in population trends or regulations for corals may influence their populations' genetic diversity (Foster et al. 2012).

Growth rates are approximately 1 cm per year for colonies at depths of less than 12 m, and growth rates decrease sharply as depth increases (Brainard et al. 2011). Slow growth coupled with low recruitment rates contribute to the three *M. annularis* complex species' vulnerability to extinction (Brainard et al. 2011).

3.8.2.5.4 Predator and Prey Interactions

Boulder star coral is much less susceptible to predation by snails than the *Acropora* species, and though preyed on by parrotfish the species is not preyed on disproportionately (Brainard et al. 2011; Roff et al.

2011). Boulder star coral feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral).

3.8.2.5.5 Species-Specific Threats

All three species of the *M. annularis* complex are moderately to highly susceptible to thermal bleaching, both warm and cool extremes (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). Recently, boulder star coral and mountainous star coral (*M. annularis* and *M. faveolata*) were found to have higher susceptibility to coral bleaching than many other species (van Hooidonk et al. 2012). Among the 25 coral species assessed after the 2010 cold-water bleaching event in Florida, *M. annularis* was the most susceptible to mortality by almost a factor of two (Lirman et al. 2011). This coral species has no species-specific threats, and is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats), although disease and pollution (e.g., the principal pollutants affecting corals are nutrients, herbicides, and pesticides) are the most damaging of the general threats (Brainard et al. 2011; Hughes et al. 2003; Pandolfi et al. 2005).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to boulder star coral's (*Montastraea annularis*) proposed endangered status are: high vulnerability to ocean warming disease, and ocean acidification; high vulnerability to sedimentation and nutrient over-enrichment; decreasing trend in abundance; low relative recruitment rate; narrow overall distribution (based on narrow geographic distribution and moderate depth distribution); restriction to the Caribbean; and inadequacy of regulatory mechanisms.

3.8.2.6 Mountainous Star Coral (*Montastraea faveolata*)

3.8.2.6.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for mountainous star coral as endangered (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

The so-called common name (mountainous star coral) is not commonly used for this species; when it is identified in literature and by enthusiasts it is almost invariably called by its scientific name.

3.8.2.6.2 Habitat and Geographic Range

Mountainous star coral occurs from 0.5 m to at least as deep as 40 m, and like *M. annularis* it is more commonly found in the shallower portions of this range. The *M. annularis* complex has been reported to at least 70–90 m, though only *M. faveolata* and *M. franksi* are likely to occur at these depths. This species is found in Bermuda but otherwise its geographic range is not materially different from *M. annularis*.

Mountainous star coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to the Naval Air Station Key West, Key West and Gulf of Mexico Range Complexes, and the Puerto Rico/St. Croix Operating Area. However, some of this geographic range information is based on ecological studies that identified the *M. annularis* complex rather than specifying *M. faveolata* in particular.

3.8.2.6.3 Population and Abundance

This species information is assumed not to be materially different from boulder star coral; however, differences may be masked since many ecological studies collected data at the *M. annularis* complex level rather than specifying *M. faveolata* in particular.

3.8.2.6.4 Predator and Prey Interactions

This species information is assumed not to be materially different from boulder star coral; however, differences may be masked since many ecological studies collected data at the *M. annularis* complex level rather than specifying *M. faveolata* in particular.

3.8.2.6.5 Species-Specific Threats

This species information is assumed not to be materially different from boulder star coral; however, differences may be masked since many ecological studies collected data at the *M. annularis* complex level rather than specifying *M. faveolata* in particular.

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to mountainous star coral's (*Montastraea faveolata*) proposed endangered status are: high vulnerability to ocean warming, disease, and ocean acidification; high vulnerability to sedimentation and nutrient over-enrichment; decreasing trend in abundance; low relative recruitment rate; moderate overall distribution (based on narrow geographic distribution and wide depth distribution); restriction to the Caribbean; and inadequacy of regulatory mechanisms.

3.8.2.7 Pillar Coral (*Dendrogyra cylindrus*)

3.8.2.7.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for pillar coral (*Dendrogyra cylindrus*) as endangered (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

3.8.2.7.2 Habitat and Geographic Range

Pillar coral most frequently occurs at depths of 3–8 m, but has been documented at depths of 1–25 m (3.3–82.0 ft.) (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). It is known to occur in south Florida as far north as Broward County and from one colony in Bermuda, but is not known to occur at the Flower Garden Banks or elsewhere in the northern or western Gulf of Mexico.

Pillar coral range coincides with the Study Area in most areas that shallow-water coral reefs occur. The principal areas of coincidence between pillar coral habitat and the Study Area are near Puerto Rico and south Florida. Pillar coral is known to occur in portions of the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to the Naval Air Station Key West, Key West Range Complex and the Puerto Rico/St. Croix Operating Area.

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and North Atlantic Gyre Open Ocean Area. Within the Study Area, pillar corals are typically found in the southern and southeastern parts of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Pillar coral also occurs in the fragments of the North Atlantic Gyre Open Ocean Area that coincide with coral reef habitat.

3.8.2.7.3 Population and Abundance

Pillar coral is both rare and conspicuous. Because pillar coral colonies have been killed by warm and cold water bleaching, disease, and physical damage it has been assumed that this rare species is in decline. In general, pillar coral is too rare for meaningful trends in abundance to be detected by typical reef monitoring programs (Brainard et al. 2011).

Growth rates for this species are typically 8 millimeters (mm) per year, though rates up to 20 mm per year have been reported (Brainard et al. 2011). Pillar coral spawns, and the first-ever observations of this species reproducing were made at around 2100 hours, 3 to 4 days after the August full moon in 2012 (Miller 2012). Sexual reproduction is unlikely to be successful because the species is so rare and colonies are gonochoric (i.e., a colony is either male or female); male and female colonies are unlikely to be in close enough proximity for reliable fertilization. For this reason, no juveniles of pillar coral have been observed in the past several decades, and fragmentation seems to be the only successful mode of reproduction for this species (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b).

3.8.2.7.4 Predator and Prey Interactions

Predators of this species seem to be few, and though the fireworm (*Hermodice carunculata*) feeds on pillar coral, it does not seem to be a major predator (Brainard et al. 2011). Pillar coral is distinctive among Caribbean corals because its tentacles are extended for feeding on zooplankton during the day, while most other corals' tentacles are retracted during the day (Boulon et al. 2005; Brainard et al. 2011). Pillar coral feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral).

3.8.2.7.5 Species-Specific Threats

Pillar coral has no species-specific threats. It is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats); however, it was historically more susceptible to exploitation by the curio trade (Brainard et al. 2011). Low population density is the principal threat to the species (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to pillar coral's proposed endangered status are: high vulnerability to disease, moderate vulnerability to ocean warming and

acidification, rare general range-wide abundance, low relative recruitment rate, narrow overall distribution (based on narrow geographic distribution and moderate depth distribution), restriction to the Caribbean, and inadequacy of regulatory mechanisms.

3.8.2.8 Rough Cactus Coral (*Mycetophyllia ferox*)

3.8.2.8.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for rough cactus coral (*Mycetophyllia ferox*) as endangered under the ESA (FR 77(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

The so-called common name is not commonly used for this species; when it is identified in literature and by enthusiasts it is almost invariably called by its scientific name.

3.8.2.8.2 Habitat and Geographic Range

Rough cactus coral is known to occur as deep as 80–90 m (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). Though reported to commonly occur at depths of 5–30 m (Aronson et al. 2008f), this could be an artifact of SCUBA diver-based survey intensity which decreases dramatically below 30 m. Rough cactus coral occurs in patch and fore reef habitat types, generally in lower energy parts of the reef (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). It is known from throughout the Caribbean and southern Gulf of Mexico, but is absent from the Flower Gardens Banks and Bermuda.

Rough cactus coral range coincides with the Study Area in most areas that shallow-water coral reefs occur. The principal areas of coincidence between rough cactus coral habitat and the Study Area are near Puerto Rico and south Florida. Rough cactus coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to the Naval Air Station Key West, Key West Range Complex, and the Puerto Rico/St. Croix Operating Area.

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and North Atlantic Gyre Open Ocean Area. Within the Study Area, rough cactus coral is typically found in the southern and southeastern parts of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Rough cactus coral also occurs in the fragments of the North Atlantic Gyre Open Ocean Area that coincide with coral reef habitat near Puerto Rico and the U.S. Virgin Islands (Brainard et al. 2011).

3.8.2.8.3 Population and Abundance

Though never particularly abundant, rough cactus coral in the Florida Keys has declined by at least 80 percent since 1996 and perhaps by much more since the 1970s (Brainard et al. 2011). Rough cactus

coral was observed in a 2012 survey near Jobos Bay in southeast Puerto Rico, but it was not abundant enough to appear in a 65 m^2 (700 $ft.^2$) sample of reef habitat (Tetra Tech Inc. 2012).

Rough cactus coral is a hermaphroditic brooder, releasing approximately 100 fully-developed larvae per polyp in the late winter (February–March) (Szmant 1986; Trnka 2006). Recruitment rates are extremely low or absent (Brainard et al. 2011).

3.8.2.8.4 Predator and Prey Interactions

Rough cactus coral is not known to be susceptible to predators (Brainard et al. 2011), and feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral).

3.8.2.8.5 Species-Specific Threats

Though not especially susceptible to mortality from warm-water bleaching (Brainard et al. 2011; van Oppen and Lough 2009), 15 percent of *Mycetophyllia* species were killed after the cold-water bleaching event in Florida (Lirman et al. 2011). Some coral diseases are characterized by the white-colored bands or pox they cause, but are otherwise difficult to discriminate (Porter et al. 2001). While diseases such as 'white plague' do not seem to be species-specific (Porter et al. 2001), rough cactus coral in the Florida Keys has been particularly susceptible to 'white plague' (Brainard et al. 2011).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to rough cactus coral's (*Mycetophyllia ferox*) proposed endangered status are: high vulnerability to disease; moderate vulnerability to ocean warming and acidification; high vulnerability to nutrient over-enrichment; rare general range-wide abundance; decreasing trend in abundance; low relative recruitment rate; moderate overall distribution (based on narrow geographic distribution and wide depth distribution); restriction to the Caribbean; and inadequacy of regulatory mechanisms.

3.8.2.9 Star Coral (*Montastraea franksi*)

3.8.2.9.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for star coral (*Montastraea franksi*) as endangered under the ESA (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

The so-called common name is not commonly used for this species; when it is identified in literature and by enthusiasts it is almost invariably called by its scientific name.

3.8.2.9.2 Habitat and Geographic Range

Star coral is found at least as deep as 50 m (164 ft.), and is found in most reef environments. The *M. annularis* complex has been reported to at least 70–90 m (230–295 ft.), though only *M. faveolata* and

M. franksi are likely to occur at these depths. The species is found in Bermuda but otherwise its geographic range is not materially different from *M. annularis*.

Star coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to Naval Air Station Key West, Key West and Gulf of Mexico Range Complexes, and the Puerto Rico/St. Croix Operating Area. However, some of this geographic range information is based on ecological studies that identified the *M. annularis* complex rather than specifying *M. franksi* in particular.

3.8.2.9.3 Population and Abundance

This species information is assumed not to be materially different from boulder star coral; however, differences may be masked since many ecological studies collected data at the *M. annularis* complex level rather than specifying *M. franksi* in particular.

3.8.2.9.4 Predator and Prey Interactions

This species information is assumed not to be materially different from boulder star coral; however, differences may be masked since many ecological studies collected data at the *M. annularis* complex level rather than specifying *M. franksi* in particular.

3.8.2.9.5 Species-Specific Threats

Star coral was less susceptible to mortality after the 2010 cold-water bleaching event in Florida than any of its congeners by at least a factor of three (Lirman et al. 2011). Otherwise, susceptibility to threats is not assumed to be materially different from boulder star coral; however, differences may be masked because many ecological studies identified the *M. annularis* complex rather than specifying *M. franksi* in particular.

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to star coral's proposed endangered status are: high vulnerability to ocean warming disease, and ocean acidification; high vulnerability to sedimentation and nutrient over-enrichment; decreasing trend in abundance; low relative recruitment rate; moderate overall distribution (based on narrow geographic distribution and wide depth distribution); restriction to the Caribbean; and inadequacy of regulatory mechanisms.

3.8.2.10 Elliptical Star Coral (*Dichocoenia stokesii*)

3.8.2.10.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for elliptical star coral as threatened under the ESA (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

The so-called common name is not commonly used for this species; when it is identified in literature and by enthusiasts it is almost invariably called by its scientific name.

The taxonomic status of this species is a matter of discussion among coral taxonomists. The supplementary information report cites a prominent coral taxonomist's comment that *Dichocoenia stokesii* and *Dichocoenia stellaris* fit the criterion of a single species rather than two separate species. Thus far, the NMFS review and listing process considers these two to be separate species (National Oceanic and Atmospheric Administration 2012b). Further, there is disagreement about whether the species name is spelled as *D. stokesi* or *D. stokesii*. The revised, current, name according to the Integrated Taxonomic Information System is *D. stokesii* (Integrated Taxonomic Information System 2012).

3.8.2.10.2 Habitat and Geographic Range

Elliptical star coral (*Dichocoenia stokesii*) has a broad depth distribution; it is found from 7 to 236 ft. (2 to 72 m) on rocky reefs, back reefs, and fore reefs (Aronson et al. 2008d; Brainard et al. 2011). It is known to occur throughout the Caribbean, Bahamas, the Flower Garden Banks, the eastern Gulf of Mexico, and Bermuda.

Elliptical star coral range coincides with the Study Area in most areas that shallow-water coral reefs occur. The principal areas of coincidence between elliptical star coral habitat and the Study Area are near Puerto Rico and south Florida. Elliptical star coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to Naval Air Station Key West, Key West and Gulf of Mexico Range Complexes, and the Puerto Rico/St. Croix Operating Area.

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and North Atlantic Gyre Open Ocean Area. Within the Study Area, elliptical star coral is typically found in the northern, southern, southeastern, and eastern parts of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Elliptical star coral also occurs in the fragments of the North Atlantic Gyre Open Ocean Area that coincide with coral reef habitat near Puerto Rico and the U.S. Virgin Islands (Aronson et al. 2008c, e).

3.8.2.10.3 Population and Abundance

Elliptical star coral is usually uncommon although on reefs in south Florida it is the ninth most abundant coral species (Brainard et al. 2011). Elliptical star coral was observed in a 2012 survey near Jobos Bay in southeast Puerto Rico that recorded four colonies in a 65 m^2 (700 $ft.^2$) sample of reef habitat (Tetra Tech Inc. 2012).

Reproduction occurs most frequently by broadcast spawning in August–September and October. Most colonies of elliptical star coral are gonochoric (i.e., a colony is either male or female), but approximately one-fifth are hermaphroditic. Average egg size is about 0.3 mm and females produce about 1,000 eggs per square cm per year (cm^2/yr.) (Brainard et al. 2011). Recruitment rates are relatively high, ranging from 0.1 to 1 juvenile per m^2 (11 $ft.^2$) in certain habitats, but survival to reproductive size (160 cm^2 [25 $in.^2$]) remains relatively low (Brainard et al. 2011).

3.8.2.10.4 Predator and Prey Interactions

Although elliptical star coral is minimally affected by predators, commensal and parasitic organisms such as bioeroding sponges and bivalves affect many colonies (Aronson et al. 2008d; Brainard et al. 2011).

Feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral).

3.8.2.10.5 Species-Specific Threats

Elliptical star coral has no known species-specific threats. It is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats). Although it is relatively resilient to most of these threats, elliptical star coral is particularly susceptible to white plague type II, which decimated the population in southern Florida (Aronson et al. 2008d; Brainard et al. 2011).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to elliptical star coral's *(Dichocoenia stokesii*) proposed threatened status are: high vulnerability to disease, moderate vulnerability to ocean warming and acidification, moderate overall distribution (based on narrow geographic distribution and wide depth distribution), restriction to the Caribbean, and inadequacy of regulatory mechanisms.

3.8.2.11 Lamarck's Sheet Coral (*Agaricia lamarcki*)

3.8.2.11.1 Status and Management

In December 2012, NMFS issued a Proposed Rule for reef-building coral species including a proposed listing for Lamarck's sheet coral (*Agaricia lamarcki*) as threatened under the ESA (FR *77*(236): 73219 – 73262, December 7, 2012). The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures (National Oceanic and Atmospheric Administration 2012b), and a supplemental information report addressing new information and public comment to both status and management reports (National Oceanic and Atmospheric Administration 2012b). Additional information regarding this coral species, including the *Petition to List 83 Coral Species Under the ESA* by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. Critical habitat has not yet been proposed for this species.

The so-called common name is not commonly used for this species; when it is identified in literature and by enthusiasts it is almost invariably called by its scientific name.

3.8.2.11.2 Habitat and Geographic Range

Lamarck's sheet coral is found across a very wide depth range from 3 to 100 m (9.8 to 328.1 ft.) and its frequency seems to increase with depth, particularly from 50 to 100 m (164.0 to 328.1 ft.). In shallower waters it is frequently found in shaded areas of the fore reef (Brainard et al. 2011; National Oceanic and Atmospheric Administration 2012b). It is known to occur throughout the Caribbean, Bahamas, and the Flower Garden Banks, but is absent from Bermuda.

Lamarck's sheet coral range coincides with the Study Area in most areas that shallow-water coral reefs occur. The principal areas of coincidence between Lamarck's sheet coral habitat and the Study Area are near Puerto Rico and south Florida. Lamarck's sheet coral is known to occur in the South Florida Ocean Measurement Facility Testing Range (Gilliam and Walker 2011), adjacent to the Naval Air Station Key West, Key West, and Gulf of Mexico Range Complexes, and the Puerto Rico/St. Croix Operating Area.

Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, and North Atlantic Gyre Open Ocean Area. Within the Study Area, Lamarck's sheet coral is typically found in the southern and southeastern parts of the Gulf of Mexico Large Marine Ecosystem, the northern part of the Caribbean Sea Large Marine Ecosystem, and the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem. Lamarck's sheet coral also occurs in the fragments of the North Atlantic Gyre Open Ocean Area that coincide with coral reef habitat near Puerto Rico and the U.S. Virgin Islands.

3.8.2.11.3 Population and Abundance

Though never particularly abundant, Lamarck's sheet coral is occasionally common and trends in abundance are not well established (Brainard et al. 2011). Lamarck's sheet coral was observed in a 2012 survey near Jobos Bay in southeast Puerto Rico that recorded five colonies in a 65 m^2 (700 $ft.^2$) sample of reef habitat (Tetra Tech Inc. 2012).

Reproduction is not known directly from Lamarck's sheet coral, but its congeners are brooders and release fully-formed larvae throughout the year with peaks at night time and in May (Brainard et al. 2011; Trnka 2006). Recruitment rates are exceptionally low and growth is slow. Average growth rate is 5 mm per year at depths shallower than 20 m (65.6 ft.), and growth rates decline substantially as depth increases (Brainard et al. 2011).

3.8.2.11.4 Predator and Prey Interactions

Predation on Lamarck's sheet coral is unknown (Brainard et al. 2011), and feeding strategies and symbioses are not materially different from elkhorn coral (Section 3.8.2.3, Elkhorn Coral).

3.8.2.11.5 Species-Specific Threats

Lamarck's sheet coral has no known species-specific threats. It is susceptible to the same suite of stressors that generally threaten corals (Section 3.8.2.15.1.5, Threats), however it was historically more susceptible to take by the curio trade (Brainard et al. 2011). Lamarck's sheet coral is not particularly susceptible to mortality from warm-water bleaching, or from cold-water bleaching following Florida's catastrophic cold-water bleaching event of 2010 (Brainard et al. 2011; Lirman et al. 2011).

NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (Table 3.8-4) to determine whether the species was likely to have an "…extremely high risk of extinction with little chance for recovery…" by 2100 (Brainard et al. 2011). Elements that contribute to Lamarck's sheet coral's (*Agaricia lamarcki*) proposed threatened status are: moderate vulnerability to ocean warming, disease, and acidification; low relative recruitment rate; moderate overall distribution (based on narrow geographic distribution and wide depth distribution); restriction to the Caribbean; and inadequacy of regulatory mechanisms.

3.8.2.12 Queen Conch (*Lobatus gigas*)

The scientific name for the queen conch was recently changed from *Strombus gigas* to *Lobatus gigas* based on taxonomic research published in the last decade, and accepted by the World Register of Marine Species in March 2011 (Bouchet 2012). *Lobatus gigas* includes seven synonymous species formerly considered to be distinct. The former name of *Strombus gigas*, rather than the valid name *Lobatus gigas*, is used in the petition to list queen conch under the ESA, the NMFS 90-day finding, and in most regulations to-date. It is likely that future documentation will use the new name *Lobatus gigas*, while referencing *Strombus gigas* and the other synonymous species.

3.8.2.12.1 Status and Management

In February 2012, NMFS received a petition to list the queen conch as threatened or endangered under the ESA and to designate critical habitat concurrently with the listing (FR *77*(166): 51763-51767, August 27, 2012). In its 90-day review, NMFS concluded that substantial scientific information may warrant listing under the ESA, and a status review for the queen conch is currently underway (FR *77*(166): 51763-51767, August 27, 2012).

Queen conch have a long history of harvest by commercial and recreational fisheries in Florida, Puerto Rico, and throughout the Caribbean. Living exclusively in shallow nearshore waters, queen conch are readily harvested by swimmers and divers. All conch fishing in Florida and adjacent federal waters has been closed since 1986 (Florida Fish and Wildlife Conservation Commission 2006; National Oceanic and Atmospheric Administration 2012a). Commercial and recreational fisheries for queen conch are open in Puerto Rico, the U.S. Virgin Islands, and adjacent federal waters; with restrictions managed by the Caribbean Fisheries Management Council (FR 70(176): 53979-54004, September 13, 2005). The majority of landings by the U.S. queen conch fishery (86 percent) are reported from state rather than federal waters (FR 70(176): 53979-54004, September 13, 2005).

3.8.2.12.2 Habitat and Geographic Range

The queen conch is typically found in nearshore tropical and subtropical sand, algae, seagrass, and coral rubble habitats from the intertidal zone to approximately 70 ft. (21 m) (National Oceanic and Atmospheric Administration 2012a), though they are occasionally found in rocky and reef habitats to at least 300 ft. (100 m) (WildEarth Guardians 2012). Queen conch are associated with subtidal sand flats, and are not associated with high-energy sandy beaches. In some circumstances, queen conch will migrate to sheltered shallow water to reproduce. These snails travel relatively short distances as juveniles and adults, but their planktonic larvae can travel great distances in the 2–8 weeks between hatching and settlement (WildEarth Guardians 2012).

The geographic range of the queen conch centers on the Caribbean; it extends northward to northern Florida and Bermuda, south to the Amazon River delta, and west throughout the Gulf of Mexico (WildEarth Guardians 2012). Because queen conch are typically found in shallow nearshore waters, relatively little of their range coincides with the Study Area. The principal areas of coincidence between queen conch habitat and the Study Area are near Puerto Rico and south Florida. Portions of the Naval Surface Warfare Center, Panama City Division Testing Range; South Florida Ocean Measurement Facility Testing Range; and the JAX, Key West, and GOMEX Range Complexes overlap with queen conch habitat.

Southeast U.S. Continental Shelf Large Marine Ecosystem. The queen conch's range includes suitable shallow nearshore habitat in Florida, particularly the Florida Keys (WildEarth Guardians 2012).

Gulf of Mexico Large Marine Ecosystem. The queen conch's range includes suitable shallow nearshore habitat throughout the Gulf of Mexico, though it is most common in the Florida Keys and the Yucatan Peninsula (WildEarth Guardians 2012).

Caribbean Sea Large Marine Ecosystem. This large marine ecosystem coincides with the center of the queen conch's range. The species can be found in suitable, shallow, nearshore habitat throughout this large marine ecosystem.

North Atlantic Gyre Open Ocean Area. Queen conch are found only in Bermuda and in the southwestern-most portions of this open ocean area, primarily in suitable, shallow, nearshore habitat adjacent to Puerto Rico, the U.S. Virgin Islands, and the Bahamas.

3.8.2.12.3 Population and Abundance

Queen conch are reproductively mature at approximately 4 years and have a typical lifespan of 20–30 years (Florida Fish and Wildlife Conservation Commission 2006; Stoner and Ray-Culp 2000). Spawning occurs from May to October, peaking in the summer. Under ideal conditions a female can lay up to nine egg masses in a season, each with hundreds of thousands of eggs (Stoner and Ray-Culp 2000; WildEarth Guardians 2012). They hatch after 3–5 days and settle into sheltered seagrass beds and sand flats after 2–8 weeks as planktonic larvae.

The lack of viable fisheries throughout most of the Caribbean is cited as an indicator for severely depleted populations (National Oceanic and Atmospheric Administration 2012a; WildEarth Guardians 2012). The abundance of queen conch, primarily inferred from fisheries landings, declined through the 1970s. The commercial fishery in the Florida Keys was closed in 1975 after the population collapsed, and similar population and fishery collapses occurred in much of the Caribbean through the 1990s. The population of adult queen conch in the Florida Keys is estimated to be 50,000 or fewer (Florida Fish and Wildlife Conservation Commission 2006; Stoner et al. 1996). Population declines are particularly concerning for slow-moving queen conch because their reproductive success is linked to the density of potential mates in a relatively small area. Recovery is less likely where populations are depleted because fewer successful matings occur. With fewer than approximately 50 adults per hectare (ha) (approximately 20 per acre [ac.]), queen conch are unlikely to find a mate in a spawning season (Stoner and Ray-Culp 2000). Where populations fall below this threshold, recovery is essentially impossible and extinction or extirpation becomes very likely (Gascoigne et al. 2009). Queen conch populations in portions of the U.S. Virgin Islands (e.g., St. Croix) were recently estimated to be 44 adults per ha (approximately 18 per ac.) (Rothenberger et al. 2008). Two recent large-scale surveys of inshore and nearshore waters of Jobos Bay, in southeastern Puerto Rico, found between 0 and 1 adult per ha (approximately 0.4 per ac.) (Tetra Tech Inc. 2012; Whitall et al. 2011).

3.8.2.12.4 Predator and Prey Interactions

Queen conch are primarily herbivorous, feeding on detritus, macroalgae, and small plants typically attached to seagrass blades (generally called epiphytes). They do not usually eat the seagrass itself (WildEarth Guardians 2012).

Queen conch are susceptible to a variety of invertebrate and vertebrate predators, particularly as planktonic larvae and juveniles (Iversen et al. 1986; WildEarth Guardians 2012). Notable among these predators are rays, nurse sharks, loggerhead turtles, and several species of snails, crabs, and lobsters (Iversen et al. 1986). Their susceptibility to predators decreases with age as their size and shell thickness increases (WildEarth Guardians 2012).

3.8.2.12.5 Species-Specific Threats

The principal species-specific threat to queen conch is fishing. The United States consumes approximately 78 percent of all conch meat taken from the Caribbean (National Oceanic and Atmospheric Administration 2012a; WildEarth Guardians 2012). Water pollution—particularly the heavy metals copper and zinc—interferes with queen conch reproduction (Spade et al. 2010). When adult

conch are translocated out of polluted habitats, they become capable of reproduction within 6 months (Delgado et al. 2004).

3.8.2.13 Foraminiferans, Radiolarians, Ciliates (Kingdom Protozoa)

Foraminiferans, radiolarians, and ciliates are small singled-celled organisms (sometimes forming colonies of cells) belonging to kingdom Protozoa (Appeltans et al. 2010). Classification schemes for Protozoa change frequently, and foraminiferans, radiolarians, and ciliates are members of three phyla that represent some of the conventional protozoan groupings. They are found in the water column and seafloor of the world's oceans (Table 3.8-3), and while most are microscopic, some species grow to approximately 4 in. (10 cm). Foraminiferans (phylum Foraminifera), such as those in the genus *Globigerina*, form diverse and intricate shells out of calcium carbonate (University of California Berkeley 2010c). Shells of foraminiferans that live in the water column eventually sink to the deep seafloor forming sediments known as foraminiferal ooze. Planktonic and benthic foraminifera shells form substantial deposits of carbonate sediment. Peculiar types of foraminifera are xenophyophores that have complex habitat-forming structures similar to sponges (Buhl-Mortensen et al. 2010). Individual xenophyophores are sometimes larger than 5 in. (10 cm) and occur throughout the oceans in waters deeper than 1,600 ft. (500 m). Foraminiferans feed on diatoms and other small organisms, and some form symbioses with algae similar to coral-algae symbiosis (Cockey et al. 1996). Their predators include copepods and other zooplankton, echinoderms, and some fish. Radiolarians (phylum Sarcodina) are microscopic organisms that form glass-like shells made of silica. Radiolarian ooze covers large areas of the ocean floor (Pearse 1987; University of California Berkeley 2010f). Ciliates (phylum Ciliophora) are protozoans with small hair-like structures called cilia used to feed and move around. They are a critical food source for primary consumers and are considered important parasites of many marine invertebrates.

3.8.2.14 Sponges (Phylum Porifera)

Sponges include approximately 8,550 marine species worldwide and are classified in the phylum Porifera (Appeltans et al. 2010; Van Soest et al. 2012). Sponges are bottom-dwelling, multicellular animals that can be best described as an aggregation of cells that perform different functions. Sponges are largely sessile (not mobile), except for their larval stages, and are common throughout the Study Area at all depths. Sponges reproduce both sexually and asexually. Water flow through the sponge provides food, oxygen, and removes wastes (Castro and Huber 2000; Pearse 1987; University of California Berkeley 2010e). Most sponges form calcium carbonate or silica structures embedded in cells to provide structural support (Castro and Huber 2000; Van Soest et al. 2012). Sponges provide homes for a huge variety of animals including shrimp, crabs, barnacles, worms, brittle stars, holothurians (e.g., sea cucumber), and other sponges (Colin and Arneson 1995d). Within the western Atlantic coral reefs and related ecosystems there are 117 genera of sponges (Spalding et al. 2001). Some species are commercially harvested in Florida waters located in the Gulf of Mexico Large Marine Ecosystem, including the sheepswool sponge (*Hippiospongia lachne*) and yellow sponge (*Cleona celata*) (Stevely and Sweat 2008).

3.8.2.14.1 Reef-Forming Sponges

Reef-forming sponges are found in the Study Area, particularly in the canyons of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Leys et al. 2007; Whitney et al. 2005). Some sponge reefs are protected as part of Essential Fish Habitat for federally managed species and their value as providers of important habitat is being intensively studied (Buhl-Mortensen et al. 2010; National Oceanic and Atmospheric Administration and U.S. Department of Commerce 2010). Although most

sponges do not form reefs because their skeletons do not persist intact after the colony's death, they are long-lived and form important habitat while they are alive.

Reef-forming sponges are known throughout the Study Area, but knowledge of their distribution and abundance is incomplete. Some areas of the Northeast U.S. Continental Shelf Large Marine Ecosystem are known to contain sponge reefs at depths of 1,000 to 1,300 m (Whitney et al. 2005), and the Gulf of Mexico Large Marine Ecosystem is being intensively explored (National Oceanic and Atmospheric Administration and U.S. Department of Commerce 2010). Reef-building sponges are filter-feeders, and animals that prey upon them are poorly known; however, using shallow water sponges as analogues, reef-forming sponges would be preyed upon by relatively few animals. The only known threats to reef-building sponges are physical strike and disturbance from anthropogenic activities (Whitney et al. 2005).

3.8.2.15 Corals, Hydroids, Jellyfish (Phylum Cnidaria)

There are more than 10,000 marine species of corals, hydroids, and jellyfish worldwide (Appeltans et al. 2010). Members of this group are found throughout the Study Area at all depths. Hydroids are colonial animals similar in form to corals. Hydroids have both flexible and rigid skeletons, and most with flexible skeletons are not considered to be reef-forming (Colin and Arneson 1995a; Gulko 1998). Jellyfish are motile as larvae, sessile as an intermediate colonial polyp stage, and motile as adults (Brusca and Brusca 2003). They are predatory at all stages and, like all cnidarians, use tentacles equipped with stinging cells to capture prey (Castro and Huber 2000; University of California Berkeley 2010b). Despite a strong popular perception that jellyfish populations are increasing in the wake of anthropogenic stressors, there is active scientific discourse about whether the apparent increase is genuine (Brotz et al. 2012), unsubstantiated (Condon et al. 2012), or equivocal (Purcell 2012). Jellyfish are an important prey species to a range of organisms, including some sea turtles and some ocean sunfish (*Mola* spp.) (Heithaus et al. 2002; James and Herman 2001).

Corals are in a class of animals that also includes anemones and soft corals. All sessile cnidarians are habitat-forming. The individual unit is referred to as a polyp, and most species occur as colonies of polyps. Reef-building corals fall into two primary zones: the shallow (photic) and deep (aphotic). Reef-building hard corals (sometimes called stony corals) in shallow water generally occur only in the warm waters bounded by the Tropics of Cancer and Capricorn (latitudinal lines), while deep-water hard and soft corals have a worldwide distribution including all large marine ecosystems in the Study Area (Freiwald et al. 2004; Sheppard et al. 2009; Spalding et al. 2001; Watling et al. 2011). Reef-building corals in the photic zone usually host symbiotic algae called zooxanthellae that provide extra energy to the corals (Castro and Huber 2000). The photic zone is defined by the limit of light penetration and the photic-aphotic transition occurs around 200 m in the open ocean, but varies with water clarity (see U.S. Department of the Navy 2012). All corals feed on small planktonic organisms or dissolved organic matter, although some shallow-water corals derive most of their energy from their symbiotic algae (Dubinsky and Berman-Frank 2001). Most hard corals and some soft corals are reef-forming (i.e., they form coral reefs) (Freiwald et al. 2004; Spalding et al. 2001; Watling et al. 2011), and some soft corals define particular habitat types (e.g., hard bottom is typically characterized by sponges and soft corals) (South Atlantic Fishery Management Council 1998a). The habitat-forming and reef-forming attributes of corals are particularly important to this EIS/OEIS and are discussed in terms of shallow-water corals, hard bottom, and deep-water corals.

3.8.2.15.1 Shallow-Water Corals

3.8.2.15.1.1 Status and Management

Coral reefs are constructed by complexes of corals and other plants and animals that build limestone skeletons or leave calcium carbonate debris as a result of their growth. The cumulative result is a three-dimensional irregular structure that is unique compared to the surrounding seascape (South Atlantic Fishery Management Council 1998a). Shallow-water coral reefs are protected by Executive Order 13089, *Coral Reef Protection*, and managed by the Coral Reef Task Force *(*FR *63*(115) 32701-32703, June 16, 1998). The aim of the U.S. Coral Reef Task Force is to protect and preserve coral reefs (FR 63(115) 32701-32703, June 16, 1998). Its efforts include research and the implementation of strategies to overcome coral decline, the reduction of reef pollution, and overfishing. The Navy is the Department of Defense (DoD) representative to the U.S. Coral Reef Task Force and also carries out the Coral Reef Protection Implementation Plan. This plan provides information for DoD agencies on the protection and conservation of coral reefs (Lobel and Lobel 2000).

These reefs are managed both as fisheries and as Essential Fish Habitat or Habitat of Particular Concern (Caribbean Fishery Management Council 1994; Gulf of Mexico Fishery Management Council 2005; South Atlantic Fishery Management Council 1998a) (Figures 3.8-2 and 3.8-3). Also, the two species of coral listed as threatened and the seven species proposed for listing under the ESA inhabit shallow water areas, and much of the shallow-water coral reef habitat in the Study Area is designated critical habitat for these species (Sections 3.8.2.3, Elkhorn Coral [*Acropora palmata*], and 3.8.2.4, Staghorn Coral [*Acropora cervicornis*]).

3.8.2.15.1.2 Geographic Range

In the Study Area, shallow-water coral reefs occur in the southern part of the Gulf of Mexico Large Marine Ecosystem, throughout the Caribbean Sea Large Marine Ecosystem, and in the southern part of the Southeast U.S. Continental Shelf Large Marine Ecosystem, including southeast Florida and the Bahamas (Spalding et al. 2001). See Figures 3.3-1 to 3.3-4 for a map of hard coral habitat in the Study Area.

In the central and eastern part of the Gulf of Mexico Large Marine Ecosystem, coral reefs occur in Flower Gardens Banks National Marine Sanctuary, Pulley Ridge Ecological Reserve, Dry Tortugas Ecological Reserve, and Florida Keys (Monaco et al. 2008; Spalding et al. 2001; United States Geological Survey 2010). In the Southeast U.S. Continental Shelf Large Marine Ecosystem, shallow-water coral reefs occur throughout the Florida Keys and southeast Florida and total, conservatively, between 250 and 364 nm^2 (Burke and Maidens 2004). Reefs also occur in the Caribbean Sea Large Marine Ecosystem surrounding Puerto Rico and the U.S. Virgin Islands. All these areas are managed as habitat areas of particular concern, as identified in Figures 3.8-2 and 3.8-3.

Although the shallow waters of Bermuda are outside the Study Area, they represent an important part of the coral reefs in the North Atlantic Gyre Open Ocean Area and cover an area of 410 nm^2 (Spalding et al. 2001). The islands of the Bahamas have patch reefs and one of the longest reefs in the western Atlantic (Andros Reef) (Spalding et al. 2001). Andros Reef is east of Andros Island in the northern part of the Caribbean Sea Large Marine Ecosystem.

Coral reefs cover approximately 380 nm^2 of the seafloor surrounding Puerto Rico within 3 nm of the coastline (Causey et al. 2002). Fringing reefs are the most common type of reef. Culebra and Vieques islands are nearly surrounded by reefs. The islands of St. Croix, St. John, and St. Thomas of the U.S. Virgin Islands have fringing reefs, patch reefs, and spur and groove reefs. St. Croix also has barrier

reefs (Causey et al. 2002). A survey that included depths to 66 ft. (20 m) found approximately 86 nm^2 of coral reef and hard bottom habitat (Causey et al. 2002).

3.8.2.15.1.3 Abundance

The coral reefs of the Florida Keys, Flower Garden Banks National Marine Sanctuary, Puerto Rico, and Bermuda host approximately 64, 21, 117, and 22 species of hard coral, respectively (Causey et al. 2002; Creary et al. 2008). Several of the most important Caribbean coral species are now listed, or are proposed for listing under the ESA (Sections 3.8.2.3, Elkhorn Coral [*Acropora palmata*] to Section 11 Lamarck's Sheet Coral [*Agaricia lamarcki*]). The number of coral species is often somewhat uncertain because coral taxonomy is updated every few years. Coral reefs in the Study Area are described as among the most degraded in the world (Bryant et al. 1998; Pandolfi et al. 2005). For further discussion of threats, Section 3.8.2.2 General Threats.

3.8.2.15.1.4 Predator-Prey Interactions

Predators of corals include sea stars, snails, and fishes (e.g., the predatory snail, *Coralliophila abbreviata*; the fireworm, *Hermodice carunculata*; and damselfish) (Boulon et al. 2005; Gochfeld 2004; Grober-Dunsmore et al. 2006; Gulko 1998).

Corals prey on zooplankton, which are small organisms that inhabit the ocean. Corals capture prey with tentacles armed with stinging cells that surround the mouth or by employing a mucus-net to catch suspended prey (Brusca and Brusca 2003). In addition to capturing prey, corals possess another method of acquiring essential nutrients through their relationship with zooxanthellae that benefits both organisms. The coral host provides nitrogen in the form of waste to the zooxanthellae, and the zooxanthellae provide organic compounds produced by photosynthesis to its host (Brusca and Brusca 2003; Schuhmacher and Zibrowius 1985). Some corals derive most of their energy from their zooxanthellae symbionts, resulting in dramatically reduced need for the coral to feed on zooplankton (Lough and Van Oppen 2009). Zooxanthellae also provide corals with most of their characteristic color.

3.8.2.15.1.5 Threats

There are very few species-specific threats for a particular coral species, though many threats have proportionally greater impact to particular groups, genera, or families of coral. For example, a type of "white" disease in the Caribbean preferentially infects colonies of the genus *Acropora* (Porter et al. 2001). Some groups of corals are more or less susceptible to predation and general threats. For example a predatory snail (*Coralliophila abbreviata*) feeds preferentially, but not exclusively, on *Acropora* species (Grober-Dunsmore et al. 2006). The aquarium industry has various taxa-specific preferences (Sakashita and Wolf 2009).

As key habitat-forming invertebrates (see U.S. Department of the Navy 2012), the threats to corals and coral reefs are well-studied. Factors that can stress or damage coral reefs are coastal development (Field et al. 2008; Risk 2009), impacts from inland pollution and erosion (Cortes and Risk 1985; Downs et al. 2011), coastal runoff (Downs et al. 2009; Downs et al. 2011), overexploitation and destructive fishing practices (Jackson et al. 2001; Pandolfi et al. 2003), global climate change and acidification (Doney et al. 2012; Doropoulos et al. 2012; Hughes et al. 2003), disease (Lesser et al. 2007; Porter et al. 2001), predation (Hayes 1990), harvesting by the aquarium trade (Caribbean Fishery Management Council 1994), vessel anchors (Burke and Maidens 2004), invasive species (Bryant et al. 1998; Galloway et al. 2009; Wilkinson 2002), ship groundings (National Oceanic and Atmospheric Administration 2010c), oil spills (National Oceanic and Atmospheric Administration 2001), and possibly human-made noise (Vermeij et al. 2010). Coral growth rates are reduced because of a

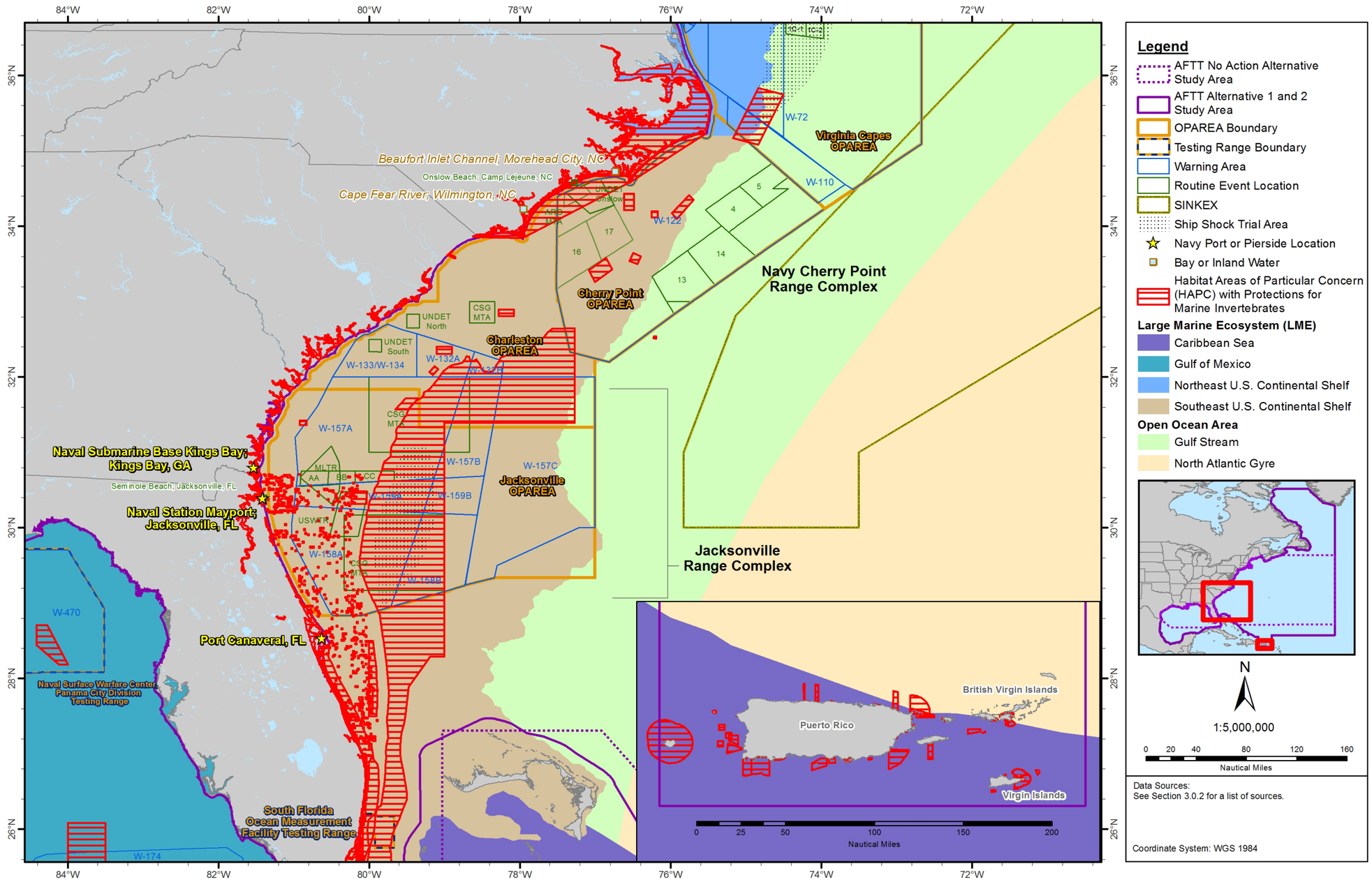

Figure 3.8-2: Habitat Areas of Particular Concern within the Southeastern Portion of the Study Area

AFTT: Atlantic Fleet Training and Testing; ARG MTA: Amphibious Readiness Group Mine Training Area; CSG MTA: Carrier Strike Group Mine Training Area; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; NC: North Carolina; OPAREA: Operating Area; SINKEX: Sinking Exercise Box; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

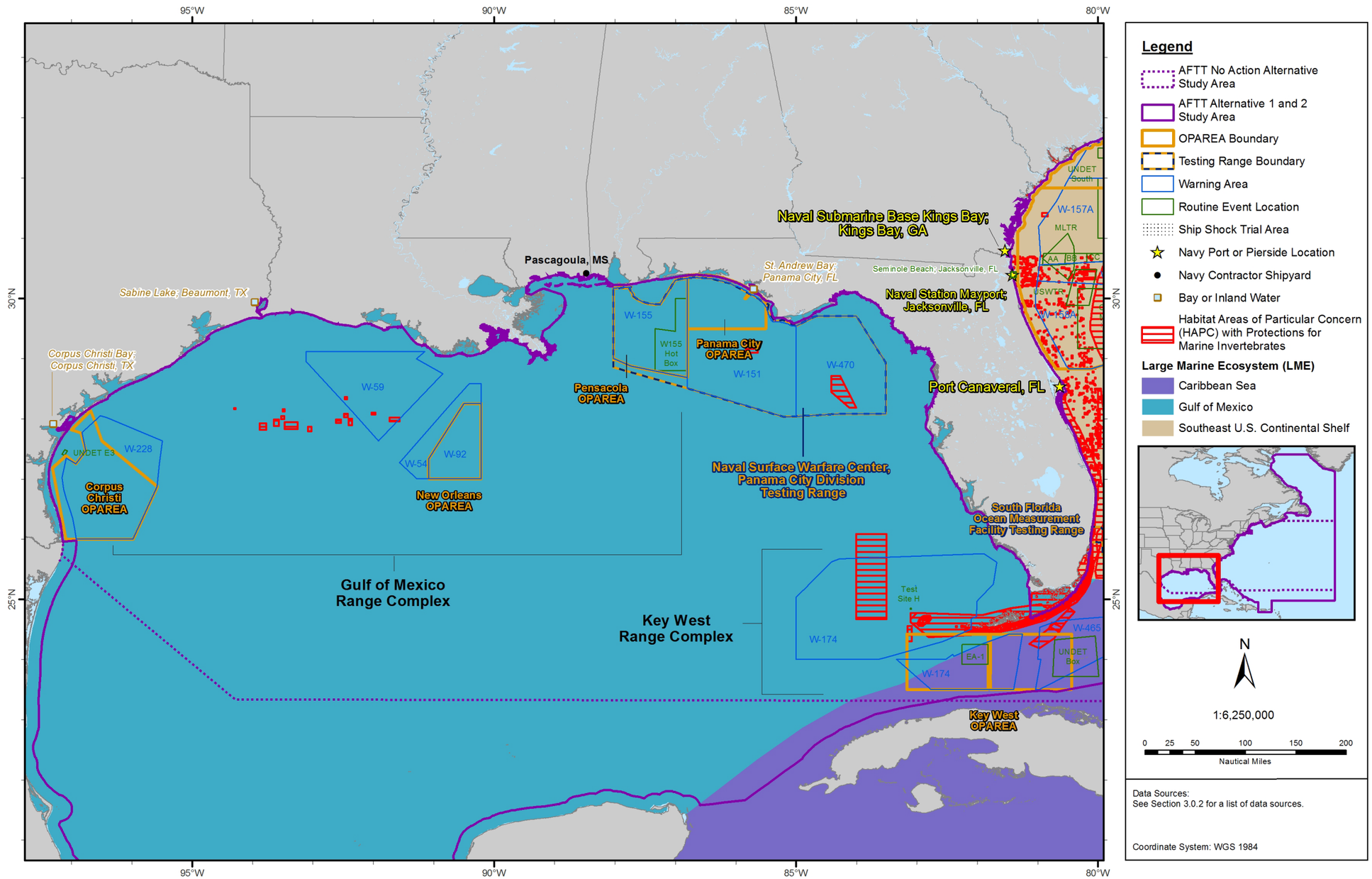

Figure 3.8-3: Habitat Areas of Particular Concern within the Gulf of Mexico Portion of the Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; MLTR: Missile Laser Training Range; MS: Mississippi; OPAREA: Operating Area; TX: Texas; UNDET: Underwater Detonation; USWTR: Undersea Warfare Training Range

decrease in the pH of the ocean linked to global climate change (Cohen et al. 2009). All these threats reduce tolerance to global climate change (Ateweberhan and McClanahan ; Carilli et al. 2010; Sheppard et al. 2009) and coral bleaching. Causes of coral bleaching are reasonably well understood and are often tied to atypically high sea temperatures (Brown 1997; Glynn 1993; van Oppen and Lough 2009). However, atypically low sea temperatures also cause substantial mortality to corals and most other reef organisms (Colella et al. 2012; Lirman et al. 2011). Human-made noise may impact coral larvae by masking the natural sounds that serve as cues to orient them toward suitable settlement sites (Vermeij et al. 2010).

Exposure to oil runoff from land, natural seepage, or spills from offshore drilling or tankers is another threat that can affect coral reefs (National Oceanic and Atmospheric Administration 2001). Factors such as the oil type, quantity, exposure time, and season can affect organism toxicity levels. Branching corals such as the ESA-listed elkhorn and staghorn corals are less resistant to oil than other types of coral (National Oceanic and Atmospheric Administration 2001). Reproductive and early life stages are especially sensitive to oil exposure (Shafir et al. 2007), which can result in coral death, delayed reproduction, altered development and growth, and altered behavior (National Oceanic and Atmospheric Administration 2001). Overall, the impact of oil spills on coral reefs is poorly documented.

Once a species is made vulnerable by human-caused events, impacts from ordinarily benign natural events can be magnified (Knowlton 2001). These factors have resulted in the coral reefs in the Study Area being described as among the most degraded in the world (Bryant et al. 1998; Pandolfi et al. 2005). Furthermore, individual species and entire evolutionary lineages of coral have been made exceptionally vulnerable to extinction (Huang 2012).

3.8.2.15.2 Deep Water Corals

3.8.2.15.2.1 Status and Management

Federally managed deep-water coral habitats focus on a suite of sessile invertebrates (Lumsden et al. 2007), and two types of reef-building coral are highlighted: *Oculina varicosa* (occurs at depths of approximately 100–500 ft. [30–150 m]) and *Lophelia pertusa* (occurs at depths of 650–2,600 ft. [200–800 m). Both are managed by the South Atlantic Fishery Management Council in Coral Habitat Areas of Particular Concern (referred to as C-HAPC in most regulatory documents) (South Atlantic Fishery Management Council 1998a). These two dominant species are used to define the Coral Habitat Areas of Particular Concern, but dozens of other habitat-forming organisms, including corals, co-occur in both habitats (Freiwald et al. 2004). Like shallow-water tropical coral reefs, these complex habitats host diverse megafauna communities that are distinct on relatively small spatial scales (e.g., as small as 0.2 acres [0.08 ha]) (Quattrini et al. 2012). The *Oculina* bank Coral Habitat Area of Particular Concern covers 300 nm^2 and lies off the coast of eastern Florida, Figure 3.8-2 (Reed et al. 2007). The *Lophelia* Coral Habitat Area of Particular Concern is 17,370 nm^2 stretching from Florida through South Carolina, with three satellite locations off North Carolina, effective 22 July 2010 (Figures 3.8-2 and 3.8-3).

3.8.2.15.2.2 Geographic Range

Both *Oculina* and *Lophelia* reefs are found in areas of rocky bottom because larvae of hard corals and most soft corals require hard substrates for settlement. Therefore, deep-water reefs are an indicator of hard bottom habitat (Figures 3.3-1 through 3.3-4), and these two habitat types are likely to be adjacent to each other (Auster et al. 2005; Reed et al. 2006). *Oculina varicosa* occurs in an unusually wide temperature range from approximately 39°F to 90°F (4°C to 32°C), although the Oculina Banks are typically 61°F (16°C) (Freiwald et al. 2004; National Oceanic and Atmospheric Administration 2010b). *Lophelia* reefs occur in water that is typically 45°F (7°C), though the range is 39°F to 55°F (4°C to 13°C)

(Buhl-Mortensen et al. 2010; National Oceanic and Atmospheric Administration 2010a; Reed et al. 2006). Both require moderate or strong currents for food delivery and many other aspects of their life histories (Lumsden et al. 2007; National Oceanic and Atmospheric Administration 2010a).

Oculina distribution in the Study Area occurs throughout the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf of Mexico Large Marine Ecosystem at depths of 100–500 ft. (30–150 m), but extensive *Oculina* reefs are found only offshore of the central east coast of Florida (National Oceanic and Atmospheric Administration 2010b; Reed et al. 2007; South Atlantic Fishery Management Council 1998a). *Lophelia* reefs occur throughout the Study Area at depths of 650–2,600 ft. (200–800 m), with the exception of the West Greenland Shelf Large Marine Ecosystem and the Labrador Current Open Ocean Area (although Freiwald et al. (2004) suggest that this is not a true absence but rather reflects insufficient survey intensity) (National Oceanic and Atmospheric Administration 2010a; National Oceanic and Atmospheric Administration and U.S. Department of Commerce 2010; Reed et al. 2006). Relative to other parts of the Study Area, the *Lophelia* reefs in the vicinity of Navy training areas of the Jacksonville (JAX) Range Complex are exceptionally well mapped (Figures 3.3-5 and 3.3-6) (U.S. Department of the Navy 2009). Although *Lophelia* is uncommon in the vicinity of the Grand Banks, extensive soft coral gardens occur at depths of 2,000–4,300 ft. (600–1,300 m) (Murillo et al. 2011).

3.8.2.15.2.3 Abundance

Although comprehensive mapping is incomplete, the seafloor in the vicinity of the JAX Range Complex has been relatively well-mapped in the approximate depth range of 50–1,500 ft. (15–450 m) (Figures 3.3-5 and 3.3-6) (U.S. Department of the Navy 2009). Using these survey data, it is possible to estimate that any portion of the southeast U.S. continental shelf in this depth range that is approximately 440 nm^2 is likely to be 5 to 39 percent live bottom or *Lophelia* (U.S. Department of the Navy 2010). Mapping in the JAX Range Complex found different types of sandy seafloor dotted with hard bottom and mounds of coral rubble capped with relatively complex invertebrate communities. *Lophelia*, the deep-water hard coral, was often present but was infrequently dominant.

Deep-water reefs are severely degraded by fishing gear that contacts the seafloor (particularly bottom-trawling), although a suite of other human stressors also degrade these habitats (particularly coral harvesting; oil, gas, and mineral exploration and extraction; marine debris; and submarine cable/pipeline deployment) (Freiwald et al. 2004). Approximately 90 percent of the living coral on the Oculina Banks has been destroyed by physical disturbance and Reed et al. (2007) note that inadequate enforcement within the Habitat Area of Particular Concern has allowed substantial degradation to continue. Both *Oculina* and *Lophelia* are slow-growing, and reef recovery from physical damage is estimated to require decades to centuries (Freiwald et al. 2004). Increases in coral cover at damaged reefs have been documented only once, at a single *Oculina* reef (Reed et al. 2007).

Deep-water reefs support substantial fish populations and are biodiversity hotspots on continental shelves and slopes (the extent of the continent that is covered by the ocean) (Baker et al. 2012; Bongiorni et al. 2010; Ross and Quattrini 2007). Because deep-water reefs provide habitat for many commercially valuable fish species, consequences of damage carry substantial socioeconomic costs as well as habitat and ecosystem costs (Morgan and Chuenpagdee 2003).

3.8.2.15.2.4 Predator-Prey Interactions

The only known predators of deep-water corals are several species of sea stars (Freiwald et al. 2004). Corals feed on zooplankton, which are small animals that inhabit the water column. Like all cnidarians,

corals capture prey with tentacles armed with stinging cells that surround the mouth or by employing a mucus net to catch suspended prey (Brusca and Brusca 2003).

3.8.2.15.2.5 Threats

There are no known species-specific threats for deep-water corals. Deep-water corals are susceptible to petroleum contamination and, once affected, show infrequent signs of recovery on short timescales (White et al. 2012). The greatest threat to deep-water coral reefs is physical strike and disturbance resulting from human-caused activities (National Oceanic and Atmospheric Administration 2010b; Reed et al. 2007). Fisheries-related damage is the single greatest threat to deep-water corals (Chuenpagdee et al. 2003; Freiwald et al. 2004). These species are extremely fragile, and even hook-and-line fishing causes extensive damage (Reed et al. 2007; Ross and Quattrini 2007).

3.8.2.15.3 Hard Bottom

3.8.2.15.3.1 Status and Management

Hard bottom (sometimes called livebottom or a variant of this) occurs on any natural structure that provides a relatively sediment-free surface for attachment, such as dead coral reefs or rock outcroppings (Lidz et al. 2006). This can occur at any depth, but hard bottom is typically encountered from the surface to approximately 2,000 ft. (600 m) in areas where water motion (e.g., waves or currents) is sufficient to prevent accumulation of unconsolidated sediment. Hard bottom itself is not a biogenic habitat *per se*, but it provides substrate for a community of habitat-forming sessile organisms that inhabit the rock structure as a living veneer. These organisms typically include sponges, hydroids, hard corals, soft corals and bivalves, and at depths less than approximately 600 ft. (200 m), hard bottom may also include vegetation (Chiappone and Sullivan 1994) (up to 30 percent attached macroalgae cover).

The South Atlantic Fishery Management Council has designated hard bottom within the Charleston Bump (a deep-water rocky outcropping) and Gray's Reef National Marine Sanctuary as Essential Fish Habitat–Habitat Areas of Particular Concern for coral. Similarly, hard bottom is managed by the Gulf of Mexico Fishery Management Council plan for habitat areas of particular concern (Gulf of Mexico Fishery Management Council 2005). Biogenic substrates are also created by worms and oysters, and these habitat-forming organisms are discussed in their respective phyla descriptions.

3.8.2.15.3.2 Geographic Range

Hard bottom is found in all large marine ecosystems of the Study Area (Figures 3.3-1 through 3.3-4). In the Southeast U.S. Continental Shelf Large Marine Ecosystem, hard bottom supporting sea fans, sea whips, hydroids, anemones, sponges, corals, and their associated fish fauna occurs on the Florida-Hatteras shelf south of Cape Hatteras, North Carolina. Natural rock hard bottom is augmented by "shell bottom," composed of living or dead oysters and hard clams, although hard bottom substrate can also comprise non-biogenic rock (e.g., basalt) (Auster et al. 2005). Shallow hard bottom off the east coast of Florida is similar to coral reefs in terms of community composition. Underdeveloped coral reefs on the periphery of mature reefs provide live hard bottom habitat around the Florida Keys. The west-central Florida inner continental shelf coast consists of exposed hard bottom containing ledges or scarps. These limestone outcroppings support complex live hard bottom communities on vertical faces up to 13 ft. (4 m) above the seafloor (Hine et al. 2003).

In the Gulf of Mexico Large Marine Ecosystem, almost all the natural shallow hard bottom habitat occurs on the west Florida shelf from the Dry Tortugas to Pensacola, Florida (Gulf of Mexico Fishery Management Council 1998). Shallow hard bottom on the Mississippi-Alabama shelf, the Texas-Louisiana

shelf, and the south Texas shelf are mostly associated with oyster beds, while deep hard bottom communities are associated with nascent or degraded deep-water reefs (Thompson et al. 1999). In the Gulf of Mexico, reef fishes, such as snappers, groupers, grunts, and porgies, are associated with hard bottom habitats (U.S. Department of the Interior and Minerals Management Service 2007).

3.8.2.15.3.3 Abundance

Hard bottom habitat is more abundant than all types of biogenic habitat and is found in all large marine ecosystems of the Study Area (Figures 3.3-1 through 3.3-4). It has been reasonably well-mapped in the Southeast U.S. Continental Shelf Large Marine Ecosystem, where it occupies approximately 36 percent of the JAX Range Complex and 96 percent of the South Florida Ocean Measurement Facility Testing Range (these figures combine reef and hard bottom abundance; see Section 3.3, Marine Habitats).

3.8.2.15.3.4 Predator-Prey Interactions

Most of the habitat-forming organisms that typify hard bottom are filter-feeders or predators of zooplankton. Most of these organisms are subject to similar predation pressures as shallow-water coral reefs, principally predation by invertebrates and fish (Section 3.8.2.15.1.4, Predator-Prey Interactions).

3.8.2.15.3.5 Threats

There are no species-specific threats to hard bottom. General threats are similar to those outlined for shallow-water and deep-water corals (Sections 3.8.2.15.1.5, Threats, and 3.8.2.15.2.5, Threats). Additionally, marine debris is a stressor of this habitat, particularly for heavily-fished and frequently-visited areas (Bauer et al. 2008).

3.8.2.16 Flatworms (Phylum Platyhelminthes)

Flatworms include between 8,000 and 20,000 marine species worldwide (Appeltans et al. 2010; Castro and Huber 2000) and are the simplest form of marine worm (Castro and Huber 2000). The largest single group of flatworms are parasites commonly found in fish, seabirds, and whales (Castro and Huber 2000; University of California Berkeley 2010d). The life history of parasitic flatworms plays a role in the regulation of populations for the marine vertebrates they inhabit. Ingestion by the host organism is the primary dispersal method for parasitic flatworms. As parasites, they are not typically found in the water column, outside of a host organism. The remaining groups found throughout the Study Area are nonparasitic carnivores, living without a host. Several species of wrasses and other reef fish prey on flatworms (Castro and Huber 2000).

3.8.2.17 Ribbon Worms (Phylum Nemertea)

Ribbon worms include approximately 1,000 marine species worldwide (Appeltans et al. 2010). Ribbon worms, with their distinct gut and mouth parts, are more complex than flatworms (Castro and Huber 2000). Organisms in this phylum are bottom-dwelling, predatory marine worms that are equipped with a long extension from the mouth (proboscis) that helps them capture food (Castro and Huber 2000). Some species are also equipped with a sharp needle-like structure that delivers poison to kill prey. Ribbon worms occupy an important place in the marine food web as prey for a variety of fish and invertebrates, and as a predator of other bottom-dwelling organisms, such as worms and crustaceans (Castro and Huber 2000). Some ribbon worms are parasitic and some are commensal, occupying the inside of the mantle of molluscs where they feed on the waste products of their host (Castro and Huber 2000). Ribbon worms are found throughout the Study Area, buried in the seafloor or hiding among the rocks or vegetation (Castro and Huber 2000).

3.8.2.18 Round Worms (Phylum Nematoda)

Round worms include more than 5,000 marine species, though this number may be a gross underestimate (Appeltans et al. 2010). Round worms are small and cylindrical, and they are abundant in sediments and in host organisms as parasites (Castro and Huber 2000). Round worms are some of the most widespread marine invertebrates, with population densities of one million organisms per 11 $ft.^2$ (1 m^2) of mud (Levinton 2009). This group has a variety of food preferences, including algae, small invertebrates, annelid worms, and organic material from sediment. One genus (*Anisakis*) inhabits the digestive tracts of marine mammals, while its larvae are found in marine fishes. These nematodes may impact other organisms that consume these infected fishes, including humans (Castro and Huber 2000). Like flatworms, parasitic nematodes provide important ecosystem services by regulating populations of other marine organisms. Round worms are found throughout the Study Area.

3.8.2.19 Segmented Worms (Phylum Annelida)

Segmented worms include approximately 12,000 marine species worldwide in the phylum Annelida, although most marine forms are in the class Polychaeta (Appeltans et al. 2010). Segmented worms are the most complex group of marine worms with a well-developed respiratory and gastrointestinal system (Castro and Huber 2000). Different species of segmented worms may be highly mobile or burrow in the seafloor (Castro and Huber 2000). Most segmented worms are predators; others are scavengers, deposit feeders, filter feeders, or suspension feeders of sand, sediment, and water (Hoover 1998c). The variety of feeding strategies and close connection to the seafloor make annelids an integral part of the marine food web (Levinton 2009). Burrowing in the seafloor and agitating the sediment increase the oxygen content of the seafloor, which makes important buried nutrients available to other organisms. This ecosystem service allows bacteria and other organisms, which are also an important part of the food web, to flourish on the seafloor. Segmented worms are found throughout the Study Area inhabiting rocky, sandy, and muddy areas of the seafloor (Castro and Huber 2000). These worms also colonize vessel hulls, docks, and floating debris. Some species of worms build rigid tubes, and aggregations of these tubes form reefs. Giant tube worms (*Riftia pachyptila*) are chemosynthetic (a primary production process without sunlight) reef-forming worms living on hydrothermal vents of the abyssal oceans. Their distribution is poorly-known in the Study Area.

3.8.2.19.1 Reef-Forming Worms

3.8.2.19.2 Status and Management

Shallow water worm reefs in the Study Area are built by the reef-building tube worm (*Phragmatopoma caudata*, synonymous with *P. lapidosa*) (Read and Fauchald 2012). The worm tube is constructed of cemented sand grains, and large colonies of worms form relatively smooth mounds up to 6 ft. (2 m) high (Zale and Memfield 1989). Worm reef is protected by the South Atlantic Fishery Management Council as a Habitat Area of Particular Concern (South Atlantic Fishery Management Council 1998a).

3.8.2.19.3 Geographic Range

The species is found in the western Atlantic from Brazil to Florida, but is uncommon in the Gulf of Mexico. In the Study Area, it is particularly common in the Southeastern U.S. Continental Shelf Large Marine Ecosystem along Florida's east coast beaches, from Cape Canaveral to Miami, at depths up to 6 ft. (2 m); however, colonies are found infrequently to depths of 328 ft. (100 m) in areas with strong currents (South Atlantic Fishery Management Council 1998a; Zale and Memfield 1989).

3.8.2.19.4 Abundance

Worm reefs cover approximately 426 ac. (172 ha) of Florida's east coast (Florida Fish and Wildlife Conservation Commission 2010).

3.8.2.19.5 Predator-Prey Interactions

Phragmatopoma species, and all members of the family Sabellariidae, are filter-feeders and detritivores. They are prey for snails, crabs, and fish. These worms form elaborate reef structures that are particularly important habitat for many marine invertebrates and fish. Furthermore, because the worms often form reefs in the surf zone, they create structured habitat in an area that would otherwise be shifting sand—a much less productive habitat (Florida Fish and Wildlife Conservation Commission 2010; Zale and Memfield 1989).

3.8.2.19.6 Threats

Principal threats to *Phragmatopoma* worm reefs are dredging and beach restoration projects. Compared with other habitat-forming organisms, the reef-building tube worm is relatively resistant to physical strikes and pollution (Zale and Memfield 1989).

3.8.2.20 Bryozoans (Phylum Ectoprocta)

Bryozoans include approximately 5,000 marine species worldwide (Appeltans et al. 2010). These organisms occur throughout the Study Area at all depths. They are lace-like colony-forming animals, many of which create habitat similar in complexity to sponges (Buhl-Mortensen et al. 2010). Though most are small, some habitat-forming colonies are at least 3 ft. (1 m) in diameter (Wood et al. 2012). Habitat-forming bryozoans are most common on temperate continental shelves with relatively strong currents (Wood et al. 2012). Bryozoans attach to a variety of surfaces, including rocks, shells, wood, and algae, and feed on particles suspended in the water (Pearse 1987; University of California Berkeley 2010a). Bryozoans are of economic importance for commercial pursuits (e.g., agriculture, pharmaceutical, and chemical products), and are a nuisance that interferes with boat operations and clogs industrial water intakes and conduits (Hoover 1998a; Western Pacific Regional Fishery Management Council 2001).

3.8.2.21 Squid, Bivalves, Sea Snails, Chitons (Phylum Mollusca)

The phylum Mollusca includes approximately 27,000 marine species worldwide (Appeltans et al. 2010). These organisms occur throughout the Study Area at all depths. Sea snails and conchs (gastropods), mussels and clams (bivalves), and chitons (polyplacophorans) are marine invertebrates that possess a muscular foot usually used for mobility, and a mantle that secretes a shell, although some molluscs have lost their shell (Castro and Huber 2000). Sea snails and slugs feed on a range of plants and animals, including fleshy algae, hydroids, sponges, sea urchins, worms, and small crustaceans, as well as dead organic matter (Castro and Huber 2000; Colin and Arneson 1995c; Hoover 1998c). Clams, mussels, and other bivalves feed on phytoplankton (small floating plant-like organisms) and other suspended food particles (Castro and Huber 2000). Most gastropods and chitons use a ribbon of teeth called a radula to feed and chitons, notably, bore deep pits into rocks as they scrape algae (Pearse 1987). Squid and octopus are active swimmers at all depths of the ocean and use a beak to prey on a variety of organisms. Squids prey on fishes, shrimps, and other squids (Castro and Huber 2000; Hoover 1998c; Western Pacific Regional Fishery Management Council 2001). Octopuses prey on fishes, shrimps, crabs, and other small crustaceans (Wood 2005).

Some mollusc species are commercially important and are federally managed (Table 3.8-2). The Atlantic sea scallop population is increasing in the Northeast U.S. Continental Shelf Large Marine Ecosystem due, in part, to effective fishery management (National Marine Fisheries Service 2012). The short-finned squid (*Ilex illecebrosus*) is among relatively few highly migratory marine invertebrates. This species inhabits the open ocean during the winter and returns to the water over the continental shelf in the spring in the Northeast Large Marine Ecosystem and Southeast U.S. Continental Shelf Large Marine Ecosystem (Hendrickson 2006). It carries out vertical daily migrations, swimming near the surface at night to feed and returning to the bottom before sunrise.

3.8.2.21.1 Reef-Forming Molluscs

Many species of mollusc, principally bivalves, are habitat-forming organisms. From the intertidal *Mytilus* mussel beds to the *Bathymodiolus* mussel reefs at deep-sea hydrothermal vents, bivalves create habitats throughout the Study Area (Buhl-Mortensen et al. 2010; South Atlantic Fishery Management Council 1998a). Oysters in general, and principally the eastern oyster (*Crassostrea virginica*), are the most familiar reef-forming mollusc on the U.S. continental shelf.

3.8.2.21.1.1 Status and Management

Oyster reefs or oyster beds are highly productive biogenic habitats in nearshore inter-tidal or shallow subtidal ecosystems, providing many of the same habitat values as coral reefs ("nearshore" generally includes inshore waters and the seaward coastal area where waves break, typically about 60–600 ft. [20–200 m] from the beach). Large oyster beds also alter the physical environment in which they occur by clarifying the water as they filter-feed on particulates, and by slowing the currents which leads to sediment retention (Tyrrell 2005). Oyster reefs are substantially degraded relative to their historical abundance (Jackson et al. 2001; National Oceanic and Atmospheric Administration Fisheries Eastern Oyster Biological Review Team 2007). Oysters and oyster reefs are components of Essential Fish Habitat or Habitat Areas of Particular Concern in all five federal fishery management councils in the Study Area.

3.8.2.21.1.2 Geographic Range

Oyster beds are found in intertidal estuarine or marine habitats throughout the Study Area. A prominent reef-forming oyster, the eastern oyster, creates important habitat in nearshore subtidal areas in all large marine ecosystems in the Study Area. Biogenic habitats on the Mississippi-Alabama shelf, the Texas-Louisiana shelf, and the south Texas shelf are mostly associated with oyster beds.

3.8.2.21.1.3 Abundance

Although populations of the eastern oyster have declined appreciably in the Study Area, they still provide substantial hard bottom habitat within the Study Area (National Oceanic and Atmospheric Administration Fisheries Eastern Oyster Biological Review Team 2007).

3.8.2.21.1.4 Predator-Prey Interactions

Oysters are filter-feeders actively pumping and feeding on up to 4 gallons (15 liters) of water per hour (Keith and Anderson 2010). Oysters are prey for various marine invertebrate, fish, and bird species. Predators, such as the oyster drill (*Urosalpinx cinerea*)—a small snail—induce oysters to thicken their shells for added protection (Lord and Whitlatch 2012). Reefs formed by oysters form highly complex, physically stable habitat in areas that would otherwise be softbottom or vegetated beds. They are "keystone species" in many estuaries, including the Chesapeake Bay, which was once dominated by oysters (Jackson et al. 2001; South Atlantic Fishery Management Council 1998a).

3.8.2.21.1.5 Threats

Fishing is the principal threat to oysters, although they are also susceptible to pollution (Jackson et al. 2001; South Atlantic Fishery Management Council 1998a). Dredging is the main method of industrial-scale fishing for oysters, and this method causes great collateral damage because it destroys the oyster reef habitat and the habitat upon which the reef was formed (Chuenpagdee et al. 2003).

3.8.2.22 Shrimp, Crab, Lobster, Barnacles, Copepods (Phylum Arthropoda)

Shrimps, crabs, lobsters, barnacles, and copepods are animals with skeletons that form outside the body (Castro and Huber 2000). The skeletons are based on a polymer called chitin, similar to cellulose in plants, to which the animals add compounds such as proteins or carbonates to achieve various properties of flexibility or hardness. There are more than 50,000 species belonging to the subphylum Crustacea (Appeltans et al. 2010). These organisms occur throughout the Study Area at all depths. Shrimps, crabs, and lobsters are typically carnivorous (feed on animal tissue) or omnivorous (feed on plant and animal tissue) predators or scavengers, preying on molluscs (primarily gastropods), other crustaceans, echinoderms (e.g., sea urchins), small fishes, algae, and seagrass (Waikiki Aquarium 2009; Waikiki Aquarium and University of Hawai'i-Manoa 2009a, b; Western Pacific Regional Fishery Management Council 2001). Barnacles and copepods filter algae and small organisms from the water (Levinton 2009).

Important commercial and recreational species of arthropods in the Study Area are listed in Table 3.8-2. Possibly the most familiar is the American lobster (*Homarus americanus*); its population in the Northeast U.S. Continental Shelf Large Marine Ecosystem has increased dramatically in the past decade due, in part, to successful fishery management (National Marine Fisheries Service 2012). Some other examples include the red crab (*Chaceon quinquedens*) (New England Fishery Management Council 2010) and brown shrimp (*Penaeus aztecus*) (Gulf of Mexico Fishery Management Council 2010; South Atlantic Fishery Management Council 1998a, b).

3.8.2.23 Sea Stars, Sea Urchins, Sea Cucumbers (Phylum Echinodermata)

Organisms in this phylum include more than 6,000 marine species, such as sea stars, sea urchins, and sea cucumbers (Appeltans et al. 2010). Sea stars (asteroids), sea urchins (echinoids), sea cucumbers (holothuroids), brittle stars and basket stars (ophuiroids), and feather stars and sea lilies (crinoids) are symmetrical around the center axis of the body (Mah and Blake 2012). All echinoderms are benthic (live on the seafloor), but some can also swim. Most echinoderms have separate sexes, but unisexual forms occur among the sea stars, sea cucumbers, and brittle stars. Many species have external fertilization producing planktonic larvae, but some brood their eggs, never releasing free-swimming larvae (Colin and Arneson 1995b; Mah and Blake 2012; McMurray et al. 2012). Many echinoderms are either scavengers or predators on attached (sessile) organisms such as algae, stony corals, sponges, clams, and oysters. However, some species filter food particles from sand, mud, or water (Hoover 1998b). Echinoderms are found throughout the Study Area. An important commercial species of echinoderm in the Northeast U.S. Continental Shelf Large Marine Ecosystem is the green sea urchin (*Strongylocentrotus drobachiensis*) (Maine Department of Marine Resources 2010), although this species is not federally managed.

3.8.3 Environmental Consequences

This section presents the analysis of potential impacts on marine invertebrates, from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative). Navy training and testing activities are evaluated for their potential impact on marine

invertebrates in general, by taxonomic groups, and in detail for species listed under the ESA, species proposed for listing, and federally managed species or groups such as coral Habitat Areas of Particular Concern (Section 3.8.2, Affected Environment).

General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis) and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to marine invertebrates discussed in Section 3.8.2 (Affected Environment), the stressors applicable to marine invertebrates in the Study Area and analyzed below include the following:

- Acoustic (sonar and other non-impulsive acoustic sources, and explosives and other impulsive acoustic sources)
- Energy (electromagnetic devices and high energy lasers)
- Physical disturbance and strike (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables, guidance wires, and parachutes)
- Ingestion (military expended materials)
- Secondary stressors

These components are analyzed for potential impacts on marine invertebrates within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components, within the context of geographic location and overlap of marine invertebrates. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic occurrence within the Study Area are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.8.3.1 Acoustic Stressors

Assessing whether sounds may disturb or injure an animal involves understanding the characteristics of the acoustic sources, the animals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. The methods used to predict acoustic effects to invertebrates build upon the Conceptual Framework for Assessing Effects from Sound-Producing Activities (Section 3.0.5.7.1). There is little information on the potential impacts on marine invertebrates from exposure to sonar, explosions, and other sound-producing activities. Most studies focused on squid or crustaceans and on the consequences of exposures to broadband impulsive airguns typically used for seismic exploration, rather than on sonars or explosions. Categories of potential impacts discussed in order below are direct trauma, auditory fatigue (hearing loss), auditory masking, behavioral reactions, and physiological stress.

Direct trauma and mortality may occur due to the rapid pressure changes associated with an explosion. Most marine invertebrates lack air cavities that could make them vulnerable to trauma due to rapid pressure changes. Marine invertebrates could also be displaced by a shock wave, which could cause injury.

To experience hearing impacts, masking, behavioral reactions, or physiological stress, a marine invertebrate must be able to perceive sound. Marine invertebrates are likely only sensitive to water particle motion caused by nearby lower-frequency sources, and likely do not sense distant or mid- and high-frequency sounds (Section 3.8.2.1, Invertebrate Hearing and Vocalization).

Little is known about impacts on marine invertebrate sensory systems from exposure to sound. Only a few studies have examined acoustic impacts to statocysts, motion sensors that are present in some invertebrates. Andre et al. (2011) found progressive damage to statocyst hair cells in squid after exposure to two hours of 50 to 100 Hz sweeps at sound pressure levels of 157 to 175 dB re 1 µPa; however, it is impossible to determine whether damage was due to the sound exposure or some other aspect of capture or captivity because inappropriate and incorrect controls were used. In other reports, no damage to statocysts and no impacts on crustacean balance (another function of the statocyst) were observed in crustaceans repeatedly exposed to high-intensity airgun firings (Christian et al. 2003; Payne et al. 2007). This limited information suggests that cephalopod and crustacean statocysts may be resistant to impulsive sound impacts, but that the impact from long-term or non-impulsive sound exposures is undetermined. There are no existing data on the effects of sound on sound perception in other invertebrate groups.

Masking occurs when a sound interferes with an animal's ability to detect other biologically relevant sounds in its environment. Little is known about how marine invertebrates use sound in their environment. Some studies show that crab and coral larvae and post-larvae may use nearby reef sounds when in their settlement phase (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010), although it is unknown what component of reef sound is used. Larvae may sense particle motion of nearby sounds, limiting their reef sound detection range (less than 330 ft. [100 m]) (Vermeij et al. 2010). Anthropogenic sounds could mask important acoustic cues, affecting detection of settlement cues or predators, potentially affecting larval settlement patterns or survivability in highly modified acoustic environments (Simpson et al. 2011). Low-frequency sounds could interfere with perception of low-frequency rasps or rumbles among crustaceans, that may be obscured by high levels of ambient noise at ranges greater than 1 m from the source (Patek et al. 2009).

Studies of invertebrate behavioral responses to sound have focused on responses to impulsive sound. Invertebrates may be more likely to respond to a sudden intense sound than sound that gradually increases in intensity, such as from an approaching source. Some caged squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 μPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a; McCauley et al. 2000b). Slight increases in behavioral responses, such as jetting away or changes in swim speed, were observed at sound exposure levels exceeding 145 dB re 1 μPa^2-s (McCauley et al. 2000a; McCauley et al. 2000b). Other studies have shown no observable response by marine invertebrates to sounds. Snow crabs did not react to repeated firings of a seismic airgun (peak received sound pressure level was 201 dB re 1 µPa) (Christian et al. 2003), squid did not respond to killer whale echolocation clicks (higher frequency signals ranging from 199 to 226 dB re 1 µPa) (Wilson et al. 2007), and krill did not respond to a research vessel approaching at 2.7 knots (source level below 150 dB re 1 µPa) (Brierley et al. 2003). Distraction may be a consequence of some sound exposures; for example hermit crabs were shown to delay reaction to an approaching visual threat when exposed to continuous noise, potentially putting them at increased risk of predation (Chan et al. 2010a; Chan et al. 2010b).

There is some evidence of possible stress effects on invertebrates from long-term or intense sound exposure. Captive sand shrimp exposed to low-frequency noise (30 to 40 dB above ambient) continuously for three months demonstrated decreases in both growth rate and reproductive rate (Lagardère 1982). Sand shrimp showed lower rates of metabolism when kept in quiet, sound-proofed tanks than when kept in tanks with typical ambient noise (Lagardère and Régnault 1980). Repeated intense airgun exposures caused no changes in biochemical stress markers in snow crabs (Christian et al.

2003); however, some biochemical stress markers were observed in lobsters, although the study indicated this may have been due to captivity rather than noise exposure (Payne et al. 2007). The effect of long-term (multiple years), intermittent sound exposure was examined in a statistical analysis of recorded catch rate of rock lobster and seismic airgun activity (Parry and Gason 2006). No correlation was found between catch rate and seismic airgun activity, implying no long-term population impacts from intermittent anthropogenic sound exposure over long periods.

Because research on the consequences of exposing marine invertebrates to anthropogenic sounds is limited, qualitative analyses were conducted to determine the effects of the following acoustic stressors on marine invertebrates within the Study Area: non-impulsive sources (including sonar, vessel noise, aircraft overflights, and other active acoustic sources) and impulsive acoustic sources (including explosives, pile driving, airguns, and weapons firing).

3.8.3.1.1 Sonar and Other Non-Impulsive Acoustic Sources

Sources of non-impulsive underwater sound during testing and training events include broadband vessel noise (including surface ships, boats, and submarines), broadband aircraft overflight noise (fixed-wing and rotary-wing aircraft), sonar, and other active non-impulsive sources. Non-impulsive sounds associated with testing and training are described in Section 3.0.5.3.1 (Acoustic Stressors).

Surface combatant ships and submarines are designed to be quiet to evade enemy detection, whereas other Navy ships and small craft have higher source levels, similar to equivalently sized commercial ships and private vessels (see Section 3.0.5.3.1.6, Vessel Noise). Ship noise tends to be low-frequency and broadband. Broadband noise from aircraft would depend on the platform, speed, and altitude (see Section 3.0.5.3.1.7, Aircraft Overflight Noise). Any sound transmitted through the air-water interface would be strongest just below the surface and directly under the aircraft. Sonar and other active acoustic sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. These sources may emit low-, mid-, high-, or very-high-frequency sounds at various sound pressure levels.

Most marine invertebrates do not have the capability to sense sound; however, some may be sensitive to nearby low-frequency and possibly lower-mid-frequency sounds, such as some active acoustic sources or vessel noise (Section 3.8.2.1, Invertebrate Hearing and Vocalization). Marine invertebrates that may detect sounds include cephalopods and crustaceans. Because marine invertebrates lack the adaptations that would allow them to sense sound pressure at long distances, the distance at which they may detect a sound is probably limited.

The relatively low sound pressure level beneath the water surface due to aircraft is likely not detectable by most marine invertebrates. For example, the sound pressure level from an H-60 helicopter hovering at 50 ft. is estimated to be about 125 dB re 1 µPa at 1 m below the surface, a sound pressure lower than other sounds to which marine invertebrates have shown no reaction (Section 3.8.3.1, Acoustic Stressors). Therefore, impacts due to aircraft overflight noise are not expected.

3.8.3.1.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, training activities using sonar and other active acoustic sources could occur throughout the Study Area, but would typically occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem (Northeast and Virginia Capes [VACAPES] Range Complexes), Southeast U.S. Continental Shelf Large Marine Ecosystem (Navy Cherry Point and JAX Range Complexes), and Gulf

of Mexico Large Marine Ecosystem (Gulf of Mexico [GOMEX] Range Complex), as well as in the Gulf Stream and North Atlantic Gyre Open Ocean Areas. Certain portions of the Study Area, such as areas near Navy ports, airfields, and range complexes are used more heavily by vessels and aircraft than other portions of the Study Area. Navy vessel noise and aircraft overflight noise associated with training could occur in all of the range complexes and throughout the Study Area while in transit. The locations and number of activities proposed for training under the No Action Alternative are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during training are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources); Section 3.0.5.3.1.6 (Vessel Noise) and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

As discussed above, most marine invertebrates cannot sense mid- or high-frequency sounds, distant sounds, or aircraft noise transmitted through the air-water interface (Section 3.8.2.1, Invertebrate Hearing and Vocalization). Most marine invertebrates would not be close enough to intense sound sources, such as some sonars, to potentially experience impacts to sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may contribute to masking of relevant environmental sounds, such as reef noise. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit and would avoid shallow water areas such as coral reefs, any sound exposures with the potential to cause masking or behavioral responses would be infrequent and brief. Without prolonged proximate exposures, measurable impacts are not expected. Although non-impulsive underwater sounds produced during training activities may briefly impact some individuals capable of detecting sounds, intermittent exposures to non-impulsive sounds are not expected to impact survival, growth, recruitment, or reproduction of marine invertebrate populations.

Under the No Action Alternative, training activities using sonar and other active acoustic sources are not proposed in ESA-listed elkhorn and staghorn critical habitat designated in shallow waters along southern Florida and around Puerto Rico (see Table 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives). In addition, vessels would avoid transit through areas containing shallow reefs. Any noise produced by transiting vessels would not result in the destruction or impairment of hard bottom or coral substrate suitable for coral settling and attachment. As with other invertebrates discussed above, non-impulsive underwater sound produced during training would not impact ESA-proposed corals, ESA-listed staghorn and elkhorn corals, or the ESA-candidate queen conch.

Pursuant to the ESA, underwater non-impulsive sound generated during training activities under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

Under the No Action Alternative, testing activities using sonar and other active acoustic sources could occur throughout the Study Area while in transit, but would typically occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems, as well as in the Gulf Stream and North Atlantic Gyre Open Ocean Areas. These testing activities could occur in all the range complexes; at Naval Undersea Warfare Center Division, Newport

Testing Range; at Naval Surface Warfare Center, Panama City Division Testing Range; and pierside at Navy ports, naval shipyards, and Navy-contractor shipyards. Certain portions of the Study Area, such as areas near Navy ports and airfields, installations, and training and testing ranges are used more heavily by vessels and aircraft than other portions of the Study Area. Underwater noise from vessels and aircraft overflights associated with testing could occur in all the range complexes, the training ranges, and throughout the Study Area while in transit. The locations and number of activities proposed for testing under the No Action Alternative are shown in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

As discussed above, most marine invertebrates cannot sense mid- or high-frequency sounds, distant sounds, or aircraft noise transmitted through the air-water interface (Section 3.8.2.1, Invertebrate Hearing and Vocalization). Most marine invertebrates would not be close enough to intense sound sources, such as some sonars, to potentially experience impacts to sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may contribute to masking of relevant environmental sounds, such as reef sound. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit and would avoid shallow water areas such as coral reefs, any sound exposures with the potential to cause masking or behavioral responses would be infrequent and brief. Without prolonged proximate exposures, measurable impacts are not expected. Although non-impulsive underwater sounds produced during testing activities may briefly impact some individuals capable of detecting sound, intermittent exposures to non-impulsive sounds are not expected to impact survival, growth, recruitment, or reproduction of marine invertebrate populations.

Under the No Action Alternative, testing activities using sonar and other active acoustic sources are not proposed in ESA-listed elkhorn and staghorn critical habitat designated in shallow waters along southern Florida and around Puerto Rico (see Table 2.8-2 and Table 2.8-3 of Chapter 2, Description of Proposed Action and Alternatives). In addition, vessels would avoid transit through areas containing shallow reefs. Any noise produced by transiting vessels would not result in the destruction or impairment of hard bottom or coral substrate suitable for coral settling and attachment. As with other invertebrates discussed above, non-impulsive underwater sound produced during training would not impact ESA-proposed corals, ESA-listed staghorn and elkhorn corals, or the ESA-candidate queen conch.

Pursuant to the ESA, underwater non-impulsive sound generated during testing activities under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, marine invertebrates would be exposed to increased amounts non-impulsive noise compared to the No Action Alternative due to increased use of sonars and other active acoustic sources; vessels; and aircraft overflights. Non-impulsive sound sources used during training would be similar to

those under the No Action Alternative, with the addition of new active acoustic sources associated with the introduction of the Littoral Combat Ship. The locations of training using vessels, aircraft, and sonars would be similar to those under the No Action Alternative. As with the No Action Alternative, training activities under Alternative 1 using sonar and other active acoustic sources are not proposed in ESA-listed elkhorn and staghorn critical habitat designated in shallow waters along southern Florida and around Puerto Rico (see Table 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives). The locations and number of activities proposed for training under Alternative 1 are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during training are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with training under Alternative 1 would increase the likelihood of exposure of marine invertebrates to non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.1 (No Action Alternative), non-impulsive sounds associated with training are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No measurable impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected. As with other invertebrates discussed above, non-impulsive underwater sound produced during training would not impact ESA-proposed corals, ESA-listed staghorn and elkhorn corals, or the ESA-candidate queen conch..

Pursuant to the ESA, underwater non-impulsive sound generated during training activities under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coal, Lamarck's sheet coral, mountainous star, pillar coral, rough cactus coral, or star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

Under Alternative 1, marine invertebrates would be exposed to increased amounts of sonars and active acoustic sources (including sources not analyzed under the No Action Alternative), vessel noise, and aircraft overflight noise during testing activities compared to the No Action Alternative. The locations of testing activities using vessels, aircraft, and sonars and other active acoustic sources would be similar to those under the No Action Alternative, with the addition of testing activities using sonars and active acoustic sources at the South Florida Ocean Measurement Facility Testing Range and the Key West Range Complex. As with the No Action Alternative, testing activities under Alternative 1 using sonar and other active acoustic sources are not proposed in ESA-listed elkhorn and staghorn critical habitat designated in shallow waters along southern Florida and around Puerto Rico. The locations and number of activities proposed for testing under Alternative 1 are shown in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with testing under Alternative 1 would increase the likelihood of exposure of marine invertebrates to

non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.1 (No Action Alternative), non-impulsive sounds associated with testing are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Active acoustic sources would be used during testing activities in the Key West Range Complex, which includes ESA-listed elkhorn and staghorn coral critical habitat, and at the South Florida Ocean Measurement Facility Testing Range, which includes suitable habitat for ESA-proposed corals, and ESA-listed elkhorn and staghorn coral in shallow waters. Activities using sonar in the Key West Range Complex introduced under Alternative 1 would typically occur in water depths greater than 600 ft. (180 m) and, therefore, would not occur near elkhorn and staghorn corals or critical habitat. Activities at the South Florida Ocean Measurement Facility Testing Range could expose corals to underwater non-impulsive sound. Vessels would avoid transit through areas containing shallow reefs. Any noise produced by transiting vessels would not result in the destruction or impairment of hard bottom or coral substrate suitable for coral settling and attachment. No impacts to designated critical habitat located to the north and south of the South Florida Ocean Measurement Facility Testing Range are expected from non-impulsive sound. As with other invertebrates discussed above, non-impulsive underwater sound produced during testing would not impact ESA-proposed corals, ESA-listed staghorn and elkhorn corals, or the ESA-candidate queen conch.

Pursuant to the ESA, underwater non-impulsive sound generated during testing activities under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coal, Lamarck's sheet coral, mountainous star, pillar coral, rough cactus coral, or star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.1.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.1.1.2 (Alternative 1).

Pursuant to the ESA, underwater non-impulsive sound generated during training activities under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coal, Lamarck's sheet coral, mountainous star, pillar coral, rough cactus coral, or star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

Under Alternative 2, marine invertebrates would be exposed to increased amounts of sonars and active acoustic sources, vessel noise, and aircraft overflight noise during testing activities compared to the No Action Alternative. Testing activities producing underwater non-impulsive sounds would increase by

approximately 10 percent compared to Alternative 1, although the types and locations of these activities would be similar. As with the No Action Alternative, testing activities under Alternative 2 using sonar and other active acoustic sources are not proposed in ESA-listed elkhorn and staghorn critical habitat designated in shallow waters along southern Florida and around Puerto Rico. The locations and number of activities proposed for testing under Alternative 2 are shown in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with testing under Alternative 2 would increase the likelihood of exposure of marine invertebrates to non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.2 (Alternative 1), non-impulsive sounds associated with testing are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

As described for Alternative 1, impacts from non-impulsive sound are not expected to ESA-proposed corals; ESA-listed elkhorn and staghorn corals or their critical habitat; or the ESA-candidate queen conch..

Pursuant to the ESA, underwater non-impulsive sound generated during testing activities under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coal, Lamarck's sheet coral, mountainous star, pillar coral, rough cactus coral, or star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.1.1.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other non-impulsive sound sources during training and testing activities will have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern.

3.8.3.1.2 Impacts from Explosives and Other Impulsive Acoustic Sources

Explosions; pile driving; weapons firing, launch, and non-explosive impacts; and airguns introduce loud, impulsive, broadband sounds into the marine environment. Impulsive sources are characterized by rapid pressure rise times and high peak pressures (Section 3.0.4, Acoustic and Explosives Primer). Explosions produce high pressure shock waves with the potential to cause injury or physical disturbance due to rapid pressure changes. Some other impulsive sources, such as airguns and impact pile driving, also produce shock waves, but of much lower intensity. Impulsive sounds are usually brief, but the associated rapid pressure changes have the potential to injure or startle.

Limited studies of crustaceans have examined mortality rates at various distances from detonations in shallow water (Aplin 1947; Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Similar studies of

molluscs have shown them to be more resistant than crustaceans to explosive impacts (Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Other invertebrates found in association with molluscs, such as sea anemones, polychaete worms, isopods, and amphipods, were observed to be undamaged in areas near detonations (Gaspin et al. 1976). Using data from these experiments, Young (1991) developed curves that estimate the distance from an explosion beyond which at least 90 percent of certain marine invertebrates would survive, depending on the weight of the explosive (Figure 3.8-4).

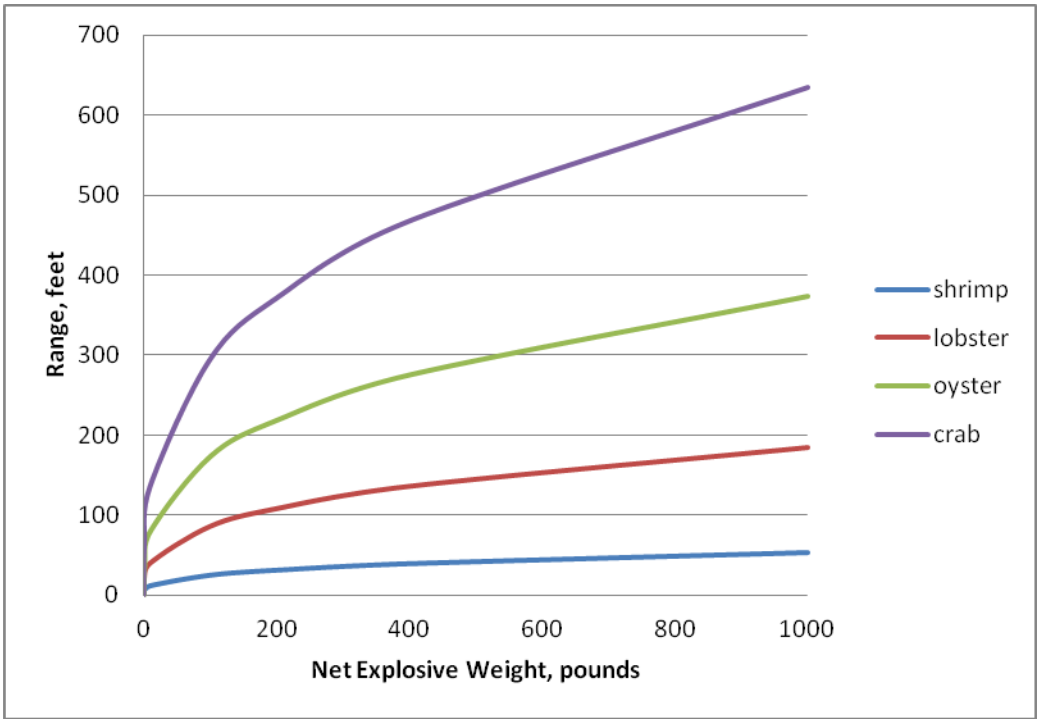

Figure 3.8-4: Distance from an Underwater Explosion where 90 Percent of Marine Invertebrates are Predicted to Survive (Young 1991)

In deeper waters where most detonations would occur, most benthic marine invertebrates would be beyond the 90 percent survivability ranges shown above, even for larger explosives (up to source class E12 [601-1,000 lb. net explosive weight]). In addition, most detonations would occur near the water surface, releasing a portion of the explosive energy into the air rather than the water and reducing impacts to marine invertebrates throughout the water column. The number of organisms affected would depend on the size of the explosive, the distance from the explosion, and the presence of groups of pelagic invertebrates. In addition to trauma caused by a shock wave, organisms could be killed in an area of cavitation that forms near the surface above large underwater detonations, such as ship shock trial charges. Cavitation is where the reflected shock wave creates a region of negative pressure followed by a collapse, or water hammer (see Section 3.0.4, Acoustic and Explosives Primer).

Some charges are detonated in shallow water or near the seafloor, including explosive ordnance disposal charges and some explosions associated with mine warfare. In addition to injuring nearby organisms, a blast near the bottom could potentially disturb hard substrate suitable for colonization (see Section 3.3.3.1, Acoustic Stressors). An explosion in the near vicinity of hard corals could cause fragmentation and siltation of the corals. However, the Navy will not conduct explosive mine countermeasures and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. Additionally, the Navy will not conduct explosive or

non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive missile exercises using a surface target, explosive and non-explosive bombing exercises, or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs (see Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). Therefore, explosions are unlikely to impact shallow coral reefs or other hard substrate suitable for coral.

Impulses from pile driving and removal are broadband and carry most of their energy in the lower frequencies (see Section 3.0.5.3.1.3, Pile Driving, for a discussion of sounds produced during impact pile driving and vibratory pile removal). Impact pile driving can produce a shock wave that is transmitted to the sediment and water column (Reinhall and Dahl 2011). Nearby marine invertebrates could be killed or injured by the physical placement of the pile or by the impulses. Marine invertebrates in the area around a pile driving and vibratory removal site would be exposed to multiple impulsive sounds over an estimated 13 days during training under Alternatives 1 and 2. Repeated exposures to impulsive noise, such as pile driving, could damage structures used by some marine invertebrates to sense water motion, although studies have shown crustaceans may withstand repeated impulsive exposures without sensory damage.

Airguns have slower rise times and lower peak pressures than many explosives. Studies of airgun impacts on marine invertebrates have used seismic airguns, which are more powerful than any airguns proposed for use during Navy testing. Studies of crustaceans have shown that adult crustaceans were not noticeably physically affected by exposures to intense seismic airgun use (Christian et al. 2003; Payne et al. 2007). Snow crab eggs repeatedly exposed to airgun firings had slightly increased mortality and apparent delayed development (Christian et al. 2003), but Dungeness crab larvae were not affected by repeated exposures (Pearson et al. 1993). Some squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 μPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a; McCauley et al. 2000b). Seismic airguns were implicated in giant squid strandings by an unpublished report (Guerra and Gonzales 2006; Guerra et al. 2004). Although analysis of the damage to the stranded squid was inconclusive (tissues samples were degraded) and proximity to the airguns was unknown, the report hypothesized that the squid may have become disoriented due to statolith damage or may have been close enough to experience shock wave impacts. Airguns used during testing of swimmer defense systems are intended to be non-lethal swimmer deterrents and are substantially less powerful than those used in seismic studies. It is unlikely they would injure marine invertebrates. Some pelagic invertebrates such as squid within a short distance may startle and swim away from these airguns.

Firing weapons on a ship generates sound by firing the gun (muzzle blast), the shell flying through the air, and vibration from the blast propagating through the ship's hull (see Section 3.0.5.3.1.5, Weapons Firing, Launch, and Impact Noise). In addition, larger non-explosive munitions and targets could produce loud impulsive noise when hitting the water, depending on the size, weight, and speed of the object at impact (McLennan 1997). Small- and medium-caliber munitions are not expected to produce substantial impact noise.

Based on studies with airguns, some marine invertebrates exposed to impulsive sounds from airguns and weapons firing may exhibit startle reactions, such as inking by a squid or changes in swim speed. Similarly, marine invertebrates beyond the range to any injurious effects from exposure to explosions or pile driving may also exhibit startle reactions. Repetitive impulses during pile driving or multiple explosions, such as during a firing exercise, may be more likely to have injurious effects or cause

avoidance reactions. However, impulsive sounds produced in water during testing and training are single impulses or multiple impulses over a limited duration (e.g., gun firing or driving a pile). Any auditory masking, in which the sound of an impulse could prevent detection of other biologically relevant sounds, would be very brief.

At a distance, impulses lose their high pressure peak and take on characteristics of non-impulsive acoustic waves. Similar to the impacts expected for non-impulsive sounds discussed previously, it is expected these exposures would cause no more than brief startle reactions in some marine invertebrates.

3.8.3.1.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, marine invertebrates would be exposed to explosions at or beneath the water surface and underwater impulsive noise from weapons firing, launches, and impacts of non-explosive munitions during training activities. Training activities under the No Action Alternative would not include pile driving or airguns.

Noise could be produced by explosions, weapons firing, launches, and impacts of non-explosive munitions throughout the Study Area, but would typically occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area. Explosives at or beneath the water surface would be used in all training range complexes, except that typically none would be used in Key West Range Complex. The number of training events using explosives, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives). The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). The largest source class proposed for training under the No Action Alternative is E12 (651-1,000 pounds [lb.] net explosive weight), used during bombing exercises (air-to-surface) and sinking exercises.

In general, explosive events would consist of a single explosion or a few smaller explosions over a short period. Some marine invertebrates (pelagic and benthic) close to a detonation would likely be killed, injured, broken, or displaced. Most detonations would occur greater than 3 nm from shore. As water depth increases away from shore, benthic invertebrates would be less likely to be impacted by detonations at or near the surface. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water.

Many corals and hard bottom invertebrates are sessile, fragile, and particularly vulnerable to shock wave impacts. Many of these organisms are slow-growing and could require decades to recover (Precht et al. 2001). Explosive impacts on benthic invertebrates are more likely when an explosive is large compared to the water depth or when an explosive is detonated at or near the bottom; however, most explosions would occur at or near the water surface, reducing the likelihood of bottom impacts. The Navy will not conduct explosive mine countermeasures and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. Additionally, the Navy will not conduct explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive missile exercises using a surface target, explosive and non-explosive bombing exercises, or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral

reefs (see Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). Therefore, explosions are unlikely to impact shallow coral reefs or other hard substrate suitable for coral.

Noise produced by weapons firing, launches, and impacts of non-explosive munitions would consist of a single or several impulses over a short period and would likely not be injurious.

Some marine invertebrates may be sensitive to the low-frequency component of impulsive sound, and they may exhibit startle reactions or temporary changes in swim speed in response to an impulsive exposure. Because exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Underwater impulsive noise from weapons firing, launches, or impacts of non-explosive munitions would not occur during training in the Key West Range Complex or in the waters off southern Florida near ESA-listed elkhorn and staghorn corals or their designated critical habitat. Mine neutralization-explosive ordnance disposal activities in the Key West Range Complex would occur in sandy bottom areas that are not near ESA-listed elkhorn and staghorn coral critical habitat. Mitigation measures described above and in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit detonations near known shallow water coral reefs, including areas known to be inhabited by ESA-listed and ESA-proposed corals. The ESA-candidate queen conch could be exposed to energy and noise from explosions in the shallow, sandy portions of the Key West Range Complex, and similar to other invertebrates, individual queen conch could be disturbed, injured, or killed by the detonation, and population level impacts are unlikely.

Pursuant to the ESA, explosions and underwater impulsive sound generated during training activities under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn critical habitats.*

Testing Activities

Under the No Action Alternative, marine invertebrates would be exposed to explosions at or beneath the water surface and underwater impulsive sounds from airguns, weapons firing, launches, and impacts of non-explosive munitions during testing activities. Testing activities under the No Action Alternative would not include pile driving.

Noise could be produced by explosives, weapons firing, launches, and impacts of non-explosive munitions throughout the Study Area, but would typically occur in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and in the Gulf Stream Open Ocean Area. Underwater impulsive sounds or explosions at or near the water surface could occur in all of the testing ranges and range complexes, except typically none would occur in the Key West Range Complex. Airguns would be used at nearshore locations during pierside integrated swimmer defense activities at Joint Expeditionary Base Little Creek, Norfolk, Virginia, and at Newport, Rhode Island. The number of testing events using explosives, airguns, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Table 2.8-2 and Table 2.8-3 of

Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives). The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise produced by the firing of airguns is discussed in Section 3.0.5.3.1.4 (Swimmer Defense Airguns). The largest source class proposed for testing under the No Action Alternative is E14 (1,741-3,625 lb. net explosive weight), used during ordnance testing at Naval Surface Warfare Center, Panama City Division Testing Range.

In general, explosive events would consist of a single explosion or a few smaller explosions over a short period. Some marine invertebrates (pelagic and benthic) close to a detonation would likely be killed, injured, broken, or displaced. As water depth increases, benthic invertebrates would be less likely to be impacted by detonations at or near the surface. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water.

Many corals and hard bottom invertebrates are sessile, fragile, and particularly vulnerable to shock wave impacts. Many of these organisms are slow-growing and could require decades to recover (Precht et al. 2001). Explosive impacts on benthic invertebrates are more likely when an explosive is large compared to the water depth or when an explosive is detonated at or near the bottom; however, most explosions would occur at or near the water surface, reducing the likelihood of bottom impacts. The Navy will not conduct explosive mine countermeasures and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. Additionally, the Navy will not conduct explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive missile exercises using a surface target, explosive and non-explosive bombing exercises, or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs (see Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). Therefore, explosions are unlikely to impact shallow coral reefs or other hard substrate suitable for coral.

Noise produced by swimmer defense airguns, weapons firing, launches, and impacts of non-explosive munitions would consist of a single or several impulses over a short period and would likely not be injurious.

Some marine invertebrates may be sensitive to the low-frequency component of impulsive sound, and they may exhibit startle reactions or temporary changes in swim speed in response to an impulsive exposure. Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

No testing activities involving explosions or underwater impulsive noise from airguns, weapons firing, launches, or impacts of non-explosive munitions would occur in the Key West Range Complex or in the waters off southern Florida near ESA-proposed corals, ESA-listed elkhorn and staghorn corals, or their designated critical habitat. Additionally, mitigation measures described above and in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit detonations near known shallow water coral reefs, including areas known to be inhabited by ESA-listed and ESA-proposed corals. The ESA-candidate queen conch could be exposed to energy and noise from explosions in the shallow, sandy portions of the Naval Surface Warfare Center, Panama City Division Testing Range. Similar to other invertebrates, individual queen conch could be disturbed, injured, or killed by the detonation, and population level impacts are unlikely.

Pursuant to the ESA, explosions and underwater impulsive sound generated during testing activities under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn coral and staghorn coral critical habitats.*

3.8.3.1.2.2 Alternative 1

Training Activities

Under Alternative 1, marine invertebrates would be exposed to additional explosions and increased amounts of underwater impulsive sounds due to increased amounts of weapons firing, launches, and impacts of non-explosive munitions during training activities. In addition, pile driving would occur during construction of the elevated causeway nearshore and within the surf zone once a year at one of the following locations: Joint Expeditionary Base (East)- Fort Story, Virginia Beach, Virginia; Joint Expeditionary Base (West)- Little Creek, Virginia Beach, Virginia; or Marine Corps Base Camp Lejeune, Jacksonville, North Carolina. Training activities under Alternative 1 do not include airguns.

Although training would increase, it would generally occur in the same areas as under the No Action Alternative, with the addition of explosives used during mine neutralization- explosive ordnance disposal. The largest source class proposed for training under Alternative 1 is E12 (651-1,000 lb. net explosive weight), used during bombing exercises (air-to-surface) and sinking exercises. The number of training events using explosives, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives). The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Pile driving noise is discussed in Section 3.0.5.3.1.3 (Pile Driving).

Although more marine invertebrates could be exposed to explosions at or near the water surface and underwater impulsive noise due to weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). The addition of pile driving could cause additional injury, mortality, displacement, or disturbance of marine invertebrates in the vicinity of the construction area; however, this event would occur just once per year, and impacts at the proposed sandy beach locations would be recoverable. Because impulsive exposures are brief, limited in number, spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion or during pile driving, no impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

No underwater impulsive noise from weapons firing, launches, or impacts of non-explosive munitions would occur during training in the Key West Range Complex or in the waters off southern Florida near ESA-proposed corals, ESA-listed elkhorn and staghorn corals or their designated critical habitat. Mine neutralization- explosive ordnance disposal activities proposed at the Key West Range Complex would occur in sandy bottom areas that are not near critical habitat. Additionally, mitigation measures described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit detonations near known shallow water coral reefs, including areas known to be inhabited by ESA-listed

and ESA-proposed corals. The ESA-candidate queen conch could be exposed to energy and noise from explosions in the shallow, sandy portions of the Key West Range Complex. Similar to other invertebrates, individual queen conch could be disturbed, injured, or killed by the detonation, and population level impacts are unlikely.

Pursuant to the ESA, explosions and underwater impulsive sound generated during training activities under Alternative 1:

- *will have no effect on ESA-listed elkhorn and staghorn corals;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

Under Alternative 1, marine invertebrates would be exposed to additional explosions at or beneath the water surface and increased amounts of underwater impulsive sounds due to airguns, weapons firing, launch, and impacts of non-explosive munitions during testing activities. Testing activities under Alternative 1 would not include pile driving. The description, number, and proposed locations of testing activities are presented in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

The largest source class of explosives used during annually recurring testing events would be E14 (1,741–3,625 lb. net explosive weight). Explosives at or beneath the water surface would be used during annually recurring testing in all range complexes, plus Naval Surface Warfare Center, Panama City Division Testing Range. The most substantial increase in explosions under Alternative 1 would occur in the Southeast U.S. Continental Shelf Large Marine ecosystem and in the Gulf Stream Open Ocean Area due to the ship shock trials of three platforms in the VACAPES or JAX Range Complexes: aircraft carrier (one event in five years), destroyer (one event in five years), and littoral combat ship (two events in five years). Aircraft carrier full ship shock trials could use charges up to source class E17 (14,501 – 58,000 lb. net explosive weight). Destroyer and littoral combat ship full ship shock trials could use charges up to source class E16 (7,251 – 14,500 lb. net explosive weight). Each full ship shock trial would use up to four of these charges in total (each one detonated about a week apart). In addition, explosives use would occur in the Key West Range Complex during sonobuoy lot acceptance testing. Use of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosives).

Airguns would be used at nearshore locations at Naval Undersea Warfare Center Division, Newport Testing Range, Rhode Island; Joint Expeditionary Base (West)- Little Creek, Virginia Beach, Virginia; and Naval Surface Warfare Center, Panama City Division Testing Range, Florida. Noise produced by the firing of airguns is discussed in Section 3.0.5.3.1.4 (Swimmer Defense Airguns).

Testing activities under Alternative 1 that produce in-water noise from weapons firing, launch, and impacts of non-explosive munitions with the water's surface would increase compared to the No Action Alternative. Additional types of testing activities would be conducted under Alternative 1, including weapons firing and impact noise in the Caribbean Sea Large Marine Ecosystem at the Key West Range Complex during combat system ship qualification trials. These new testing activities under Alternative 1 would not occur in waters near ESA-proposed corals, ESA-listed elkhorn and staghorn corals, or their designated critical habitat. The types of noise produced during weapons firing, launches, and non-

explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise).

The detonations during ship shock trials would injure, kill, break, or displace the marine invertebrates around the explosion, especially in the widespread zone of cavitation above the detonation (see Section 3.0.5.3.1.2, Explosives). Although ship shock trials would occur in water depths greater than 600 ft. (180 m), benthic invertebrates could also be impacted by the detonation.

Although more marine invertebrates could be exposed to explosions and impulsive noise due to airguns, weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Weapons firing, launches, and impacts of non-explosive munitions during combat ship qualification trials and explosives use during sonobuoy lot acceptance testing in the Key West Range Complex would not occur near the shallow waters where ESA-proposed corals, ESA-listed elkhorn and staghorn corals, or their critical habitat occurs. Additionally, mitigation measures described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit detonations near known shallow water coral reefs, including areas known to be inhabited by ESA-listed and ESA-proposed corals. The ESA-candidate queen conch could be exposed to energy and noise from explosions in the shallow, sandy portions of the Naval Surface Warfare Center, Panama City Division Testing Range. Similar to other invertebrates, individual queen conch could be disturbed, injured, or killed by the detonation, and population level impacts are unlikely.

Pursuant to the ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.1.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative are identical to those described in Section 3.8.3.1.2.2 (Alternative 1).

Pursuant to the ESA, explosions and underwater impulsive sound generated during training activities under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

Under Alternative 2, marine invertebrates would be exposed to additional explosions at or beneath the water surface and increased amounts of underwater impulsive sounds due to airguns, weapons firing, launches, and impacts of non-explosive munitions during testing activities compared to the No Action Alternative. Annually recurring testing activities would increase by approximately 10 percent compared to Alternative 1. The types of testing activities (both annually recurring activities and ship shock trials), source classes, and locations would be the same as those under Alternative 1. Testing activities under Alternative 2 would not include pile driving. The description, number, and proposed locations of testing activities are presented in Table 2.8-2 and Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives).

The detonations during ship shock trials would injure, kill, break, or displace the marine invertebrates around the explosion, especially in the widespread zone of cavitation above the detonation (see Section 3.0.5.3.1.2, Explosives). Although ship shock trials would occur in water depths greater than 600 ft. (180 m), benthic invertebrates could also be impacted by the detonation.

Although more marine invertebrates could be exposed to explosions at or near the water surface and underwater impulsive noise due to airguns, weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Weapons firing, launches, and impacts of non-explosive munitions during combat ship qualification trials and explosives use during sonobuoy lot acceptance testing in the Key West Range Complex would not occur near the shallow waters where ESA-proposed corals, ESA-listed elkhorn and staghorn corals, or their critical habitat occurs. Additionally, mitigation measures described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit detonations near known shallow water coral reefs, including areas known to be inhabited by ESA-listed and ESA-proposed corals. The ESA-candidate queen conch could be exposed to energy and noise from explosions in the shallow, sandy portions of the Naval Surface Warfare Center, Panama City Division Testing Range. Similar to other invertebrates, individual queen conch could be disturbed, injured, or killed by the detonation, and population level impacts are unlikely.

Pursuant to the ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral and staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, and star coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.1.2.4 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives and pile driving during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality or quantity of water column (sound and electro-chemical environment) and sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013). All adverse impacts would be minimal and temporary to long-term. The use of swimmer defense airguns and weapons firing, launch, and impact noise during training and testing activities would not have an adverse effect on Essential Fish Habitat by reducing the quality or quantity of sedentary invertebrate beds or offshore reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.8.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from: (1) electromagnetic devices, and (2) high energy lasers.

3.8.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. For a discussion of the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.2.1 (Electromagnetic Devices). Aspects of electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

Little information exists regarding marine invertebrates' susceptibility to electromagnetic fields. Most corals are thought to use water temperature, day length, and tidal fluctuations as cues for spawning. Magnetic fields are not known to control coral spawning release or larval settlement. Some arthropods (e.g., spiny lobster and American lobster) can sense magnetic fields, and this is thought to assist the animal with navigation and orientation (Lohmann et al. 1995; Normandeau et al. 2011). These animals travel relatively long distances during their lives, and it is possible that magnetic field sensation exists for other invertebrates that travel long distances. Marine invertebrates, including several commercially important species and federally managed species, have the potential to use magnetic cues (Normandeau et al. 2011). Susceptibility experiments have focused on arthropods, but several molluscs and echinoderms are also susceptible. However, because susceptibility is variable within taxonomic groups it is not possible to make generalized predictions for groups of marine invertebrates. Sensitivity thresholds vary by species ranging from 0.3–30 milliTesla (mT), and responses included non-lethal physiological and behavioral changes (Normandeau et al. 2011). For reference, the Earth's magnetic field is approximately 50 microTesla (μT), roughly a thousand times weaker than these thresholds (Hore

2012; Normandeau et al. 2011). The primary use of magnetic cues seems to be navigation and orientation. Human-introduced electromagnetic fields have the potential to disrupt these cues and interfere with navigation, orientation, and migration.

With the exception of magnetic cues for navigation and orientation, no physiological effects from electromagnetic fields have yet been substantiated (Hore 2012). Because electromagnetic fields weaken exponentially with distance from the source, large and sustained magnetic fields present greater exposure risks than small and transient fields, even if the small field is many times stronger than the earth's magnetic field (Normandeau et al. 2011). Transient or moving electromagnetic fields may cause temporary disturbance to susceptible organisms' navigation and orientation.

Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Section 3.8.2.3.2, Habitat and Geographic Range. There is no established mechanism for energy stressors to affect important characteristics of this critical habitat. Therefore, it is not probable that energy stressors could degrade the quality, and potentially the quantity, of elkhorn and staghorn coral critical habitat.

3.8.3.2.1.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, training activities involving electromagnetic devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Use of electromagnetic devices is concentrated within the VACAPES Range Complex.

Species that do not occur within these specified areas—including all nine ESA-listed and proposed coral species and the ESA-candidate queen conch—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above would have the potential to be exposed to electromagnetic devices.

There is no overlap of electromagnetic device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, electromagnetic devices would not affect elkhorn and staghorn coral critical habitat.

The impact of electromagnetic devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the number of activities involving the stressor is low, (3) exposures would be localized, temporary, and would cease with the conclusion of the activity, and (4) even for susceptible organisms such as invertebrates (e.g., some species of arthropods, molluscs, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation. Electromagnetic activities are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, testing activities involving electromagnetic devices occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within Naval Surface Warfare Center, Panama City Division Testing Range and the VACAPES Range Complex.

Species that do not occur within these specified areas—including all nine ESA-listed and proposed coral species—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to the electromagnetic devices.

There is no overlap of electromagnetic device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, electromagnetic devices would not affect elkhorn and staghorn coral critical habitat.

The impact of electromagnetic devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the number of activities involving the stressor is low, (3) exposures would be localized, temporary, and would cease with the conclusion of the activity, and (4) even for susceptible organisms, such as invertebrates (e.g., some species of arthropods, molluscs, and echinoderms), the consequences of exposure are limited to temporary disruptions to navigation and orientation. Electromagnetic activities are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, the use of electromagnetic devices in the Study Area would increase by less than two percent compared to the No Action Alternative. Training activities involving electromagnetic devices would continue to occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. In addition, activities would be introduced within the Gulf of Mexico Large Marine Ecosystem—specifically

within the GOMEX Range Complex, as well as in one of the following bays or inland waters: Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas. Electromagnetic device activities would remain concentrated within the VACAPES Range Complex.

Species that do not occur within these specified areas—including all nine ESA-listed and proposed coral species—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to electromagnetic devices.

There is no overlap of electromagnetic device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, electromagnetic devices would not affect elkhorn and staghorn coral critical habitat.

As discussed in Section 3.8.3.2.1.1 (No Action Alternative), the impact of electromagnetic devices on marine invertebrates would be inconsequential. Considering the minor increase in activities in previously identified locations and introduction of activities in the additional locations, the potential impacts remain inconsequential. As described in the No Action Alternative, the increase in electromagnetic activities are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase by approximately 14 percent in the Study Area as compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within the Naval Surface Warfare Center, Panama City Division Testing Range and the VACAPES Range Complex. In addition, activities will be introduced in the JAX Range Complex and the South Florida Ocean Measurement Facility Testing Range (both within the Southeast U.S. Continental Shelf Large Marine Ecosystem), and anywhere within the Gulf of Mexico. Activities involving electromagnetic device use would remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range.

Species that do not occur within these specified areas would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to electromagnetic devices.

There is no overlap of electromagnetic device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). The entire footprint of the South Florida Ocean Measurement Facility Testing Range is exempt from elkhorn and staghorn coral critical habitat designation. Therefore, electromagnetic devices would not affect elkhorn and staghorn coral critical habitat.

As discussed in Section 3.8.3.2.1.1 (No Action Alternative), the impact of electromagnetic devices on marine invertebrates would be inconsequential. Considering the minor increase in activities in previously identified locations and introduction of activities in the additional locations, the potential impacts remain inconsequential. Although Alternative 1 introduces activities where corals occur in the JAX Range Complex and South Florida Ocean Measurement Facility Testing Range, there is no evidence to suggest that corals can detect or respond to electromagnetic energy. As described in the No Action Alternative, the increase in electromagnetic activities is not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

As discussed in 3.0.5.3.2.1 (Electromagnetic Devices), Alternative 1 includes the introduction of kinetic energy weapon testing in the VACAPES Range Complex. The kinetic energy weapon is a new weapon system for which there are inadequate data or information available to analyze potential impacts. However, for the reasons discussed in Section 3.8.3.2.1.1 (No Action Alternative), the potential consequences of electromagnetic devices are likely to be inconsequential.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.2.1.2 (Alternative 1).

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, electromagnetic device use would increase by approximately 35 percent in the Study Area as compared to the No Action Alternative, but only increases by approximately 18 percent as compared to Alternative 1. The location

of testing activities and species potentially impacted under Alternative 2 are identical to those specified under Alternative 1.

Species that do not occur within these specified areas would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to electromagnetic devices.

There is no overlap of electromagnetic device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). The entire footprint of the South Florida Ocean Measurement Facility Testing Range is exempt from elkhorn and staghorn coral critical habitat designation. Therefore, electromagnetic devices would not affect elkhorn and staghorn coral critical habitat.

As discussed in Section 3.8.3.2.1.1 (No Action Alternative), the impact of electromagnetic devices on marine invertebrates would be inconsequential. Considering the minor increase in activities in previously identified locations and introduction of activities in the additional locations, the potential impacts remain inconsequential. Although Alternative 1 introduces activities where corals occur in the VACAPES and JAX Range Complexes and South Florida Ocean Measurement Facility Testing Range, there is no evidence to suggest that corals can detect or respond to electromagnetic energy. As described in the No Action Alternative, the increase in electromagnetic activities is not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

As discussed in 3.0.5.3.2.1 (Electromagnetic Devices), Alternative 2 includes the introduction of kinetic energy weapon testing in the VACAPES Range Complex. The kinetic energy weapon is a new weapon system for which there are inadequate data or information available to analyze potential impacts. However, for the reasons discussed in Section 3.8.3.2.1.1 (No Action Alternative), the potential consequences of electromagnetic devices are likely to be inconsequential.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.2.1.4 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of electromagnetic devices during training and testing activities would have minimal and temporary adverse effects on invertebrates that occupy water column Essential Fish Habitat or Habitat Areas of Particular Concern, and would have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.8.3.2.2 Impacts from High Energy Lasers

This section analyzes the potential impacts of high energy lasers on invertebrates. As discussed in Section 3.0.5.3.2.2 (Lasers), high energy laser weapons are designed to disable surface targets, rendering them immobile. The primary concern is the potential for an invertebrate to be struck with the laser beam at or near the water's surface, which could result in injury or death.

Marine invertebrates could be exposed to the laser only if the beam misses the target. Should the laser strike the sea surface, individual invertebrates at or near the surface, such as jellyfish, floating eggs, and larvae could potentially be exposed. The potential for exposure to a high energy laser beam decreases as water depth increases. Most marine invertebrates are not susceptible to laser exposure because they occur beneath the sea surface.

3.8.3.2.2.1 No Action Alternative

As indicated in Section 3.0.5.3.2.2 (Lasers) under the No Action Alternative, no high energy lasers would be used during training or testing activities.

3.8.3.2.2.2 Alternatives 1 and 2 (Preferred Alternative)

Training Activities

As indicated in Section 3.0.5.3.2.2 (Lasers) under Alternatives 1 and 2, no high energy lasers would be used during training activities.

Testing Activities

As indicated in Section 3.0.5.3.2.2 (Lasers) under Alternatives 1 and 2, high energy laser weapons tests would be introduced in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex.

Invertebrate species that do not occur within the VACAPES Range Complex, or that do not occur near the sea surface, including all nine ESA-listed or proposed coral species, and the ESA-candidate queen conch would not be exposed because they occur on the seafloor. There is no overlap of high energy laser device use with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, high energy laser devices will not affect elkhorn and staghorn coral critical habitat.

Invertebrates are unlikely to be exposed to high energy lasers based on the: (1) relatively low number of events, (2) very localized potential impact area of the laser beam, and (3) temporary duration of potential impact (seconds). Activities involving high energy lasers are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level, although individuals or larvae may be impacted.

Pursuant to the ESA, the use of high energy laser during testing activities as described under Alternatives 1 and 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.2.2.3 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high energy laser devices during testing activities would have minimal and temporary adverse effects on invertebrates that occupy water column Essential Fish Habitat or Habitat Areas of Particular Concern, and would have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.8.3.3 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors used by Navy during training and testing activities within the Study Area. For a list of locations and numbers of activities that may cause physical disturbance and strikes refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). The physical disturbance and strike stressors that may impact marine invertebrates include: (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

Most marine invertebrate populations extend across wide areas containing hundreds or thousands of discrete patches of suitable habitat. Sessile (attached to the seafloor) invertebrate populations may be maintained by complex currents that carry adults and young from place to place (see organism descriptions in Section 3.8.2, Affected Environment, for general information on dispersal). Such widespread populations are difficult to evaluate in terms of Navy training and testing activities that occur intermittently and in relatively small patches in the Study Area. Sedentary invertebrate habitats, such as hard bottom, cover enormous areas (Figures 3.3-1 through 3.3-4). In this context, the impact of a physical strike or disturbance would impact individual organisms directly or indirectly, but not to the extent that viability of populations or species would be impacted.

With few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. Except for amphibious activities and bottom-crawling unmanned underwater vehicles, there is no potential strike impact and limited potential disturbance impact on benthic or habitat-forming marine invertebrates.

With the exception of corals and other sessile benthic invertebrates, most invertebrate populations recover quickly from non-extractive disturbance. Other invertebrates, such as the small soft-bodied organisms that live in the bottom sediment, are thought to be well-adapted to natural physical disturbances, although recovery from human-induced disturbance is delayed by decades or more (Kaiser et al. 2002; Lindholm et al. 2011). Biogenic habitats such as coral reefs, deep coral, and sponge communities may take decades to re-grow following a strike or disturbance (Jennings and Kaiser 1998; Precht et al. 2001).

3.8.3.3.1 Impacts from Vessels and In-Water Devices

The majority of the training and testing activities under all the alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). See Table 3.0-25 for a representative list of Navy vessel sizes and speeds and Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area. Figures 3.0-20 and 3.0-21 provide graphics that illustrate

the location for the Preferred Alternative and the relative use of vessels in training and testing activities, respectively.

Vessels and in-water devices have the potential to impact marine invertebrates by disturbing the water column or sediments, or directly striking organisms (Bishop 2008). Propeller wash (water displaced by propellers used for propulsion) from vessel movement and water displaced from vessel hulls can potentially disturb marine invertebrates in the water column and are a likely cause of zooplankton mortality (Bickel et al. 2011). This localized and short-term exposure to vessel and propeller movements could displace, injure, or kill zooplankton, eggs or larvae of invertebrates, including coral and conch, and macro-invertebrates in the upper portions of the water column. Surface vessels represent the majority of vessels used in the Study Area, and these have drafts up to approximately 40–50 ft. (12–15 m), meaning that physical strikes are limited to the uppermost portion of the ocean. Disturbance caused by propeller wash can extend to approximately twice this depth. The average depth of the Atlantic Ocean is approximately 3,339 m, so approximately 99.1 percent of the water column is too deep to be exposed to physical strike or disturbance from surface vessels.

There are few sources of information on the impact of nonlethal chronic disturbance to marine invertebrates. One study of seagrass-associated marine invertebrates found that chronic disturbance from vessel wakes resulted in the long-term displacement of some marine invertebrates from the impacted area (Bishop 2008). Impacts of this type resulting from repeated exposure in shallow water are unlikely to result from Navy training and testing activities, because most vessel movements in shallow water are concentrated in well-established port facilities and associated channels (Mintz and Parker 2006).

Vessels and in-water devices do not normally collide with invertebrates that inhabit the seafloor because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. A consequence of vessel operation in shallow water is increased turbidity from stirring up bottom sediments. Turbidity can impact corals and invertebrate communities on hard bottom areas by reducing the amount of light that reaches these organisms and by increasing the effort the organism expends on sediment removal (Riegl and Branch 1995). Reef-building corals are sensitive to water clarity because of their symbiotic algae (i.e., zooxanthellae) that require sunlight to live. Encrusting organisms residing on hard bottom can be impacted by persistent silting from increased turbidity. In addition, propeller wash and physical contact with coral and hard bottom areas can cause structural damage to the substrate, as well as mortality to encrusting organisms. While information on the frequency of vessel operations in shallow water is not adequate to support a specific risk assessment, typical navigational procedures minimize the likelihood of contacting the seafloor, and most Navy vessel movements in nearshore waters are confined to established channels and ports or predictable transit lanes within the Northeast U.S. Continental Shelf and Southeast U.S. Continental Shelf Large Marine Ecosystems, primarily between Norfolk, Virginia, and Jacksonville, Florida (Mintz and Parker 2006). For example, approximately 80 percent of Naval Surface Warfare Center, Panama City Division Testing Range surface activities occur beyond St. Andrew Bay and the inshore surf zone (the nearshore area of the beach where waves break, typically about 60–600 ft. [20–200 m]) (Dean and Dalrymple 2004), while approximately 20 percent of surface operations may enter estuarine and nearshore waters.

Amphibious vessels would make contact with the seafloor in the surf zone during amphibious assault and amphibious raid operations. The Study Area extends from the seafloor up to the mean high tide line (often termed mean high water in literature). Benthic invertebrates of the surf zone, such as crabs,

clams, and polychaete worms, within the disturbed area could be displaced, injured, or killed during amphibious operations. Amphibious operations take place in a limited area in the Southeast U.S. Continental Shelf Large Marine Ecosystem along Onslow Beach in North Carolina and at Naval Station Mayport, Florida, both long-established training beaches. Benthic invertebrates inhabiting these areas are adapted to a highly variable environment and are expected to rapidly re-colonize disturbed areas by immigration and larval recruitment. Studies indicate that benthic communities of high energy sandy beaches recover relatively quickly (typically within 2 to 7 months) following beach nourishment (U.S. Army Corps of Engineers 2001). Schoeman et al. (2000) found that the macrobenthic (visible organisms on the seafloor) community required between 7 and 16 days to recover following excavation and removal of sand from a 2,153 ft.^{2} (200 m^2) quadrant from the intertidal zone of a sandy beach.

Unmanned underwater vehicles travel at relatively low speeds and are smaller than most vessels, making the risk of strike or physical disturbance to marine invertebrates very low. Zooplankton, invertebrate eggs or larvae, and macro-invertebrates in the water column could be displaced, injured, or killed by unmanned underwater vehicle movements.

3.8.3.3.1.1 No Action Alternative, Alternative 1 and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) and Section 3.0.5.3.3.2 (In-Water Devices) provide estimates of relative vessel use and location for each of the alternatives. These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel usage is dependent on military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Training and testing concentrations are most dependent on locations of Navy shore installations and established training and testing areas. Even with introduction of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel and in-water device use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade and, therefore, the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), the majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. See Table 3.0-25 for a representative list of Navy vessel sizes and speeds and Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area. Figures 3.0-20 and 3.0-21 provide graphics that illustrate the location for the Preferred Alternative and the relative use of vessels in training and testing activities, respectively. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and ranges. Navy training vessel traffic would be concentrated in the Northeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Norfolk in Norfolk, Virginia, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Mayport in Jacksonville, Florida. There is no seasonal

differentiation in Navy vessel use. Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open ocean portions of the Study Area because of the concentration of vessel movements in those areas.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices occur in the Northeast, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and anywhere in the Gulf of Mexico. Use of in-water devices is concentrated within the VACAPES Range Complex. The number of in-water device activities increases by 75 percent under Alternative 1 and Alternative 2 compared to the No Action Alternative.

Species that do not occur near the surface within the Study Area—including all nine ESA-listed and proposed coral species and the ESA-candidate queen conch—would not be exposed to vessel strikes. Species that do occur near the surface within the Study Area would have the potential to be exposed to vessel strikes.

There is no overlap of vessels and in-water devices with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management) because vessels and in-water devices do not contact the seafloor during training and testing activities. Amphibious vehicles are an exception, but beaches are not critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, vessels and in-water devices will not affect elkhorn and staghorn coral critical habitat.

Exposure of marine invertebrates to vessel disturbance and strikes is limited to organisms in the uppermost portions of the water column. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Invertebrates that occur on the seafloor, including shallow-water corals, hard bottom, and deep-water corals, are not likely to be exposed to this stressor because they typically occur at depths greater than those potentially impacted by vessels.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges, (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event, and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), Navy testing vessel traffic would be concentrated near Naval Station Norfolk in Norfolk, Virginia, in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Naval Station Mayport in Jacksonville, Florida in the Southeast U.S. Continental Shelf Large Marine Ecosystem.

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices are concentrated in the Gulf of Mexico and Northeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the Northeast and VACAPES Range Complexes and Naval Surface Warfare Center, Panama City Division Testing Range. The number of in-water device activities increases by approximately 123 percent under Alternative 1 and 146 percent under Alternative 2 compared to the No Action Alternative.

Species that do not occur near the surface within the Study Area—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would not be exposed to vessel strikes. Species that do occur near the surface within the Study Area would have the potential to be exposed to vessel strikes.

There is no overlap in the use of vessels and in-water devices with designated critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management) because vessels and in-water devices do not contact the seafloor during training and testing activities. Amphibious vehicles are an exception, but beaches are not critical habitat for elkhorn and staghorn coral (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Therefore, vessels and in-water devices will not affect elkhorn and staghorn coral critical habitat.

There would be a higher likelihood of vessel strikes over the continental shelf portions of the Study Area because of the concentration of vessel movements in those areas. Exposure of marine invertebrates to vessel disturbance and strikes is limited to organisms in the uppermost portions of the water column. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Invertebrates that occur on the seafloor, including shallow-water corals, hard bottom, and deep-water corals, are not likely to be exposed to this stressor because they typically occur at depths greater than that potentially impacted by vessels.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges, (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event, and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under the No Action Alternative, Alternative 1, or Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.3.1.2 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training and testing activities will have no effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.8.3.3.2 Impacts from Military Expended Materials

This section analyzes the strike potential to marine invertebrates of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes). Note that the analysis of all potential impacts (disturbance, strike, ingestion, and entanglement) of military expended materials on critical habitat is included in this section.

The spatial extent of military expended materials deposition includes all of the Study Area. Despite this broad range, the majority of military expended materials deposition occurs within established range complexes and testing ranges. Physical disturbance or strikes by military expended materials on marine invertebrates is possible at the water's surface, through the water column, and at the seafloor. Disturbance or strike impacts on marine invertebrates by military expended materials falling through the water column is possible, but not very likely because their kinetic energy dissipates within a few feet of the sea surface and they do not generally sink rapidly enough to cause strike injury. Exposed invertebrates would likely experience only temporary displacement as the object passes by. Therefore, the discussion of military expended materials disturbance and strikes will focus on military expended materials on the water's surface and the seafloor.

Sessile marine invertebrates and infauna (organisms attached to the seafloor or living in the seafloor sediments) are particularly susceptible to military expended material strike. This includes shallow-water corals, hard bottom, and deep-water corals. Physical disturbance and strikes on deep-water corals (both military expended materials and marine debris) were inferred during a recent mapping expedition where objects were observed resting on and near deep-water invertebrates (U.S. Department of the Navy 2009, 2011). Most shallow-water coral reefs in the Study Area are within or adjacent to the Key West Range Complex, where the greatest numbers of military expended materials are primarily lightweight flares and chaff, which have inconsequential strike potential. The organisms that define coral Habitat Areas of Particular Concern in other areas are susceptible and exposed to military expended materials strike and disturbance impacts.

Military expended materials may impact benthic invertebrate individuals, eggs, and larvae by disturbance, strike, burial, or abrasion of individuals at the site, and may disturb marine invertebrates

outside the footprint of the military expended materials. Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). These characteristics can be summarized as any hard substrate of suitable quality and availability to support settlement, recruitment, and attachment at depths from mean low water to 30 m within the organism's former geographic range (FR *73*(229): 72210-72241, November 26, 2008). Primary constituent elements were not formally defined for these species. Exemptions from critical habitat designations include a small zone around Naval Air Station Key West, and a small area within the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). All activities using military expended materials in the Key West Range Complex and in waters shallower than 30 m in the South Florida Ocean Measurement Facility Testing Range could expose this substrate to disturbances that could degrade the quality of critical habitat.

Small-, Medium-, and Large-Caliber Projectiles. Various types of projectiles have the potential to cause a temporary localized impact when they strike the surface of the water. Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and use of a variety of non-explosive training and testing rounds.

Direct strike from firing or dropping munitions are potential stressors to marine invertebrates. Military expended materials have the potential to impact the water with great force. Physical disruption of the water column is a localized, temporary impact and would be limited to within tens of meters of the impact area, persisting for a matter of minutes. Physical and chemical properties of the surrounding water would be temporarily changed (e.g., slight heating or cooling and increased oxygen concentrations due to turbulent mixing with the atmosphere), but there would be no lasting change on the water resulting in long-term impacts on marine invertebrates. Although the sea surface is rich with invertebrates, most are zooplankton and relatively few are large pelagic invertebrates (e.g., some jellyfish and some swimming crabs). Zooplankton, eggs and larvae, and larger pelagic organisms in the upper portions of the water column could be displaced, injured, or killed by military expended materials impacting the sea surface. Potential indirect impacts of military expended materials are addressed in Section 3.8.3.6 (Secondary Stressors).

Marine invertebrate communities, eggs, and larvae on the seafloor throughout the Study Area would be exposed to munitions, including small-, medium-, and large-caliber projectiles. Marine invertebrates on the seafloor could be displaced, injured, or killed by military expended materials contacting the seafloor.

Potential impacts of projectiles to marine invertebrates on shallow-water corals, hard bottom, or deep-water corals present the greatest risk of long-term damage compared with other seafloor communities because: (1) many corals and hard bottom invertebrates are sessile, fragile, and particularly vulnerable; (2) many of these organisms are slow-growing and could require decades to recover (Precht et al. 2001); and (3) military expended materials are likely to remain mobile for a longer time because natural encrusting and burial processes are much slower on hard substrates than on soft bottom habitats.

Bombs, Missiles, and Rockets. Direct strike from bombs, missiles, and rockets are potential stressors to marine invertebrates. The nature of their potential impacts is the same as projectiles; however, they are addressed separately because their size in both non-explosive and high-explosive forms is greater than most projectiles and because high-explosive bombs, missiles, and rockets are likely to produce a greater number of small fragments than do projectiles. Propelled fragments are produced by high-explosives. Close to the explosion, invertebrates could potentially sustain injury from propelled fragments.

However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keefe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms. Bombs, missiles, and rockets are designed to explode within 3 ft. (1 m) of the sea surface, where large marine invertebrates are relatively infrequent.

Vessel Hulk. During a sinking exercise, aircraft, ship, and submarine crews fire or drop munitions on a surface target, a clean (Section 3.1, Sediments and Water Quality) deactivated ship that is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes, as shown in Figures 3.0-2 and 3.0-3. The analysis of sinking exercises as a strike potential for benthic invertebrates is discussed in terms of the ship hulk landing on the seafloor. The primary difference between a vessel hulk and other military expended materials as a strike potential for marine invertebrates is the difference of scale. As the vessel hulk settles on the seafloor, all marine invertebrates within the footprint of the hulk would be impacted by strike or burial, and invertebrates a short distance beyond the footprint of the hulk would be disturbed. It is likely that habitat-forming invertebrates are absent where sinking exercises are planned because this activity occurs in depths greater than the range of corals and most other habitat-forming invertebrates (approximately 3,000 m) and away from known hydrothermal vent communities.

Parachutes. Parachutes of varying sizes are used during training and testing activities. For a discussion of the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.4.2 (Parachutes). Activities that expend sonobuoy and air-launched torpedo parachutes generally occur in water deeper than 183 m. Because they are in the air and water column for a time span of minutes (see Section 3.0.5.3.4.2, Parachutes), it is improbable that such a parachute deployed over water deeper than 183 m could travel far enough to affect shallow-water corals, including any of the nine ESA-listed or proposed coral species. Parachutes may impact marine invertebrates by disturbance, strikes, burial/smothering, or abrasion. Movement of parachutes in the water may break more fragile invertebrates such as deep-water corals.

3.8.3.3.2.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes, and in the Gulf of Mexico and Other AFTT Areas. However, the largest potential impacted area from military expended materials occurs in Other AFTT Areas (sinking exercises) (Table 3.3-9).

Species that do not occur within these specified areas would not be exposed to military expended materials. Species that do occur within the areas listed above—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to military expended materials. Human induced physical damage, such as exposure to military expended material strikes, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

All training activities involving military expended materials in the Key West Range Complex could expose substrate to disturbances that could degrade the quality, and potentially the quantity, of elkhorn and staghorn coral critical habitat (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). Exemptions from critical habitat designations include a small zone around Naval Air Station Key West (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). However, exposure is less likely to occur because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), minimize potential impacts to the physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat. Military expended materials with the highest likelihood of overlap with elkhorn and staghorn coral critical habitat are chaff and flares, and these pose negligible risks to habitat. It is unlikely that training activities involving military expended materials would reduce the conservation value of elkhorn and staghorn coral critical habitat.

Military expended materials that are munitions (e.g., bombs, missiles, rockets, projectiles, and associated fragments) have the potential to directly strike marine invertebrates, zooplankton, eggs, and larvae at the sea surface and on the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms could be impacted directly or indirectly, but not to the extent that viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes (see Table 3.3-9 for quantification of military expended material impact footprints).

Sinking exercises occur in open ocean areas, outside of the coastal range complexes, shown in Figures 3.0-2 and 3.0-3. Pelagic invertebrates present near the water's surface in the immediate vicinity of the exercise have the potential to be injured or killed. Vessel hulks contacting the seafloor would result in mortality of marine invertebrates within the footprint of the hulk and disturbance of marine invertebrates near the footprint of the hulk. Though the footprint of a vessel hulk is large relative to other military expended materials, the impacted area is extremely small relative to the spatial distribution of marine invertebrate populations. Habitat-forming invertebrates are likely to be absent where sinking exercises are planned (depths of approximately 3,000 m). Consequences of sinking exercises would impact individual organisms directly or indirectly, but not to the extent that viability of populations or species would be measurably impacted.

Activities occurring in the Key West Range Complex have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Because these organisms also constitute critical habitat, these same impacts could degrade habitat quality, and potentially quantity. Coral reefs along the continental U.S. are estimated to cover between 330 and 480 $mi.^2$ (850–1,250 km^2), most of which is within or adjacent to the Key West Range Complex (Section 3.8.2.15.1, Shallow-Water Coral). Mitigation measures described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would prohibit many military expended material-producing activities in shallow water near known shallow water coral reefs, including areas known to be inhabited by ESA-listed and ESA-proposed corals.

Activities occurring at depths of 650–2,600 ft. (200–800 m) have the potential to impact deep-water corals (Section 3.8.2.15.2, Deep-Water Corals). Activities in the Northeast U.S. Continental Shelf Large Marine Ecosystem in VACAPES Range Complex, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem in Navy Cherry Point Range Complex and, particularly, the JAX Range Complex, have the potential to impact hard bottom and deep-water corals. Consequences could include breakage, injury, or mortality for each projectile or munition (Sections 3.8.2.15.2, Deep-Water Corals, and 3.3, Marine

Habitats). Parachutes could cause abrasion injury or mortality and breakage. Because these organisms are habitat-forming and also constitute some Habitat Areas of Particular Concern, these same impacts could degrade habitat quality. Individual organisms would be impacted directly or indirectly to the extent that viability of populations or species would be impacted (see Table 3.3-9 for quantification of military expended material footprints).

The impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individual marine invertebrates—particularly soft-bodied organisms that are smaller than the military expended materials, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized and would cease when the military expended material stops moving. Activities involving military expended material are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

For cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to minimize the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Pursuant to the ESA, the use of military expended materials during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, areas that involve the use of expended materials include the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Naval Surface Warfare Center, Panama City Division Testing Range; Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; and in the Other AFTT Areas. However, the largest potential impact footprint for military expended materials occurs in the VACAPES Range Complex (Table 3.3-10).

Species that do not occur within these specified areas would not be exposed to military expended materials. Species that do occur within the areas listed above—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to military expended materials. Human-induced physical damage, such as exposure to military expended material strikes, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

A very low number of military expended materials may occur in the Key West Range Complex (Table 3.3-10), which also includes critical habitat designations for ESA-listed coral species. Exemptions from critical habitat designations include a small zone around Naval Air Station Key West (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management).

Bombs, missiles, rockets, projectiles, torpedo (explosive) testing, and associated fragments have the potential to directly strike marine invertebrates, zooplankton, eggs, and larvae at the sea surface and at the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms would be impacted directly or indirectly, but not to the extent that viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes (see Table 3.3-10) for quantification of military expended material impact footprints).

Activities occurring at depths of 200–800 m have the potential to impact deep-water corals. Activities occurring in the Northeast U.S. Continental Shelf Large Marine Ecosystem in VACAPES Range Complex, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem in Navy Cherry Point Range Complex and, particularly, the JAX Range Complex have the potential to impact hard bottom and deep-water corals. Consequences could include breakage, injury, or mortality for each projectile, munition, or fragment (Sections 3.8.2.15.2, Deep-Water Corals, and 3.3, Marine Habitats). Parachutes could cause abrasion, injury, or mortality and breakage. Because these organisms are habitat-forming and also constitute some Habitat Areas of Particular Concern, these same impacts could degrade habitat quality.

The impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individual marine invertebrates—particularly soft-bodied organisms that are smaller than the military expended materials, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized and would cease when the military expended material stops moving. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality (see Table 3.3-10 for quantification of military expended material impact footprints).

Mitigation measures designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Pursuant to the ESA, the use of military expended materials during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

3.8.3.3.2.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1 the total amount of military expended materials is more than twice the amount expended in the No Action Alternative, most of which are small- and medium-caliber projectiles. However, the potential impacted area from military expended materials actually declines from the No Action Alternative due to a reduction in the number of sinking exercises that expend ship hulks (Table 3.3-11). The activities under Alternative 1 would occur in the same geographic locations with the same types of expended materials in the same relative dimensions (excluding sinking exercises) as the No Action Alternative.

Species that do not occur within these specified areas would not be exposed to military expended materials. Species that do occur within the areas listed above—including any of the nine ESA-listed or proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to military expended materials. As under the No Action Alternative, military expended materials may affect critical habitat for elkhorn and staghorn coral. Human induced physical damage, such as exposure to military expended material strikes, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

Sinking exercises occur in open ocean areas, outside of the coastal range complexes, shown in Figures 3.0-2 and 3.0-3, and vessel hulks contacting the seafloor would result in mortality of marine invertebrates within the footprint of the hulk and disturbance of marine invertebrates near the footprint of the hulk. Consequences are identical to the No Action Alternative, but reduced to only one event.

Activities occurring in the Key West Range Complex have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed or proposed coral species. Coral reefs along the continental United States are estimated to cover between 330 and 480 $mi.^2$ (850-1,250 km^2), most of which is within or adjacent to the Key West Range Complex (Section 3.8.2.9.1, Shallow-Water Coral). It is possible that parachutes could overlap with coral reefs in this region; however it is unlikely since they are generally expended in water deeper than 600 ft. (183 m) and would most likely not travel far enough to impact shallow-water species.

Also, activities occurring at depths of 200–800 m in the VACAPES Range Complex, Navy Cherry Point Range Complex and, particularly, the JAX Range Complex have the potential to impact hard bottom and deep-water corals. The differences in species overlap and potential impacts from military expended material strikes on marine invertebrates and ESA-listed or -proposed coral species during training activities would not be discernible from those described for training activities in Section 3.8.3.3.2.1 (No Action Alternative).

As discussed in Section 3.8.3.3.2.1 (No Action Alternative), impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, eggs, and larvae at the sea surface and at the seafloor—particularly soft-bodied organisms that are smaller than the military expended materials—but impacts to populations would be inconsequential. Considering the increase in activities in previously identified locations, the potential impacts remain inconsequential for the reasons discussed under the No Action Alternative (Section 3.8.3.3.2.1, No Action Alternative). Similarly, the use of military expended materials would not reduce the conservation value of critical habitat for elkhorn coral or staghorn coral for reasons stated in Section 3.8.3.3.2.1 (No Action Alternative). Activities

involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Mitigation measures designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Pursuant to the ESA, the use of military expended materials during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1 the total amount of military expended materials is nearly four times greater than the amount expended in the No Action Alternative. Activities under Alternative 1 would occur in the same geographic locations using the same types of military expended materials as the No Action Alternative, with the addition of the South Florida Ocean Measurement Facility Testing Range. Based on the potential impacted area from military expended materials, there is a decline in the VACAPES Range Complex and corresponding increase in the JAX and Navy Cherry Point Range Complexes (Table 3.3-12), compared to the No Action Alternative.

Species that do not occur within these specified areas would not be exposed to military expended materials. Species that do occur within the areas listed above—including all nine ESA-listed or proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to military expended materials. Activities occurring in Other AFTT Areas or anywhere in the AFTT Study Area could overlap with ESA-listed elkhorn and staghorn coral and their critical habitat. All nine ESA-listed and ESA-proposed coral species occur within the South Florida Ocean Measurement Facility Testing Range. Human-induced physical damage, such as exposure to military expended material strikes, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

All testing activities involving military expended materials in both the Key West Range Complex and the South Florida Ocean Measurement Facility Testing Range could expose substrate to disturbances that could degrade the quality of elkhorn and staghorn coral critical habitat (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). While critical habitat for staghorn and elkhorn coral has been designated within part of the shallow (less than 30 m) nearshore portion of the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management), testing activities that involve the use of military expended materials occur offshore of these areas within the Training Minefield Operating Area, which ranges in depth from approximately 230–280 m. Exemptions from critical habitat designations include a small zone around Naval Air Station Key West and a small area within the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management).

Activities occurring in the Key West Range Complex have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Coral reefs along the continental United States are estimated to cover between 330 and 480 $mi.^2$ (850–1,250 km^2), most of which is within or adjacent to the Key West Range Complex (Section 3.8.2.9.1, Shallow-Water Coral). It is possible that parachutes could overlap with coral reefs in this region; however it is unlikely since they are generally expended in water deeper than 600 ft. (183 m) and would most likely not travel far enough to impact shallow-water species. As described under the No Action Alternative, military expended materials may affect critical habitat for elkhorn and staghorn coral in the Key West Range Complex. However, exposure is less likely to occur because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), minimize potential impacts to the physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat. Therefore, it is unlikely that testing activities involving military expended materials within the Key West Range Complex would reduce the conservation value of elkhorn and staghorn coral critical habitat.

Testing activities occurring in the South Florida Ocean Measurement Facility Testing Range have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Military expended materials utilized within the South Florida Ocean Measurement Facility Testing Range are limited to anchor blocks used to moor minefield targets and shapes. Deployment of the anchor blocks is conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. At the conclusion of the testing event, the minefield targets and shapes are typically recovered. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources, including shallow coral reefs, are discussed in Chapter 5. Also, activities occurring at depths of 200–800 m in the VACAPES Range Complex, Navy Cherry Point Range Complex, and particularly the JAX Range Complex have the potential to impact hard bottom and deep-water corals. The differences in species overlap and potential impacts from military expended material strikes on marine invertebrates and ESA-listed or proposed coral species during testing activities would not be discernible from those described for testing activities in Section 3.8.3.3.2.1 (No Action Alternative).

As discussed in Section 3.8.3.3.2.1 (No Action Alternative), impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, eggs, and larvae at the sea surface and at the seafloor, but impacts to populations would be inconsequential. Considering the increase in activities in previously identified locations and the addition of new locations, the potential impacts remain inconsequential for the reasons discussed under the No Action Alternative (Section 3.8.3.3.2.1, No Action Alternative). Similarly, the use of military expended materials would not reduce the conservation value of critical habitat for elkhorn coral or staghorn coral within the Key West Range Complex for reasons stated in Section 3.8.3.3.2.1 (No Action Alternative). For critical habitat designated within the confines of the South Florida Ocean Measurement Facility Testing Range, the use of military expended materials is not likely to reduce the conservation value of critical habitat for elkhorn coral or staghorn coral due to mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Individual organisms would be impacted directly or indirectly, but not to the extent that viability of populations or species would be impacted. However, the combined consequences of all military expended materials could degrade habitat quality (see Table 3.3-12 for quantification of military expended material impact footprints). Mitigation measures designed to minimize the potential impacts

to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn coral and staghorn coral critical habitat.*

3.8.3.3.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.3.2.2 (Alternative 1).

Testing Activities

As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2 the total amount of military expended materials is nearly four times the amount expended in the No Action Alternative, but only increases by 5 percent as compared to Alternative 1. The activities under Alternative 2 would occur in the same geographic locations using the same types of military expended materials and will have the same relative potential impact area as Alternative 1 (Table 3.3-13).

Species that do not occur within these specified areas would not be exposed to military expended materials. Species that do occur within the areas listed above—including all nine ESA-listed and proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to military expended materials. Activities occurring in Other AFTT Areas and anywhere in the AFTT Study Area could overlap with ESA-listed elkhorn and staghorn coral and their critical habitat. As under Alternative 1, human induced physical damage, such as exposure to military expended material strikes, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]). As under Alternative 1, military expended materials may affect critical habitat for elkhorn and staghorn coral.

The differences in species overlap and potential impacts from military expended material strikes on marine invertebrates and ESA-listed or -proposed coral species during testing activities would not be discernible from those described for testing activities in Section 3.8.3.3.2.2 (Alternative 1).

Activities occurring in the Key West Range Complex have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed or proposed coral species. Coral reefs along the continental United States are estimated to cover between 330 and 480 mi.^{2} (850–1,250 km^2), most of which is within or adjacent to the Key West Range Complex (Section 3.8.2.15.1, Shallow-Water Coral). It is possible that parachutes could overlap with coral reefs in this region; however it is unlikely since they are generally expended in water deeper than 600 ft. (183 m) and would most likely not travel far enough to impact shallow-water species. Similarly, the use of military expended materials within the Key West

Range Complex is not expected to reduce the conservation value of critical habitat for elkhorn coral or staghorn coral for reasons stated in Section 3.8.3.3.2.2 (Alternative 1).

Testing activities occurring in the South Florida Ocean Measurement Facility Testing Range have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Military expended materials utilized within the South Florida Ocean Measurement Facility Testing Range are limited to anchor blocks used to moor minefield targets and shapes. Deployment of the anchor blocks is conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. At the conclusion of the testing event, the minefield targets and shapes are typically recovered. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Also, activities occurring at depths of 200–800 m in the VACAPES Range Complex, Navy Cherry Point Range Complex, and particularly the JAX Range Complex have the potential to impact hard bottom and deep-water corals. The differences in species overlap and potential impacts from military expended material strikes on marine invertebrates and ESA-listed or -proposed coral species during testing activities would not be discernible from those described for testing activities in Section 3.8.3.3.2.1 (No Action Alternative).

As discussed in Section 3.8.3.3.2.1 (No Action Alternative), impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, eggs, and larvae at the sea surface and at the seafloor, but impacts to populations would be inconsequential. Considering the increase in activities in previously identified locations and the addition of new locations, the potential impacts remain inconsequential for the reasons discussed under the No Action Alternative (Section 3.8.3.3.2.1, No Action Alternative). Similarly, the use of military expended materials would not reduce the conservation value of critical habitat for elkhorn coral or staghorn coral within the Key West Range Complex for reasons stated in Section 3.8.3.3.2.1 (No Action Alternative). For critical habitat designated within the confines of the South Florida Ocean Measurement Facility Testing Range, the use of military expended materials is not likely to reduce the conservation value of critical habitat for elkhorn coral or staghorn coral due to mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality (see Table 3.3-13 for quantification of military expended material impact footprints). Mitigation measures designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

3.8.3.3.2.4 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials during training and testing activities may have an adverse effect on Essential Fish Habitat by reducing the quality or quantity of sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013). The AFTT Essential Fish Habitat Assessment states that the impact to sedentary invertebrate beds would be minimal and long-term to permanent in duration (based on substrate impacts), whereas impacts to reefs would be individually minimal and permanent in duration (U.S. Department of the Navy 2013).

3.8.3.3.3 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Sections 3.0.5.3.3.4 (Seafloor Devices) and Section 3.3.3.2.2 (Seafloor Devices). These include items that are placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom placed targets that are recovered (not expended).

Placement or mooring of objects on the seafloor may impact benthic invertebrates, eggs, and larvae by disturbance, strike, burial, or abrasion of individuals at the site and may disturb marine invertebrates outside the footprint of the seafloor device. Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). These characteristics can be summarized as any hard substrate of suitable quality and availability to support settlement, recruitment, and attachment at depths from mean low water to 30 m within the organism's former geographic range (FR 73(229): 72210-72241, November 26, 2008). Primary constituent elements were not formally defined for these species. Exemptions from critical habitat designations include a small zone around Naval Air Station Key West, and a small area within the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). All activities using seafloor devices in the Key West Range Complex and the South Florida Ocean Measurement Facility Testing Range could expose this substrate to disturbances that could degrade the quality of critical habitat.

Precision anchoring is qualitatively different and potential impacts to the seafloor are more intense than for other seafloor devices. The training activity involves navigation to a preplanned position and deployment of the ship's anchor. The ship's crew is evaluated on the accuracy of the ship's position after the anchor is deployed. Precision anchoring may result in short-term and localized disturbances to water column habitats and long-term disturbances to seafloor habitats. Bottom sediments would be disturbed, and localized increases in turbidity would occur when an anchor makes contact with the seafloor, but turbidity would quickly dissipate (i.e., time scales of minutes to hours) following the exercise. Seafloor

habitat and associated marine invertebrates in designated anchorage areas are likely prevented from fully recovering due to long-term, historical use of the same areas for anchoring.

3.8.3.3.3.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

Species that do not occur within these specified areas—including all nine ESA-listed or proposed coral species—would not be exposed to seafloor devices. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to seafloor devices.

No activities occur in southern Florida or the Key West Range Complex. Therefore, there would be no impact on elkhorn and staghorn coral critical habitat under the No Action Alternative.

Activities occurring at depths less than 800 m have the potential to impact hard bottom or deep-water corals. Activities in the VACAPES Range Complex, Navy Cherry Point Range Complex, and particularly the JAX Range Complex have the potential to impact hard bottom and deep-water corals (Sections 3.8.2.15.2, Deep-Water Corals; 3.8.2.15.3, Hard Bottom; and 3.3, Marine Habitats). Consequences could include breakage, injury, or mortality for each device, mooring, or anchor.

Potential impacts of precision anchoring are qualitatively different from other seafloor devices because the activity involves repeated disturbance to the same area of seafloor. Precision anchoring occurs in long-established soft-bottom areas that have a history of disturbance by anchors, and continued exposure is likely to be inconsequential and not detectable.

The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, the use of seafloor devices during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative the use of seafloor devices occurs in the Gulf of Mexico, Northeast, and Southeast U.S. Continental Shelf Large Marine

Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex, Naval Undersea Warfare Center Division, Newport Testing Range, Naval Surface Warfare Center, Panama City Division Testing Range, and nearshore locations at Newport, Rhode Island and Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.

Species that do not occur within these specified areas would not be exposed to seafloor devices. Species that do occur within the areas listed above—including all nine ESA-listed or proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to seafloor devices. Human-induced physical damage, such as exposure to seafloor devices, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

Benthic organisms would be exposed to strike and disturbance in the relatively small area transited by bottom-crawling unmanned underwater vehicles. Potential consequences of a strike by bottom-crawling unmanned underwater vehicles would be dependent upon the type of benthic invertebrate encountered. Within the Naval Undersea Warfare Center Division, Newport Testing Range and the Naval Surface Warfare Center, Panama City Division Testing Range where primarily soft bottom habitats are present, impacts to benthic invertebrates are unlikely to be greater than consequences of disturbance because the pressure exerted by the unmanned underwater vehicle is so little. The largest unmanned underwater vehicle weighs 92 lb. (42 kg) and has a footprint of 4.8 $ft.^2$ (0.45 m^2). Assuming, worst case, that the unmanned underwater vehicle's buoyant weight is 92 lb., it exerts a pressure of only 0.133 pounds per square inch (PSI) (917 Pa). Few benthic marine invertebrates would be injured by such little pressure, particularly over soft sediments which would compress under the invertebrate and relieve some of the pressure being exerted by the weight of the crawler.

Activities occurring at depths less than 800 m have the potential to impact hard bottom and deep-water corals (with the exception of VACAPES W-50). Activities in the VACAPES Range Complex, Navy Cherry Point Range Complex, and particularly the JAX Range Complex have the potential to impact hard bottom and deep-water corals (Sections 3.8.2.15.2, Deep-Water Corals; 3.8.2.15.3, Hard Bottom; and 3.3, Marine Habitats).

Activities involving seafloor devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level—including ESA-listed or proposed species.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

3.8.3.3.3.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1 the number of activities using seafloor devices is 44 percent more than that of the No Action Alternative. Activities using seafloor devices under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing seafloor devices in the following bays or inland waters: Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas.

Species that do not occur within these specified areas—including all nine ESA-listed or proposed coral species—would not be exposed to seafloor devices. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to seafloor devices.

No activities occur in southern Florida or the Key West Range Complex. Therefore, there would be no impact on elkhorn and staghorn coral critical habitat.

As stated in Section 3.8.3.3.3.1 (No Action Alternative), seafloor devices are not expected to result in impacts to the viability of populations or species of marine invertebrates—including ESA-listed or proposed species. There is no overlap between activities and shallow-water corals or elkhorn and staghorn coral critical habitat. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to seafloor devices. The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential for the reasons described in the No Action Alternative.

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *will have no effect on elkhorn and staghorn coral critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1 the number of activities using seafloor devices is approximately twice that of the No Action Alternative. New activities proposed under Alternative 1 include the use of bottom crawling unmanned underwater vehicles within the South Florida Ocean Measurement Facility Testing Range. Activities using seafloor devices under Alternative 1 would be undertaken in the same geographic locations as the No Action Alternative in addition to the South Florida Ocean Measurement Facility Testing Range; Northeast, Navy Cherry Point, and JAX Range Complexes; and anywhere in the Gulf of Mexico.

Species that do not occur within these specified areas would not be exposed to seafloor devices. Species that do occur within the areas listed above—including all nine ESA-listed or proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to seafloor devices. All nine of the ESA-listed and ESA-proposed coral species occur within the South Florida Ocean Measurement Facility Training Range (Gilliam and Walker 2011). Human-induced physical damage, such as exposure to

seafloor devices, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

Testing activities involving the use of anchor blocks, used to moor minefield targets and shapes, that are deployed and recovered within the South Florida Ocean Measurement Facility Testing Range have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Deployment of the anchor blocks is conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. At the conclusion of the testing event, the minefield targets and shapes are typically recovered, but may be left in place. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

While critical habitat for staghorn and elkhorn coral has been designated within part of the shallow (less than 30 m) nearshore portion of the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management), testing activities that involve the use of seafloor devices, in this case the deployment and recovery of anchor blocks, mainly occur offshore of these areas within the Training Minefield Operating Area, which ranges in depth from approximately 230–280 m (754.6–918.6 ft.). Furthermore, the use of seafloor devices is not likely to reduce the conservation value of critical habitat for elkhorn coral or staghorn coral due to mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Testing activities involving the use of bottom crawling unmanned underwater vehicles within the South Florida Ocean Measurement Facility Testing Range would be limited to the Port Everglades Restricted Anchorage Area (Section 2.1.6.2, Sea and Undersea Space). Deployment of the bottom crawling unmanned underwater vehicles would mainly occur in waters less than 9.8 ft. (3 m) in depth. However, if deployment is necessary deeper than 9.8 ft. (3 m), it will be conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). This specific area within the South Florida Ocean Measurement Facility Testing Range is exempted from designation of critical habitat for elkhorn and staghorn coral. However, the area does contain all nine ESA-listed and proposed coral species which may potentially be impacted by the use of crawlers during testing activities within the range.

Seafloor devices are not expected to result in impacts to the viability of populations or species of marine invertebrates—including ESA-listed or proposed species. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to seafloor devices. As described in the No Action Alternative, the fitness of individual organisms would not be impacted directly or indirectly to the extent that viability of populations or species could be impacted because the areas exposed to these devices are extremely small relative to population sizes.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

3.8.3.3.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.3.3.2 (Alternative 1).

Testing Activities

As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2 the number of activities using seafloor devices is approximately twice that of the No Action Alternative and Alternative 1. Activities using seafloor devices under Alternative 2 would be undertaken in the same geographic locations as the No Action Alternative, in addition to the Northeast, Navy Cherry Point, and JAX Range Complexes and anywhere in the Gulf of Mexico.

Species that do not occur within these specified areas would not be exposed to seafloor devices. Species that do occur within the areas listed above—including all nine ESA-listed or proposed coral species, and the ESA-candidate queen conch—would have the potential to be exposed to seafloor devices. Activities could overlap with ESA-listed or proposed coral when they occur in the South Florida Ocean Measurement Facility Testing Range. All nine of the ESA-listed and ESA-proposed coral species occur within the South Florida Ocean Measurement Facility Training Range. Human-induced physical damage, such as exposure to seafloor devices, was considered by NMFS to be a "negligible to low-importance" threat to coral species and was not cited as a factor when considering the ESA-listing of any coral species or the queen conch (Table 3.8-4 and Sections 3.8.2.3 Elkhorn Coral [*Acropora palmata*] to Section 3.8.2.12 Queen Conch [*Lobatus gigas*]).

Testing activities involving the use of anchor blocks, used to moor minefield targets and shapes, that are deployed and recovered within the South Florida Ocean Measurement Facility Testing Range have the potential to impact shallow-water and deep-water corals, including all nine ESA-listed and proposed coral species. Deployment of the anchor blocks is conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. At the conclusion of the testing event, the minefield targets and shapes are typically recovered, but may be left in place. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). For critical habitat designated within the confines of the South Florida Ocean Measurement Facility Testing Range, the use of seafloor devices is not likely to reduce the conservation value of critical habitat for elkhorn coral or staghorn coral due to mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

Testing activities involving the use of bottom crawling unmanned underwater vehicles within the South Florida Ocean Measurement Facility Testing Range would be limited to the Port Everglades Restricted Anchorage Area (Section 2.1.6.2, Sea and Undersea Space). Deployment of the bottom crawling unmanned underwater vehicles would mainly occur in waters less than 9.8 ft. (3 m) in depth. However, if deployment is necessary deeper than 9.8 ft. (3 m), it will be conducted using real-time Geographic Information System (GIS) and global positioning system (GPS), along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities. Mitigation measures specific to South Florida Ocean Measurement Facility Testing Range that are designed to minimize the potential impacts to seafloor resources including shallow coral reefs, are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). This specific area within the South Florida Ocean Measurement Facility Testing Range is exempted from designation of critical habitat for elkhorn and staghorn coral. However, the area does contain all nine ESA-listed and proposed coral species which may potentially be impacted by the use of crawlers during testing activities within the range.

As stated in Section 3.8.3.3.3.2 (Alternative 1), seafloor devices are not expected to result in impacts to the viability of populations or species of marine invertebrates—including ESA-listed or proposed species. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to seafloor devices. As described in the No Action Alternative, the fitness of individual organisms would not be impacted directly or indirectly to the extent that viability of populations or species could be impacted because the areas exposed to these devices are extremely small relative to population sizes.

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but is not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but is not likely to adversely affect elkhorn and staghorn coral critical habitat.*

3.8.3.3.3.4 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitats (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training and testing activities could have an adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013). The AFTT Essential Fish Habitat Assessment states that the impact to sedentary invertebrate beds (e.g., amphipod tubes, bryozoans) may be minimal and long-term.

3.8.3.4 Entanglement Stressors

This section analyzes the potential entanglement impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Included are potential impacts from two types of military expended materials: (1) fiber optic cables and guidance wires, and (2) parachutes. Aspects of entanglement stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.4 (Conceptual Framework for Assessing Effects from Entanglement).

Most marine invertebrates are less susceptible to entanglement than fishes, sea turtles, and marine mammals due to their size, behavior, and morphology. Fishing nets, which are designed to take marine

invertebrates, operate by enclosing rather than entangling. Marine invertebrates seem to be somewhat less susceptible than vertebrates to entanglement (Chuenpagdee et al. 2003; Morgan and Chuenpagdee 2003). A survey of marine debris entanglements found that marine invertebrates composed 16 percent of all animal entanglements (Ocean Conservancy 2010). The same survey cites potential entanglement in military items only in the context of waste-handling aboard ships, and not for military expended materials. Nevertheless, it is conceivable that marine invertebrates, particularly arthropods and echinoderms with rigid appendages, might become entangled in cables and guidance wires, and in parachutes. Entanglement of sessile invertebrates is discussed under physical disturbance in Section 3.8.3.3 (Physical Disturbance and Strike Stressors).

Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). There is no established mechanism for entanglement stressors to affect important characteristics of this critical habitat; however, potential consequences of physical disturbance and strike stressors associated with these objects are addressed in Section 3.8.3.3.2 (Impacts from Military Expended Materials). Therefore, it is not probable that entanglement stressors could degrade the quality of elkhorn and staghorn coral critical habitat and this discussion will not be carried forward.

3.8.3.4.1 Impacts from Fiber Optic Cables and Guidance Wires

Fiber optic cables are only expended during airborne mine neutralization testing activities and torpedo guidance wires are used in training and testing activities. For a discussion of the types of activities that use guidance wires and fiber optic cables, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, see Sections 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires). Abrasion and shading-related impacts on sessile benthic (attached to the seafloor) marine invertebrates that may result from entanglement stressors are discussed with physical impacts in Section 3.8.3.3 (Physical Disturbance and Strike Stressors).

A marine invertebrate that might become entangled could be only temporarily confused and escape unharmed, it could be held tightly enough that it could be injured during its struggle to escape, it could be preyed upon while entangled, or it could starve while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. Potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris, which is far more prone to tangling than guidance wire or fiber optic cable (Environmental Sciences Group 2005; Ocean Conservancy 2010). The small number of guidance wires and fiber optic cables expended across the Study Area results in an extremely low rate of potential encounter for marine invertebrates.

Tube-launched, optically tracked, wire-guided missiles would expend wires in the nearshore or offshore waters of the Navy Cherry Point Range Complex, during training only and are discussed together with torpedo guidance wires because their potential impacts would be similar to those described here for torpedo guidance wires, which are also expended in the Navy Cherry Point Range Complex.

3.8.3.4.1.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative activities that expend fiber optic cables occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems – specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. The area that would have the greatest concentration of expended cables or

wires is within the VACAPES Range Complex (specifically W-50). The W-50 location includes 123 nm^2 of sea space. Under the No Action Alternative, there would be approximately six cables per nm^2 if they were expended evenly throughout the area.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative torpedoes expending guidance wires would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes. Guidance wires would be concentrated in the Southeast U.S. Continental Shelf Large Marine Ecosystem in the JAX Range Complex. Guidance wires could also be expended outside the range complexes anywhere in the Gulf of Mexico portion of the Study Area.

Species that do not occur within these specified areas—including all nine ESA-listed coral species, and the ESA-candidate queen conch—would not be exposed to cables and guidance wires. Species that do occur within the areas listed above would have the potential to be exposed to cables and guidance wires. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

No activities occur in southern Florida or the Key West Range Complex. Therefore, there is no overlap between cables and guidance wires and elkhorn and staghorn coral critical habitat under the No Action Alternative.

Only pelagic and deep water benthic invertebrates could be exposed to this substressor; therefore, there would be no overlap between activities and shallow-water corals—including all nine ESA-listed or proposed coral species. Given the low numbers used, most marine invertebrates would never be exposed to a cable or guidance wire.

The impact of cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed. Activities involving cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables or guidance wires expended during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under the No Action Alternative, activities that expend fiber optic cables would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex and Naval Surface Warfare Center,

Panama City Division Testing Range. Under the No Action Alternative, there would be approximately one cable per 17 nm^2 if they were expended evenly throughout these areas.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative torpedoes expending guidance wires would occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes, the Cape Cod torpedo exercise box in the northeast, Narragansett Bay and surrounding waters, and Other AFTT Areas.

Species that do not occur within these specified areas—including all nin ESA-listed and proposed coral species—would not be exposed to cables and guidance wires. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to cables and guidance wires. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Only pelagic and deep-water benthic invertebrates could be exposed to this substressor. Therefore, there would be no overlap between activities and shallow-water corals—including any of the nine ESA-listed or proposed coral species. All locations potentially coincide with deep-water corals, and the torpedo guidance wires used in the JAX Range Complex potentially coincide with hard bottom habitat. Given the low numbers of wires used, most marine invertebrates would never be exposed to a cable or guidance wire.

The impact of cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed. Activities involving cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables or guidance wires expended during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.4.1.2 Alternative 1

Training Activities

The activities using fiber optic cables under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the addition of activities in the GOMEX Range Complex. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 1, the number of activities that expend fiber optic cables is approximately three times that of the No Action Alternative.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 1, more than three times as many fiber optic cables and 21 percent more guidance wires would be expended compared to the No Action Alternative. This would result in a maximum concentration of approximately

one cable every 16 nm^2 if they were expended evenly throughout the area. Activities using guidance wires under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing guidance wires in the Other AFTT Areas while vessels are in transit.

Species that do not occur within these specified areas—including any of the nine ESA-listed coral species—would not be exposed to cables and guidance wires. Species that do occur within the areas listed above, including the ESA-candidate queen conch would have the potential to be exposed to cables and guidance wires. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

No activities occur in southern Florida or the Key West Range Complex. Therefore, there is no overlap between cables and guidance wires and elkhorn and staghorn coral critical habitat under Alternative 1.

Only pelagic and deep-water benthic invertebrates could be exposed to this substressor. Therefore, there would be no overlap between activities and shallow-water corals—including any of the nine ESA-listed coral species. Given the low numbers used, most marine invertebrates would never be exposed to a cable or guidance wire.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires are not likely to cause injury or mortality to individuals—including ESA-listed species. The use of cables and guidance wires would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to cables and guidance wires.

Pursuant to the ESA, the use of fiber optic cables or guidance wires expended during training activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, the number of activities that expend fiber optic cables is more than two times that of the No Action Alternative. Activities using fiber optic cables under Alternative 1 would occur in the same geographic locations as the No Action Alternative, except that activities may occur in the JAX Range Complex and throughout the Gulf of Mexico. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended evenly throughout the area.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 1, the number of activities that expend guidance wires is approximately six times that of the No Action Alternative. The torpedo activities using guidance wires under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of eliminating guidance wires from the Cherry Point Range Complex and introducing guidance wires anywhere in the Gulf of Mexico portion of the Study Area.

Species that do not occur within these specified areas—including any of the nine ESA-listed coral species—would not be exposed to cables and guidance wires. Species that do occur within the areas listed above, including the ESA-candidate queen conch would have the potential to be exposed to cables and guidance wires. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Only pelagic and deep-water benthic invertebrates could be exposed to this substressor. Therefore, there would be no overlap between activities and shallow-water corals—including any of the nine ESA-listed coral species. Under Alternative 1, all locations of fiber optic cable use in the Study Area potentially coincide with deep-water corals, and torpedo guidance wires used in the JAX Range Complex potentially coincide with hard bottom habitat. Given the numbers used, most marine invertebrates would never be exposed to a cable or guidance wire.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires are not likely to cause injury or mortality to individuals—including ESA-listed species. The use of cables and guidance wires would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to cables and guidance wires.

Pursuant to the ESA, the use of fiber optic cables or guidance wires expended during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.4.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.4.1.2 (Alternative 1).

Testing Activities

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 2, the number of activities that expend fiber optic cables is 2.5 times higher than that of the No Action Alternative, but only increases by approximately 17 percent as compared to Alternative 1. The activities using fiber optic cables under Alternative 2 would occur in the same geographic locations as the No Action Alternative, except that activities may occur in the JAX Range Complex and throughout the Gulf of Mexico. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended randomly in this area.

As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 2, the number of activities that expend guidance wires is approximately six times that of the No Action Alternative, but only increases by approximately 13 percent as compared to Alternative 1. The torpedo activities using guidance wires under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing guidance wires anywhere in the Gulf of Mexico portion of the Study Area.

Species that do not occur within these specified areas—including any of the nine ESA-listed coral species—would not be exposed to cables and guidance wires. Species that do occur within the areas listed above, including the ESA-candidate queen conch would have the potential to be exposed to cables and guidance wires. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Only pelagic and deep-water benthic invertebrates could be exposed to this substressor. Therefore, there would be no impact on shallow-water corals—including any of the nine ESA-listed coral species. Under Alternative 2, all locations of fiber optic cable use in the Study Area potentially coincide with deep-water corals, and torpedo guidance wires used in the JAX Range Complex potentially coincide with hard bottom habitat. Given the numbers used, most marine invertebrates would never be exposed to a cable or guidance wire.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires not likely to cause injury or mortality to individuals—including ESA-listed species. The use of cables and guidance wires would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to cables and guidance wires.

Pursuant to the ESA, the use of fiber optic cables or guidance wires expended during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral;*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.4.2 Impacts from Parachutes

Parachutes of varying sizes are used during training and testing activities. For a discussion of the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.4.2 (Parachutes). Parachutes pose a potential, though unlikely, entanglement risk to susceptible marine invertebrates. The most likely method of entanglement would be a marine invertebrate crawling through the fabric or cord that could then tighten around it.

Abrasion and shading-related impacts on sessile benthic marine invertebrates that may result from entanglement stressors are discussed with physical impacts in Section 3.8.3.3 (Physical Disturbance and Strike Stressors). Potential indirect effects of the parachute being transported laterally along the seafloor are discussed in Section 3.8.3.6 (Secondary Stressors).

Shallow- or deep-water coral species potentially occur everywhere that parachute use occurs. The ESA-listed and proposed coral species are susceptible to entanglement in parachutes, but the principal mechanism of damage is shading and abrasion. Therefore, this potential stressor is addressed in Section 3.8.3.3.2 (Impacts from Military Expended Materials). Entanglement of corals that results in breakage was addressed in the same section. Similarly entanglement cannot affect habitat and the discussion of potential consequences to critical habitat will not be carried forward. However, potential consequences of physical disturbance and strike stressors associated with these objects are addressed in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

A marine invertebrate that might become entangled could be temporarily confused and escape unharmed, held tightly enough that it could be injured during its struggle to escape, preyed upon while entangled, or starved while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. Potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris (Environmental Sciences Group 2005; Ocean Conservancy 2010). The number of parachutes expended across the Study Area is extremely small relative to the number of marine invertebrates, resulting in a low rate of potential encounter for marine invertebrates.

3.8.3.4.2.1 No Action Alternative

Training Activities

The number and footprint of parachutes are detailed in Table 3.3-9. As indicated in Section 3.0.5.3.4.2 (Parachutes) under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes; and anywhere in the Gulf of Mexico portion of the Study Area, as well as Other AFTT Areas while vessels are in transit. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For training events, this is in the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 2 nm^2 if they were evenly expended throughout the area.

Species that do not occur within these specified areas—including any of the nine ESA-listed coral species—would not be exposed to parachutes. Species that do occur within the areas listed above, including the ESA-candidate queen conch would have the potential to be exposed to parachutes. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

No activities occur in southern Florida or the Key West Range Complex. Therefore, there is no overlap between parachutes and elkhorn and staghorn coral critical habitat under the No Action Alternative.

Most marine invertebrates would never encounter a parachute. The impact of parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed. Activities involving parachutes are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of parachutes expended during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

The number and footprint of parachutes are detailed in Table 3.3-10. As indicated in Section 3.0.5.3.4.2 (Parachutes), under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and in Other AFTT Areas while vessels are in transit. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, this is in Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 22 nm^2 if the parachutes were expended evenly throughout the area.

Species that do not occur within these specified areas would not be exposed to parachutes. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to parachutes. Activities could overlap with ESA-listed or proposed coral and elkhorn and staghorn coral critical habitat in Other AFTT Areas. However, overlap is unlikely because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) minimize potential exposures to these military expended materials. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Most marine invertebrates would never encounter a parachute. Some individual marine invertebrates could be injured or killed in the unlikely event of exposure and entanglement, but most mobile marine invertebrates would avoid entanglement and simply be temporarily disturbed and would recover completely soon after exposure. The growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Pursuant to the ESA, entanglement in parachutes expended during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.4.2.2 Alternative 1

Training Activities

The number and footprint of parachutes are detailed in Table 3.3-11. As indicated in Section 3.0.5.3.4.2 (Parachutes), under Alternative 1, the number of activities involving the use of parachutes is approximately 5 percent higher than that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, parachutes would also be expended in the Key West and GOMEX Range Complexes. Under Alternative 1, there would be a concentration of approximately one parachute per 2 nm^2 if the parachutes were expended evenly throughout the area.

Species that do not occur within these specified areas would not be exposed to parachutes. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to parachutes. Activities could overlap with ESA-listed or proposed coral and elkhorn and staghorn coral critical habitat in Other AFTT Areas. However, overlap is unlikely because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and

Monitoring) minimize potential exposures to these military expended materials. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Most marine invertebrates would never encounter a parachute. As stated in Section 3.8.3.4.2.1 (No Action Alternative), parachute entanglement is not likely to cause injury or mortality to individuals—including ESA-listed species. The use of parachutes would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to parachutes.

Pursuant to the ESA, the use of parachutes expended during training activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

The number and footprint of parachutes are detailed in Table 3.3-12. As indicated in Section 3.0.5.3.4.2 (Parachutes), under Alternative 1 the number of activities involving the use of parachutes is four times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Key West Range Complex, Gulf of Mexico, and throughout the Study Area. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, this is in Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under Alternative 1, there would be a concentration of approximately one parachute per 5 nm^2 if the parachutes were expended evenly throughout the area.

Species that do not occur within these specified areas would not be exposed to parachutes. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to parachutes. Activities that occur anywhere in the AFTT Study Area will overlap with ESA-listed or proposed coral and elkhorn and staghorn coral critical habitat only if the activities occur shallow waters in or near the Key West Range Complex or the South Florida Ocean Measurement Facility Testing Range. However, overlap is unlikely because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) minimize potential exposures to these military expended materials. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Most marine invertebrates would never be exposed to a parachute. As stated in Section 3.8.3.4.2.1 (No Action Alternative), parachute entanglement is not likely to cause injury or mortality to individuals—including ESA-listed species. The use of parachutes would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to parachutes.

Pursuant to the ESA, entanglement in parachutes expended during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.4.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are nearly identical to training activities under Alternative 1 (3 additional parachutes relative to Alternative 1). Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.4.2.2 (Alternative 1).

Testing Activities

The number and footprint of parachutes are detailed in Table 3.3-13. As indicated in Section 3.0.5.3.4.2 (Parachutes), under Alternative 2 the number of activities involving the use of parachutes is more than five times that of the No Action Alternative, but only increases by approximately 19 percent as compared to Alternative 1. The activities using parachutes under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Gulf of Mexico Large Marine Ecosystem in the Key West Range Complex and Gulf of Mexico, and throughout the AFTT Study Area. Under Alternative 2, there would be a concentration of approximately one parachute per 4 nm^2 if the parachutes were expended evenly throughout the area.

Species that do not occur within these specified areas would not be exposed to parachutes. Species that do occur within the areas listed above—including the ESA-candidate queen conch—would have the potential to be exposed to parachutes. Activities that occur anywhere in the AFTT Study Area will overlap with ESA-listed or proposed coral and elkhorn and staghorn coral critical habitat if the activities occur in shallow waters within or near the Key West Range Complex or the South Florida Ocean Measurement Facility Testing Range. However, overlap is unlikely because mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), minimize potential exposures to these military expended materials. Potential consequences of entanglement on corals and critical habitat are discussed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

Most marine invertebrates would never be exposed to a parachute. As stated in Section 3.8.3.4.2.1 (No Action Alternative), parachute entanglement is not likely to cause injury or mortality to individuals—including ESA-listed species. The use of parachutes would not reduce the conservation value of critical habitat for elkhorn and staghorn coral because overlap between the stressor and resource is not anticipated. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to parachutes.

Pursuant to the ESA, the use of parachutes expended during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.5 Ingestion Stressors

This section analyzes the potential ingestion impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5 (Conceptual Framework for Assessing Effects from Ingestion).

Ingestion of expended materials by marine invertebrates could occur in all large marine ecosystems and open ocean areas and can occur at the surface, in the water column, or at the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the animal. Floating material is more likely to be eaten by animals that feed at or near the water surface, while materials that sink to the seafloor present a higher risk to bottom-feeding animals. While marine invertebrates are universally present in the water and the seafloor, the majority of individuals are smaller than a few millimeters (e.g., zooplankton, most roundworms, and most arthropods). Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments.

Among invertebrates, many arthropods such as blue crab (*Callinectes sapidus*) and spiny lobster (*Panulirus argus*) are known to discriminate between palatable and unpalatable food items inside the mouth, so in a strict sense, only items that are passed into the interior digestive tract should be considered to be ingested (Aggio et al. 2012). If an expended material is ingested by marine invertebrates, the primary risk is associated with blockages in the digestive tract. Most components used in military expended materials are relatively inert in the marine environment and are not likely to cause injury or mortality via chemical effects. Section 3.8.3.6 (Secondary Stressors) provides more information on the chemical properties of these materials.

3.8.3.5.1 Impacts from Military Expended Materials

Impacts from Military Expended Materials in this section include munitions, fragments from high-explosive munitions, and military expended materials other than munitions. The most abundant military expended material of ingestible size is chaff. The materials in chaff are generally nontoxic in the marine environment except in quantities substantially larger than those any marine invertebrate could reasonably be exposed to from normal use. Fibers are composed of an aluminum alloy coating on glass fibers of silicon dioxide (Section 3.0.5.3.5.3, Military Expended Materials Other Than Munitions). Chaff is similar in form to fine human hair and somewhat analogous to the spicules of sponges or the siliceous cases of diatoms (Spargo 1999). Many invertebrates ingest sponges, including the spicules, without suffering harm (Spargo 1999). Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they take in prey or water. Literature reviews and controlled experiments detailed in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002; Spargo 1999). Studies were conducted to determine likely effects to marine invertebrates from ingestion of chaff involving a laboratory investigation of crabs that were fed radiofrequency chaff. Blue crabs were force fed a chaff-and-food mixture daily for a few weeks at concentrations 10 to 100 times predicted real-world exposure levels without a notable increase in mortality (Arfsten et al. 2002). Some aluminum compounds bioaccumulate in the marine food chain and are weakly toxic (U.S. Department of the Navy 2012).

As described in Section 3.8.2 (Affected Environment), tens of thousands of marine invertebrate species occur in the Study Area. There is little literature regarding the effects of debris ingestion on marine invertebrates; consequently, there is little basis for an evidence-based assessment of risks. It is not feasible to speculate on which invertebrates in which locations might ingest specific types of military expended materials. However, invertebrates that actively forage (e.g., worms, octopus, shrimp, and sea cucumbers) are at much greater risk of military expended materials ingestion than invertebrates that filter-feed (e.g., sponges, corals, oysters, and barnacles). Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals are unlikely and the potential for impacts on populations would be inconsequential and not detectable. Adverse consequences of marine invertebrates ingesting military expended materials are possible, but not probable.

Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). There is no established mechanism for ingestion stressors to affect important characteristics of this critical habitat and the discussion of potential consequences to critical habitat will not be carried forward. Potential impacts of military expended material on corals and critical habitat are discussed and analyzed as a physical impact in Section 3.8.3.3.2 (Impacts from Military Expended Materials).

3.8.3.5.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, a variety of potentially ingestible military expended materials would be released to the marine environment by Navy training activities, as described in Section 3.0.5.3.5 (Ingestion Stressors). The number and locations of activities that expend potentially ingestible materials are detailed in Section 3.0.5.3.5 (Ingestion Stressors) and the numbers of expended materials are detailed in Table 3.3-9. The amount of ingestible military expended material that an individual animal would encounter is generally low based on the patchy distribution of expended materials.

Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. Military expended materials of ingestible size, or that become ingestible after degradation, are unlikely to impact individuals. Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals—including the ESA-candidate queen conch—are unlikely and the potential for impacts on populations would be inconsequential and not detectable. Adverse consequences of marine invertebrates ingesting military expended materials are possible, but not probable.

Pursuant to the ESA, the potential for ingestion of military expended materials expended during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

Under the No Action Alternative, a variety of potentially ingestible military expended materials would be released into the marine environment by Navy testing activities, as described in Section 3.0.5.3.5 (Ingestion Stressors). The number and locations of activities that expend potentially ingestible materials

are detailed in Section 3.0.5.3.5 (Ingestion Stressors) and the numbers of expended materials are detailed in Table 3.3-10.

Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. Military expended materials of ingestible size, or that become ingestible after degradation, are unlikely to impact individuals. Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals—including the ESA-candidate queen conch—are unlikely and the potential for impacts on populations would be inconsequential and not detectable. Adverse consequences of marine invertebrates ingesting military expended materials are possible, but not probable.

Pursuant to the ESA, the potential for ingestion of military expended materials expended during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.5.1.2 Alternative 1

Training Activities

Under Alternative 1, a variety of potentially ingestible military expended materials would be released into the marine environment by Navy training activities, as described in Section 3.0.5.3.5 (Ingestion Stressors). The number and locations of activities that expend potentially ingestible materials are detailed in Section 3.0.5.3.5 (Ingestion Stressors) and the numbers of expended materials are detailed in Table 3.3-11.

As stated in Section 3.8.3.5.1.1 (No Action Alternative), ingestion stressors are not likely to cause injury or mortality to individuals—including ESA-listed, ESA-proposed, or ESA-candidate species. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to ingestion stressors.

Pursuant to the ESA, the potential for ingestion of military expended materials expended during training activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

Testing Activities

Under Alternative 1, a variety of potentially ingestible military expended materials would be released into the marine environment by Navy testing activities, as described in Section 3.0.5.3.5 (Ingestion Stressors). The number and locations of activities that expend potentially ingestible materials are detailed in Section 3.0.5.3.5 (Ingestion Stressors) and the numbers of expended materials are detailed in Table 3.3-12.

As stated in Section 3.8.3.5.1.1 (No Action Alternative), ingestion stressors are not likely to cause injury or mortality to individuals—including ESA-listed, ESA-proposed, or ESA-candidate species. In comparison

to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to ingestion stressors.

Pursuant to the ESA, the potential for ingestion of military expended materials expended during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.5.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.8.3.5.1.2 (Alternative 1).

Testing Activities

Under Alternative 2, a variety of potentially ingestible military expended materials would be released into the marine environment by Navy testing activities, as described in Section 3.0.5.3.5 (Ingestion Stressors). The number and locations of activities that expend potentially ingestible materials are detailed in Section 3.0.5.3.5 (Ingestion Stressors) and the numbers of expended materials are detailed in Table 3.3-13.

As stated in Section 3.8.3.5.1.1 (No Action Alternative), ingestion stressors are not likely to cause injury or mortality to individuals—including ESA-listed, ESA-proposed, or ESA-candidate species. In comparison to the No Action Alternative, the increase in activities does not substantially increase the risk of exposure to ingestion stressors.

Pursuant to the ESA, the potential for ingestion of military expended materials expended during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed elkhorn coral or staghorn coral; and*
- *will have no effect on ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral.*

3.8.3.6 Secondary Stressors

This section analyzes potential impacts on marine invertebrates exposed to stressors indirectly through impacts on their habitat (i.e., sediment and water quality, and physical disturbance). These two ecosystem constituents—sediment and water quality—are also primary constituents of marine invertebrate habitat, and firm distinctions between indirect impacts and habitat impacts are difficult to maintain. For this analysis, indirect impacts on marine invertebrates via sediment or water that do not require trophic transfer (e.g., bioaccumulation, predation) to be observed are considered here. Potential impacts that can only be observed after trophic transfer are considered in the *Ecosystem Technical Report for the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement* (U.S. Department of the Navy 2012). It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the impact may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose secondary or indirect impacts on marine invertebrates via impacts to habitat. These include: (1) explosives and byproducts, (2) metals, (3) chemicals, (4) other materials such as targets, chaff, and plastics, and (5) physical disturbance.

The Navy does not intentionally take marine invertebrates, and avoiding contact with the seafloor as part of human safety precautions also minimizes potential impacts on shallow benthic marine invertebrates such as corals and oysters. See Chapter 4 (Cumulative Impacts) and U.S. Department of the Navy (2012) for more detailed discussions of Navy activities in the context of other industries.

Secondary or indirect stressors may impact benthic invertebrates, eggs, and larvae by sediment and water quality, and physical disturbance of individuals. Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). These characteristics can be summarized as any hard substrate of suitable quality and availability to support settlement, recruitment, and attachment at depths from mean low water to 30 m within the organism's former geographic range (FR 73(229): 72210-72241, November 26, 2008). Primary constituent elements were not formally defined for these species. Exemptions from critical habitat designations include a small zone around Naval Air Station Key West, and a small area within the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). All activities, including secondary stressors in the Key West Range Complex and the South Florida Ocean Measurement Facility Testing Range, could expose this substrate to disturbances that could degrade the quality of critical habitat.

3.8.3.6.1 Explosives, Explosion Byproducts, and Unexploded Ordnance

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of royal demolition explosive, 98 percent of the products are common seawater constituents and the remainder is rapidly diluted below threshold effect level (see Section 3.1.3.1.2, Background, and Table 3.1-8). Explosion byproducts associated with high-order detonations present no indirect stressors to marine invertebrates through sediment or water. Low-order detonations and unexploded ordnance present elevated likelihood of effects on marine invertebrates, and the potential impacts of these on marine invertebrates will be analyzed. Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high-explosives (Table 3.1-10). Undetonated explosives associated with ordnance disposal and mine clearance are collected after training is complete; therefore, potential impacts are assumed to be inconsequential and not detectable for these training and testing activities. Marine invertebrates may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Most marine invertebrates are very small relative to ordnance or fragments, and direct ingestion of unexploded ordnance is unlikely.

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways discussed in Section 3.1.3.1 (Explosives and Explosion Byproducts). Degradation products of royal demolition explosive are not toxic to marine organisms including corals, and have reversible neurological effects for other invertebrates at realistic exposure levels (Garcia-Reyero et al. 2011; Rosen and Lotufo 2010). Trinitrotoluene (TNT) and its degradation products impact developmental processes in marine invertebrates and are acutely toxic to adults at concentrations similar to real-world exposures (Rosen and Lotufo 2007b, 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in

marine sediment approximately 6–12 in. (15–30 cm) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 and 6 ft. (1 and 2 m) from the degrading ordnance (Section 3.1.3.1, Explosives and Explosion Byproducts). Taken together, it is likely that marine invertebrates, eggs, and larvae would be adversely impacted by the indirect effects of degrading explosives within a very small radius of the explosive (1–6 ft. [0.3–2 m]).

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via water are likely to be inconsequential and not detectable for two reasons. First, most explosives and explosive degradation products have very low solubility in seawater (Table 3.1-13). This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation are unlikely to accumulate except within confined spaces. Second, a low concentration of contaminants, slowly delivered into the water column, is readily diluted to harmless concentrations. While it is conceivable that marine invertebrates may be adversely impacted by the indirect effects of degrading explosives via water (Rosen and Lotufo 2007a, 2010), this is extremely unlikely in realistic scenarios.

Impacts on marine invertebrates, zooplankton, eggs, and larvae are likely within a very small radius of the ordnance (1–6 ft. [0.3–2 m]). These impacts may continue as the ordnance degrades over months to decades (Section 3.1.3.1.5, Impacts from Explosives and Explosion Byproducts). Because most ordnance is deployed as projectiles, it is unlikely that multiple unexploded or low-order detonations will accumulate on spatial scales of 1–6 ft. (0.3–2 m); therefore, potential impacts are likely to remain localized and widely separated. Given these conditions, the possibility of population-level impacts on marine invertebrates is inconsequential.

3.8.3.6.2 Metals

Certain metals and metal-containing compounds are harmful to marine invertebrates at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Chan et al. 2012; Negri et al. 2002; Wang and Rainbow 2008). Responses vary from physiological toxicity to subtle behavioral changes that affect escape from predators (Gutierrez et al. 2012). Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended material including batteries (extensively discussed in Section 3.1.3.2, Metals). Many metals bioaccumulate and some physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals (U.S. Department of the Navy 2012). Different species, even sister species, have highly varied tolerances for metals and diverse mechanisms to cope with these physiological stressors (Figueira et al. 2012; Gall et al. 2012). Indirect impacts of metals to marine invertebrates via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Marine invertebrates may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Ingested metal contaminants are toxic at substantially lower effective concentrations than contaminants dissolved or suspended in the water (Brix et al. 2012). Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and direct ingestion of metals is unlikely.

Because metals often concentrate in sediments, potential adverse indirect impacts are much more likely via sediment than via water (Zhao et al. 2012). Despite the acute toxicity of some metals (e.g., hexavalent chromium or tributyltin) (Negri et al. 2002) concentrations above safe limits are scarcely encountered even in live fire areas of Vieques, Puerto Rico, where deposition of metals from Navy activities is very high (Section 3.1.3.2, Metals). Other studies described in Section 3.1.3.2 (Metals) find no harmful concentrations of metals associated with deposition of military metals into the marine

environment. It is conceivable that marine invertebrates, eggs, or larvae could be indirectly impacted by metals via sediment within a few inches of the object.

Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that marine invertebrates would be indirectly impacted by Navy-derived toxic metals via the water, in the absence of bioaccumulation. It is conceivable, though extremely unlikely, that marine invertebrates, eggs, or larvae could be indirectly impacted by metals via sediment within a few inches of the object, but these potential impacts would be localized and widely separated. Concentrations of metals in water are extremely unlikely to be high enough to cause injury or mortality to marine invertebrates; therefore, indirect impacts of metals via water are likely to be inconsequential and not detectable. Given these conditions, the possibility of population-level impacts on marine invertebrates is likely to be inconsequential and not detectable.

3.8.3.6.3 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, principally, flares, and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls (PCBs) are discussed in Section 3.1.3.3 (Chemicals Other Than Explosives), but there is inconsequential additional risk to marine invertebrates because the use of PCBs in U.S. applications, including the Navy, has been nearly nonexistent since 1979. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow release of propellants and their degradation products into the marine environment. The greatest risk to marine invertebrates from flares, missiles, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Torpedo propellant poses little risk to marine invertebrates because the chemicals have relatively low toxicity (Section 3.1.3.3.2, Missile and Rocket Propellant – Solid Fuel). Marine invertebrates may be exposed by contact with the chemical, contact with chemical contaminants in the sediment or water, and ingestion of contaminated sediments. These situations typically include rapid dilution, and doses large enough to have detectable effects are uncommon in most circumstances. Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and direct ingestion of chemicals is unlikely.

The principal toxic component of missiles and rockets is perchlorate, which is highly soluble and does not readily adsorb to sediments. Therefore, missile and rocket fuel poses inconsequential risk of indirect impact on marine invertebrates via sediment and surrounding waters. In contrast, the principal toxic components of torpedo fuel—propylene glycol dinitrate and nitrodiphenylamine—adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Section 3.1.3.3, Chemicals Other Than Explosives). It is conceivable that marine invertebrates, eggs, or larvae could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades.

In seawater, however, perchlorate, the principal ingredient of solid missile and rocket propellant, is highly soluble, persistent, and impacts metabolic processes in many plants and animals. Perchlorate contamination rapidly disperses throughout the water column and water within sediments. While it impacts terrestrial biological processes at low concentrations (e.g., less than 10 parts per billion), toxic concentrations are unlikely to be encountered in seawater. The principal mode of perchlorate toxicity in the environment is bioaccumulation, which is discussed separately in U.S. Department of the Navy (2012).

Torpedo propellants have relatively low toxicity and pose inconsequential risk to marine invertebrates. It is conceivable that marine invertebrates, zooplankton, eggs, or larvae could be indirectly impacted by hydrogen cyanide produced by torpedo fuel combustion, but these impacts would diminish rapidly as the chemical becomes diluted below toxic levels. Chemicals are rapidly diluted, readily biodegraded, or both, and concentrations high enough to be acutely toxic are unlikely in the marine environment (see Section 3.1.3.3, Chemicals Other Than Explosives, for a discussion of these mechanisms). Concentrations of chemicals in sediment and water are unlikely to be high enough to cause injury or mortality to marine invertebrates; therefore, indirect impacts of chemicals via sediment and water are likely to be inconsequential and not detectable. Potential impacts of chemicals after bioaccumulation are discussed separately. Given these conditions, the possibility of population-level impacts on marine invertebrates is likely to be inconsequential and not detectable.

3.8.3.6.4 Other Materials

Military expended materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine invertebrates. Secondary physical strike and disturbances are relatively unlikely because most expended materials are denser than their surrounding sediments (i.e., metal) and are likely to remain in place as the surrounding sediment moves. The principal exception is likely to be parachutes, which are moved easily relative to projectiles and fragments. Potential secondary physical strike and disturbance impacts may cease only when the: (1) military expended material is too massive to be mobilized by typical oceanographic processes, (2) military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) military expended material becomes permanently buried. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that viability of populations or species would be impacted.

All military expended material, including targets and vessel hulks involved in sinking exercises that contains materials other than metal, explosives, or chemicals, is evaluated for potential indirect impacts on marine invertebrates via sediment and water. Principal components of these military expended materials include aluminized fiberglass (chaff), carbon or Kevlar fiber (missiles), and plastics (canisters, targets, sonobuoy components, parachutes). Potential effects of these materials are discussed in Section 3.1.3.4 (Other Materials). Chaff has been extensively studied, and no indirect toxic effects are known at realistic concentrations in the marine environment (Arfsten et al. 2002). Glass, carbon, and Kevlar fibers are not known to have potential toxic effects on marine invertebrates. Plastics contain chemicals that have potential indirect effects on marine invertebrates (Derraik 2002; Mato et al. 2001; Teuten et al. 2007). Marine invertebrates may be exposed by contact with the plastic, contact with associated plastic chemical contaminants in the sediment or water, and ingestion of contaminated sediments. Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and direct ingestion of plastics is unlikely.

The only material with the potential to impact marine invertebrates via sediment is plastics. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine invertebrates are most at risk via ingestion or bioaccumulation (Sections 3.8.3.5, Ingestion Stressors, and U.S. Department of the Navy (2012). Because plastics retain many of their chemical properties as they physically degrade into microplastic particles (Singh and Sharma 2008), the exposure risks to marine invertebrates are dispersed over time. It is conceivable that marine invertebrates could be indirectly impacted by chemicals associated with plastics but, absent bioaccumulation, these effects would be limited to direct contact with the material. Because of these

conditions, the possibility of population-level impacts on marine invertebrates attributable to Navy expended materials is likely to be inconsequential and not detectable.

3.8.3.6.5 Physical Disturbance

Important physical and biological characteristics of ESA-listed elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.1 and 3.8.2.4.1 (Status and Management). Secondary stressors associated with military expended materials could affect important characteristics of this critical habitat. All activities involving military expended materials in the Southeast U.S. Continental Shelf, Caribbean Sea, and the Gulf Of Mexico Large Marine Ecosystems, particularly in the Key West Range Complex and the South Florida Ocean Measurement Facility Testing Range could expose this substrate to physical disturbances that could degrade the quality of critical habitat. However, the likelihood of exposure is reduced by mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). It is unlikely that secondary stressors would reduce the conservation value of elkhorn and staghorn coral critical habitat.

3.8.3.6.6 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training

Pursuant to the ESA, secondary stressors for training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but are not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but are not likely to adversely affect elkhorn coral or staghorn coral critical habitat.*

3.8.3.6.7 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Testing

Pursuant to the ESA, secondary stressors for testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect ESA-listed elkhorn coral or staghorn coral;*
- *may affect but are not likely to adversely affect ESA-proposed boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, elliptical star coral, or Lamarck's sheet coral; and*
- *may affect but are not likely to adversely affect elkhorn coral or staghorn coral critical habitat.*

3.8.3.6.8 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitats (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of metal, chemical, and other material contaminants; and secondary physical disturbances during training and testing activities will have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. The use of explosives, explosion byproducts, and unexploded ordnance during training and testing activities may have an adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment states that substressor impacts on invertebrate beds or reefs would be minimal and short-term (U.S. Department of the Navy 2013).

3.8.4 SUMMARY OF POTENTIAL IMPACTS ON MARINE INVERTEBRATES

3.8.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all stressors from the Proposed Action. Analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above and summarized in Sections 3.8.4.2 (Endangered Species Act Determinations) and 3.8.4.3 (Essential Fish Habitat Determinations). Stressors associated with Navy training and testing activities do not typically occur in isolation, but rather occur in some combination. For example, mine neutralization activities include elements of acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of aggregate exposure to all stressors and the repetitive or additive consequences of exposure over multiple years. This analysis makes the reasonable assumption that the majority of exposures to stressors are non-lethal, and instead focuses on consequences potentially impacting the organism's fitness (e.g., physiology, behavior, reproductive potential).

It is unlikely that mobile or migratory marine invertebrates that occur within the water column would be exposed to multiple activities during their lifespan because they are relatively short-lived, and most Navy training and testing activities impact small, widely-dispersed areas. It is much more likely that stationary organisms or those that only move over a small range (e.g., corals, worms, and sea urchins) would be exposed to multiple activities because many Navy activities recur in the same location (e.g., gunnery and mine warfare).

Multiple stressors can co-occur with marine invertebrates in two general ways. The first would be if a marine invertebrate were exposed to multiple sources of stress from a single event or activity. The second is exposure to a combination of stressors over the course of the organism's life. Both general scenarios are more likely to occur where training and testing activities are concentrated (e.g., in the vicinity of Naval Stations Norfolk and Mayport, the gunnery box in the JAX Range Complex, the Undersea Warfare Training Range, and the Naval Surface Warfare Center, Panama City Division and Naval Undersea Warfare Center Division, Newport Testing Ranges). The key difference between the two scenarios is the amount of time between exposures to stressors. Time is an important factor because some stressors develop over a long period while others occur and pass quickly (e.g., dissolution of secondary stressors into the sediment versus physical disturbance). Similarly, time is an important factor for the organism because subsequent disturbances or injuries often increase the time needed for the organism to recover to baseline behavior or physiology, extending the time that the organism's fitness is impacted.

Marine invertebrates are susceptible to multiple stressors (Section 3.8.2.2, General Threats), and susceptibilities of many species are enhanced by additive or synergistic effects of multiple stressors (Section 3.8.2.9, Corals, Hydroids, Jellyfish [Phylum Cnidaria]). The global decline of corals, for example, is driven primarily by synergistic impacts of pollution, ecological consequences of overfishing, and climate change (Section 3.8.2.15.1, Shallow-Water Coral). As discussed in the analyses above, marine invertebrates are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities (Section 3.8.3.2, Energy Stressors; Section 3.8.3.4, Entanglement Stressors; and Section 3.8.3.5, Ingestion Stressors); therefore, the opportunity for Navy stressors to result in additive or synergistic consequences is most likely limited to acoustic, physical strike and disturbance, and secondary stressors.

Despite uncertainty in the nature of consequences resulting from combined impacts, the location of potential combined impacts can be predicted with more certainty because combinations are much more likely in locations where training and testing activities are concentrated. Particularly susceptible habitat-forming marine invertebrates co-occur with multiple training and testing activities in the Jacksonville Range Complex gunnery box and the Undersea Warfare Training Range. However, analyses of the nature of potential consequences of combined impacts of all stressors on marine invertebrates remain largely qualitative and speculative. Where multiple stressors coincide with marine invertebrates, the likelihood of a negative consequence is elevated, but it is not feasible to predict the nature of the consequence or its likelihood because not enough is known about potential additive or synergistic interactions. Even for shallow-water coral reefs, an exceptionally well-studied resource, predictions of the consequences of multiple stressors are semi-quantitative and generalized predictions remain qualitative (Hughes and Connell 1999; Jackson 2008; Norström et al. 2009). It is also possible that Navy stressors would combine with non-Navy stressors, and this is qualitatively discussed in the Cumulative Impacts chapter (Chapter 4).

3.8.4.2 Endangered Species Act Determinations

Table 3.8-5 summarizes the Navy's determination of effect on ESA-listed and ESA-proposed marine invertebrates. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with NMFS for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative). Accordingly, the Navy included elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), boulder star coral (*Montastraea annularis*), mountainous star coral (*Montastraea faveolata*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), star coral (*Montastraea franksi*), elliptical star coral (*Dichocoenia stokesii*), and Lamarck's sheet coral (*Agaricia lamarcki*), in the Section 7 ESA consultation with NMFS. No other ESA-listed invertebrate species occur within the Study Area.

Primary constituent elements for elkhorn and staghorn coral critical habitat are defined in Sections 3.8.2.3.1 and 3.8.2.4.1 (Status and Management) and important physical and biological characteristics of elkhorn and staghorn coral habitat are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range). Exemptions from critical habitat designations include a small zone around Naval Air Station Key West, and the South Florida Ocean Measurement Facility Testing Range (Sections 3.8.2.3.1 and 3.8.2.4.1, Status and Management). All activities involving military expended materials, seafloor devices, and secondary stressors in the Key West Range Complex and the South Florida Ocean Measurement Facility Testing Range could expose this substrate to disturbances that could degrade the quality of critical habitat. However, the likelihood of exposure is reduced by mitigation measures, discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). It is unlikely that activities involving military expended materials, seafloor devices, and secondary stressors would reduce the conservation value of elkhorn and staghorn coral critical habitat.

3.8.4.3 Essential Fish Habitat Determinations

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other acoustic sources, vessel noise, swimmer defense airguns, weapons firing noise, high energy lasers, vessel movement, in-water devices, and metal, chemical, or other material contaminants will have no adverse effect on sedentary invertebrate beds or reefs that constitute Essential Fish Habitat or Habitat Areas of Particular Concern. The use of explosives, pile driving, electromagnetic sources, military expended materials, seafloor devices, and explosives and explosive byproduct contaminants may have an adverse effect on Essential Fish Habitat by reducing the quality and quantity of sedentary invertebrate beds or reefs that constitute

Essential Fish Habitat or Habitat Areas of Particular Concern. The AFTT Essential Fish Habitat Assessment states that individual stressor impacts were all either no-effect, or minimal and ranged in duration from temporary to permanent, depending on the stressor (U.S. Department of the Navy 2013).

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Table 3.8-5: Summary of Endangered Species Act Determinations for Marine Invertebrates for the Preferred Alternative

Stressor		Elkhorn Coral	Staghorn Coral	Boulder Star Coral	Mountainous Star Coral	Pillar Coral	Rough Cactus Coral	Star Coral	Elliptical Star Coral	Lamarck's Sheet Coral
Acoustic Stressors										
Sonar and Other Acoustic Sources	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Explosives	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Pile Driving	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Swimmer Defense Airguns	Training activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Weapons Firing, Launch, and Impact Noise	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Vessel Noise	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Aircraft Noise	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Energy Stressors										
Electromagnetic Devices	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
High Energy Lasers	Training activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Physical Disturbance and Strike Stressors										
Vessels and In-Water Devices	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Military Expended Materials	Training activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Seafloor Devices	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Entanglement Stressors										
Fiber Optic Cables and Guidance Wires	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Parachutes	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Ingestion Stressors										
Munitions	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Military Expended Materials Other Than Munitions	Training activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
	Testing activities	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Secondary Stressors										
Secondary Stressors	Training activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

NOTE: The scientific names of the listed species are as follows: elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), pillar coral (*Dendrogyra cylindrus*), boulder star coral (*Montastraea annularis*), mountainous star coral (*Montastraea faveolata*), star coral (*Montastraea franksi*), rough cactus coral (*Mycetophyllia ferox*), Lamarck's sheet coral (*Agaricia lamarcki*), and elliptical star coral (*Dichocoenia stokesii*).

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3.9 FISH

FISH SYNOPSIS

The Navy considered all potential stressors and the following were analyzed for fish:

- Acoustic (sonar and other non-impulsive acoustic sources, and explosives and other impulsive acoustic sources)
- Energy (electromagnetic devices, high energy lasers)
- Physical disturbance and strikes (vessels and in-water devices, military expended materials, and seafloor devices)
- Entanglement (fiber optic cables and guidance wires, parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (explosives and explosion byproducts, metals, chemicals, and other materials)

Alternative 2 (Preferred Alternative)

- Acoustic: Pursuant to the Endangered Species Act (ESA), the use of sonar and other non-impulsive acoustic sources may affect but is not likely to adversely affect ESA-listed fish species; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat.

  Pursuant to the ESA, the use of explosives and other impulsive acoustic sources may affect and is likely to adversely affect ESA-listed Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish; may affect but is not likely to adversely affect the Atlantic salmon, largetooth sawfish, and shortnose sturgeon; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat.
- Energy: Pursuant to the ESA, the use of electromagnetic devices during training and testing activities may affect but is not likely to adversely affect ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; will have no effect on Atlantic salmon; will have no effect on Atlantic salmon or smalltooth sawfish critical habitat; and may affect but is not likely to adversely affect Gulf sturgeon critical habitat. Pursuant to the ESA, the use of high energy lasers will have no effect on ESA-listed fish species; and will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.
- Physical Disturbance and Strikes: Pursuant to the ESA, the use of vessels, in-water devices, military expended materials, and seafloor devices may affect but is not likely to adversely affect ESA-listed fish species; may affect but is not likely to adversely affect Gulf sturgeon critical habitat; and will have no effect on Atlantic salmon and smalltooth sawfish critical habitat.
- Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect ESA-listed fish species.
- Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials may affect but is not likely to adversely affect ESA-listed fish species.
- Secondary Stressors: Pursuant to the ESA, secondary stressors may affect but are not likely to adversely affect ESA-listed fish species and will have no effect on Atlantic salmon, smalltooth sawfish, and Gulf sturgeon critical habitat.
- Pursuant to the Essential Fish Habitat requirements, the use of sonar and other active acoustic sources (Atlantic herring only), explosives, pile driving, and electromagnetic devices may have a minimal and temporary adverse effect on the fishes that occupy water column Essential Fish Habitat.

3.9.1 INTRODUCTION

This section analyzes the potential impacts of the Proposed Action on fish found in the Study Area. Section 3.9.1 (Introduction) introduces the Endangered Species Act (ESA) species and taxonomic groups that occur in the Study Area. Section 3.9.2 (Affected Environment) discusses the baseline affected environment. The complete analysis of environmental consequences is in Section 3.9.3 (Environmental Consequences) and the potential impacts of the Proposed Action on marine fish species are summarized in Section 3.9.4 (Summary of Potential Impacts on Fish).

For this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), marine fish are evaluated as groups of species characterized by distribution, morphology (body type), or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential effects on the marine fish in the Study Area that are listed, proposed, or candidate species under the ESA, as well as other fish in the Study Area generally by major marine fish groupings. Fish are not distributed uniformly throughout the Study Area but are closely associated with a variety of habitats. Some species, such as large sharks, salmon, tuna, and billfish, range across thousands of square miles. Other species, such as gobies and most reef fish, generally have small home ranges and restricted distributions (Helfman et al. 2009). The early life stages (e.g., eggs and larvae) of many fish may be widely distributed even when the adults have relatively small ranges. The movements of some open-ocean species may never overlap with coastal fish that spend their lives within several hundred feet (a few hundred meters) of the shore. The distribution and specific habitats in which an individual of a single fish species occurs may be influenced by its developmental stage, size, sex, reproductive condition, and other factors. There are more than 1,600 marine fish species in the Study Area, approximately 65 percent of which occur in the coastal zone. About 35 percent of the known species, including deep-sea fish, occur in the oceanic zone (Froese and Pauly 2010).

Marine fish species that are regulated under the Magnuson-Stevens Fishery Conservation and Management Act are listed in Section 3.9.1.3 (Major Marine Fish Groups). Additional general information on the biology, life history, distribution, and conservation of marine fish is available on the websites of the following agencies and organizations, as well as many others:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Regional Fishery Management Councils
    - New England Fishery Management Council
    - Mid-Atlantic Fishery Management Council
    - South Atlantic Fishery Management Council
    - Gulf of Mexico Fishery Management Council
    - Caribbean Fishery Management Council
- Regional Marine Fisheries Commissions
    - Atlantic States Marine Fisheries Commission
    - Gulf States Marine Fisheries Commission
- International Union for Conservation of Nature and Natural Resources
- FishBase: A Global Information System on Fish

3.9.1.1 Endangered Species Act Species

Six marine fish species in the Study Area are listed under the ESA: Atlantic salmon (*Salmo salar*), largetooth sawfish (*Pristis pristis*), smalltooth sawfish (*Pristis pectinata*), shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and Gulf sturgeon (*Acipenser oxyrinchus desotoi*). One fish species, the scalloped hammerhead shark (*Sphyrna lewini*), is proposed to be listed as threatened under the ESA for the central and southwest Atlantic distinct population segment only. The remaining Atlantic population is considered a species of concern. Seven additional fish species are candidates for listing by NMFS as threatened or endangered in the future: American eel (*Anguilla rostrata*), cusk (*Brosme brosme*), dusky shark (*Carcharhinus obscurus*), dwarf seahorse (*Hippocampus zosterae*), great hammerhead shark (*Sphyrna mokarran*), Nassau grouper (*Epinephelus striatus*), and river herring (*Alosa pseudoharengus* and *Alosa aestivalis*) (Table 3.9-1). NMFS manages most ESA-protected marine fish species, and it co-manages some species that move between freshwater and saltwater (e.g., Atlantic salmon, sturgeon) with the United States (U.S.) Fish and Wildlife Service. NMFS also manages a proactive conservation program that allows for a listing of "species of concern." Species of concern are those fish that, "NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA" (National Marine Fisheries Service 2011). There are 19 fish species of concern in the Study Area. Species of concern status does not carry any procedural or substantive protections under the ESA, but these species are included in Table 3.9-1 for informational purposes.

The species-specific information in the following sections focuses on the federally managed species, the six species listed as endangered or threatened, and the seven species listed as candidates for listing. The species protected under the ESA warrant special attention because the unit of protection is the individual rather than the population.

3.9.1.2 Federally Managed Species

The fisheries of the United States are managed within a framework of overlapping international, federal, state, interstate, and tribal authorities. Individual states and territories generally have jurisdiction over fisheries in marine waters within 3 nm of their coast (9 nm in Texas and the gulf coast of Florida). Federal jurisdiction includes fisheries in marine waters inside the U.S. Exclusive Economic Zone, which encompasses the area from the outer boundary of state waters out to 200 nm offshore of any U.S. coastline, except where intersected closer than 200 nm by bordering countries (Federal Register [FR] 61 (85): 19390-19429, May 1, 1996).

Table 3.9-1: Status and Presence of Endangered Species Act Endangered, Threatened, Proposed, and Candidate Fish Species, and Species of Concern in the Study Area

Species Name and Regulatory Status			Presence in Study Area*		
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean Area**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Atlantic Salmon	*Salmo salar*	Endangered	Gulf Stream, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	Kennebec River Estuary (Bath, ME)
Largetooth Sawfish	*Pristis pristis*	Endangered	None	Gulf of Mexico[1]	St. Andrew Bay[1] (Panama City, FL); Pascagoula River Estuary[1]; Sabine Lake[1] (Beaumont, TX); Corpus Christi Bay[1] (Corpus Christi, TX)
Smalltooth Sawfish	*Pristis pectinata*	Endangered	None	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	St. Andrew Bay (Panama City, FL); Pascagoula River Estuary, Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered	None	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Scotian Shelf	Kennebec River Estuary (Bath, ME); Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay; lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL)
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	None	Gulf of Mexico	St. Andrew Bay (Panama City, FL); Pascagoula River Estuary
Atlantic Sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered/ threatened	None	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Kennebec River Estuary (Bath, ME); Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay; lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL)

CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; NC: North Carolina; NJ: New Jersey; RI: Rhode Island; TX: Texas; U.S.: United States

*Presence in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, North Atlantic Subtropical Gyre, and Gulf Stream) or by coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea).

[1] Based on historical records only; the last documented sighting of largetooth sawfish in U.S. waters was in 1961.

Table 3.9-1: Status and Presence of Endangered Species Act Endangered, Threatened, Proposed, and Candidate Fish Species, and Species of Concern in the Study Area (Continued)

Species Name and Regulatory Status			Presence in Study Area*		
Common Name	Scientific Name	Endangered Species Act Status	Open Ocean Area	Large Marine Ecosystem	Bays, Estuaries, and Rivers
Scalloped Hammerhead Shark	*Sphyrna lewini*	Proposed threatened[2]	Gulf Stream, North Central Atlantic Gyre	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	Lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL); St. Andrew Bay (Panama City, FL); Pascagoula River Estuary; Sabine Lake, (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
American Eel	*Anguilla rostrata*	Candidate (U.S. Fish & Wildlife Service)	Gulf Stream, North Central Atlantic Gyre, Labrador Current	All large marine ecosystems in the Study Area	All bays, estuaries, and rivers in the Study Area
Cusk	*Brosme brosme*	Candidate/ species of concern[3]	Gulf Stream, North Central Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	None
Dusky Shark	*Carcharhinus obscurus*	Candidate[4]	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	Kennebec River Estuary (Bath, ME); Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay; lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL); St. Andrew Bay (Panama City, FL); Pascagoula River Estuary; Sabine Lake, (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)

CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; NC: North Carolina; NJ: New Jersey; RI: Rhode Island; TX: Texas; U.S.: United States

*Presence in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, North Atlantic Subtropical Gyre, and Gulf Stream) or by coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea).

[2] Central and Southwest Atlantic Distinct Population Segment only.

[3] Species of concern status does not carry any procedural or substantive protections under the ESA, but these species are included in Table 3.9-1 for informational purposes.

[4] Species write-up not included in Section 3.9.2 for this species as its status was recently updated. However, consultation with the National Marine Fisheries Service would occur for this species should it become ESA-listed.

Table 3.9-1: Status and Presence of Endangered Species Act Endangered, Threatened, Proposed, and Candidate Fish Species, and Species of Concern in the Study Area (Continued)

Species Name and Regulatory Status			Presence in Study Area*		
Common Name	Scientific Name	Endangered Species Act Status	Open Ocean Area	Large Marine Ecosystem	Bays, Estuaries, and Rivers
Dwarf Seahorse	*Hippocampus zosterae*	Candidate	None	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	St. Johns River (Jacksonville, FL); St. Andrew Bay[1] (Panama City, FL); Pascagoula River Estuary; Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Great hammerhead shark	*Sphyrna mokarran*	Candidate[4]	Gulf Stream, North Central Atlantic Gyre	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL); St. Andrew Bay (Panama City, FL); Pascagoula River Estuary; Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Nassau Grouper	*Epinephelus striatus*	Candidate/ species of concern[3]	Gulf Stream	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	None
River Herring (Alewife and Blueback Herring)	*Alosa pseudoharengus* and *Alosa aestivalis*	Candidate/ species of concern[3]	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Kennebec River Estuary (Bath, ME); Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay; lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL)
Alabama Shad	*Alosa alabamae*	Species of concern[3]	None	Gulf of Mexico	St. Andrew Bay (Panama City, FL)
Atlantic Bluefin Tuna	*Thunnus thynnus*	Species of concern[3]	Gulf Stream, North Central Atlantic Gyre	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, Gulf of Mexico, Caribbean Sea	None

CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; NC: North Carolina; NJ: New Jersey; RI: Rhode Island; TX: Texas; U.S.: United States

*Presence in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, North Atlantic Subtropical Gyre, and Gulf Stream) or by coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea).

[3] Species of concern status does not carry any procedural or substantive protections under the ESA, but these species are included in Table 3.9-1 for informational purposes

[4] Species write-up not included for this species in Section 3.9.2 because of recent status change in 2013. Consultation with NMFS would occur for this species should it become ESA-listed.

Table 3.9-1: Status and Presence of Endangered Species Act Endangered, Threatened, Proposed, and Candidate Fish Species, and Species of Concern in the Study Area (Continued)

Species Name and Regulatory Status			Presence in Study Area*		
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean Area**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Atlantic Halibut	*Hippoglossus hippoglossus*	Species of concern[3]	Gulf Stream, North Central Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	None
Atlantic Wolffish	*Anarhichas lupus*	Species of concern[3]	Gulf Stream, North Central Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	None
Key Silverside	*Menidia conchorum*	Species of concern[3]	None	Gulf of Mexico	None
Mangrove Rivulus	*Rivulus marmoratus*	Species of concern[3]	None	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	None
Night Shark	*Carcharhinus signatus*	Species of concern[3]	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	None
Opossum Pipefish	*Microphis brachyurus lineatus*	Species of concern[3]	None	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	St. Andrew Bay (Panama City, FL); Pascagoula River Estuary; Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Porbeagle Shark	*Lamna nasus*	Species of concern[3]	Gulf Stream, North Central Atlantic Gyre, Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	None

CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; NC: North Carolina; NJ: New Jersey; RI: Rhode Island; TX: Texas; U.S.: United States

*Presence in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, North Atlantic Subtropical Gyre, and Gulf Stream) or by coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea).

[3] Species of concern status does not carry any procedural or substantive protections under the ESA, but these species are included in Table 3.9-1 for informational purposes.

Table 3.9-1: Status and Presence of Endangered Species Act Endangered, Threatened, Proposed, and Candidate Fish Species, and Species of Concern in the Study Area (Continued)

Species Name and Regulatory Status			Presence in Study Area*		
Common Name	Scientific Name	Endangered Species Act Status	Open Ocean Area	Large Marine Ecosystem	Bays, Estuaries, and Rivers
Rainbow Smelt	*Osmerus mordax*	Species of concern[3]	None	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf	Kennebec River Estuary (Bath, ME); Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay
Sand tiger Shark	*Carcharias taurus*	Species of concern[3]	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, Gulf of Mexico, Caribbean Sea	Narragansett Bay; Rhode Island Sound; Thames River Estuary (Groton, CT); Sandy Hook Bay; lower Chesapeake Bay; Beaufort Inlet Channel (Morehead City, NC); Cape Fear River (Wilmington, NC); Kings Bay; and St. Johns River (Jacksonville, FL); St. Andrew Bay (Panama City, FL); Pascagoula River Estuary; Sabine Lake (Beaumont, TX); Corpus Christi Bay (Corpus Christi, TX)
Speckled Hind	*Epinephelus drummondhayi*	Species of concern[3]	Gulf Stream	Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	None
Striped Croaker	*Bairdiella sanctaeluciae*	Species of concern[3]	None	Southeast U.S. Continental Shelf, Caribbean Sea	None
Thorny Skate	*Amblyraja radiata*	Species of concern[3]	None	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf	None
Warsaw Grouper	*Epinephelus nigritus*	Species of concern[3]	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Caribbean Sea	None

CT: Connecticut; FL: Florida; GA: Georgia; ME: Maine; NC: North Carolina; NJ: New Jersey; RI: Rhode Island; TX: Texas; U.S.: United States

*Presence in the Study Area is characterized by open-ocean oceanographic features (Labrador Current, North Atlantic Subtropical Gyre, and Gulf Stream) or by coastal waters of large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea).

[3] Species of concern status does not carry any procedural or substantive protections under the ESA, but these species are included in Table 3.9-1 for informational purposes.

The Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act (see Section 3.0.1.1 (Federal Statutes) led to the formation of eight fishery management councils that share authority with NMFS to manage and conserve the fisheries in federal waters. Essential Fish Habitat is also identified and managed under this act. For analyses of impacts on those habitats included as Essential Fish Habitat within the Study Area, refer to Sections 3.3 (Marine Habitats), 3.7 (Marine Vegetation), and 3.8 (Marine Invertebrates). Together with NMFS, the councils maintain fishery management plans for species or species groups to regulate commercial and recreational fishing within their geographic regions. The Study Area overlaps the jurisdiction of five regional fishery management councils, as well as the range of the highly migratory species, which is managed by NMFS.

- **New England Fishery Management Council** includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut.
- **Mid-Atlantic Fishery Management Council** includes New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina (from its northern border to Cape Hatteras).
- **South Atlantic Fishery Management Council** includes North Carolina (from Cape Hatteras to its southern border), South Carolina, Georgia, and the east coast of Florida.
- **Gulf of Mexico Fishery Management Council** includes west coast of Florida, Alabama, Mississippi, Louisiana, and Texas.
- **Caribbean Fishery Management Council** includes the Commonwealth of Puerto Rico and the U.S. Virgin Islands.
- **NMFS, Office of Sustainable Fisheries** includes all federally managed waters of the United States where highly migratory species occur.

Federally managed marine fish species are listed in Table 3.9-2. These species are included in the list of fish in Table 3.9-3, but are also given consideration as recreationally and commercially important species in the analysis of impacts in Section 3.9.3 (Environmental Consequences). The analysis of impacts on commercial and recreational fisheries is provided in Section 3.11 (Socioeconomic Resources).

3.9.1.3 Major Marine Fish Groups

Groups of marine fish are provided in Table 3.9-3 and are described further in Section 3.9.2 (Affected Environment), to supplement information on fish of the Study Area beyond the ESA-protected species in this document. These fish groups are based on the organization presented in Helfman et al. (2009), Moyle and Cech (1996), and Nelson (2006). These groupings are intended to organize the extensive and diverse list of fish that occur in the Study Area, as a means to structure the analysis of potential impacts on fish with similar ecological niches, behavioral characteristics, and habitat preferences. Exceptions to these generalizations exist within each group, and are noted wherever appropriate in the analysis of potential impacts.

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan

New England Fishery Management Council	
Common Name	**Scientific Name**
New England Multispecies Fishery Management Plan	
American Plaice	*Hippoglossoides platessoides*
Atlantic Cod	*Gadus morhua*
Atlantic Halibut	*Hippoglossus hippoglossus*
Haddock	*Melanogrammus aeglefinus*
Ocean Pout	*Zoarces americanus*
Offshore Hake	*Merluccius albidus*
Pollock	*Pollachius virens*
Red Hake	*Urophycis chuss*
Redfish	*Sebastes* spp.
Silver Hake/Whiting	*Merluccius bilinearis*
White Hake	*Urophycis tenuis*
Windowpane Flounder	*Scophthalmus aquosus*
Winter Flounder	*Pseudopleuronectes americanus*
Witch Flounder	*Glyptocephalus cynoglossus*
Yellowtail Flounder	*Limanda ferruginea*
New England Skate Fishery Management Plan	
Barndoor Skate	*Dipturus laevis*
Clearnose Skate	*Raja eglanteria*
Little Skate	*Leucoraja erinacea*
Rosette Skate	*Leucoraja garmani virginica*
Smooth Skate	*Malacoraja senta*
Thorny Skate	*Amblyraja radiata*
Winter Skate	*Leucoraja ocellata*
Atlantic Salmon Fishery Management Plan	
Atlantic Salmon	*Salmo salar*
Atlantic Herring Fishery Management Plan	
Atlantic Herring	*Clupea harengus*
Monkfish Fishery Management Plan	
Goosefish/Monkfish	*Lophius americanus*

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

Mid-Atlantic Fishery Management Council	
Common Name	**Scientific Name**
Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan	
Black Sea Bass	*Centropristis striata*
Scup	*Stenotomus chrysops*
Summer Flounder	*Paralichthys dentatus*
Atlantic Bluefish Fishery Management Plan	
Bluefish	*Pomatomus saltatrix*
Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan	
Atlantic Mackerel	*Scomber scombrus*
Butterfish	*Peprilus triacanthus*
Tilefish Fishery Management Plan	
Tilefish	*Lopholatilus chamaeleonticeps*
Spiny Dogfish Fishery Management Plan	
Spiny Dogfish	*Squalus acanthias*

South Atlantic Fishery Management Council	
Common Name	**Scientific Name**
Coastal Migratory Pelagics Fishery Management Plan	
Cero	*Scomberomorus regalis*
Cobia	*Rachycentron canadum*
King Mackerel	*Scomberomorus cavalla*
Little Tunny	*Euthynnus alletteratus*
Spanish Mackerel	*Scomberomorus maculatus*
Dolphin-Wahoo Fishery Management Plan	
Dolphinfish	*Coryphaena hippurus*
Pompano Dolphinfish	*Coryphaena equiselis*
Wahoo	*Acanthocybium solandri*
Snapper-Grouper Fishery Management Plan	
Almaco Jack	*Seriola rivoliana*
Atlantic Spadefish	*Chaetodipterus faber*
Banded Rudderfish	*Seriola zonata*
Bank Sea Bass	*Centropristis ocyurus*
Bar Jack	*Caranx ruber*
Black Grouper	*Mycteroperca bonaci*
Black Sea Bass	*Centropristis striata*
Black Snapper	*Apsilus dentatus*
Blackfin Snapper	*Lutjanus buccanella*
Blue Runner	*Caranx crysos*
Blueline Tilefish	*Caulolatilus microps*

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

South Atlantic Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Coney	*Cephalopholis fulva*
Cottonwick	*Haemulon melanurum*
Cubera Snapper	*Lutjanus cyanopterus*
Dog Snapper	*Lutjanus jocu*
Gag	*Mycteroperca microlepis*
Goliath Grouper/Jewfish	*Epinephelus itajara*
Gray Snapper/Mangrove Snapper	*Lutjanus griseus*
Gray Triggerfish	*Balistes capriscus*
Graysby	*Cephalopholis cruentata*
Greater Amberjack	*Seriola dumerili*
Hogfish	*Lachnolaimus maximus*
Jolthead Porgy	*Calamus bajonado*
Knobbed Porgy	*Calamus nodosus*
Lane Snapper	*Lutjanus synagris*
Lesser Amberjack	*Seriola fasciata*
Longspine Porgy	*Stenotomus caprinus*
Mahogany Snapper	*Lutjanus mahogoni*
Margate	*Haemulon album*
Misty Grouper	*Epinephelus mystacinus*
Mutton Snapper	*Lutjanus analis*
Nassau Grouper	*Epinephelus striatus*
Ocean Triggerfish	*Canthidermis sufflamen*
Queen Triggerfish	*Balistes vetula*
Red Grouper	*Epinephelus morio*
Red Hind	*Epinephelus guttatus*
Red Porgy	*Pagrus pagrus*
Red Snapper	*Lutjanus campechanus*
Rock Hind	*Epinephelus adscensionis*
Rock Sea Bass	*Centropristis philadelphica*
Sailor's Choice	*Haemulon parra*
Sand Tilefish	*Malacanthus plumieri*
Saucereye Porgy	*Calamus calamus*
Scamp	*Mycteroperca phenax*
Schoolmaster	*Lutjanus apodus*
Scup	*Stenotomus chrysops*
Silk Snapper	*Lutjanus vivanus*
Snowy Grouper	*Epinephelus niveatus*
Speckled Hind	*Epinephelus drummondhayi*
Tilefish	*Lopholatilus chamaeleonticeps*

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

South Atlantic Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Tomtate	*Haemulon aurolineatum*
Vermilion Snapper	*Rhomboplites aurorubens*
Warsaw Grouper	*Epinephelus nigritus*
White Grunt	*Haemulon plumierii*
Whitebone Porgy	*Calamus leucosteus*
Wreckfish	*Polyprion americanus*
Yellowedge Grouper	*Epinephelus flavolimbatus*
Yellowfin Grouper	*Mycteroperca venenosa*
Yellowmouth Grouper	*Mycteroperca interstitialis*
Yellowtail Snapper	*Ocyurus chrysurus*

Gulf of Mexico Fishery Management Council	
Common Name	**Scientific Name**
Reef Fish Resources of the Gulf of Mexico Fishery Management Plan	
Almaco Jack	*Seriola rivoliana*
Banded Rudderfish	*Seriola zonata*
Black Grouper	*Mycteroperca bonaci*
Blackfin Snapper	*Lutjanus buccanella*
Blueline Tilefish	*Caulolatilus microps*
Cubera Snapper	*Lutjanus cyanopterus*
Gag	*Mycteroperca microlepis*
Goldface Tilefish	*Caulolatilus chrysops*
Goliath Grouper/Jewfish	*Epinephelus itajara*
Gray Snapper/Mangrove Snapper	*Lutjanus griseus*
Gray Triggerfish	*Balistes capriscus*
Greater Amberjack	*Seriola dumerili*
Hogfish	*Lachnolaimus maximus*
Lane Snapper	*Lutjanus synagris*
Lesser Amberjack	*Seriola fasciata*
Mutton Snapper	*Lutjanus analis*
Nassau Grouper	*Epinephelus striatus*
Queen Snapper	*Etelis oculatus*
Red Grouper	*Epinephelus morio*
Red Snapper	*Lutjanus campechanus*
Scamp	*Mycteroperca phenax*
Silk Snapper	*Lutjanus vivanus*
Snowy Grouper	*Epinephelus niveatus*
Speckled Hind	*Epinephelus drummondhayi*

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

Gulf of Mexico Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Tilefish	*Lopholatilus chamaeleonticeps*
Vermilion Snapper	*Rhomboplites aurorubens*
Warsaw Grouper	*Epinephelus nigritus*
Wenchman	*Pristipomoides aquilonaris*
Yellowedge Grouper	*Epinephelus flavolimbatus*
Yellowfin Grouper	*Mycteroperca venenosa*
Yellowmouth Grouper	*Mycteroperca interstitialis*
Yellowtail Snapper	*Ocyurus chrysurus*
Gulf of Mexico Red Drum Fishery Management Plan	
Red Drum	*Sciaenops ocellatus*
Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic Fishery Management Plan	
Bluefish	*Pomatomus saltatrix*
Cero Mackerel	*Scomberomorus regalis*
Cobia	*Rachycentron canadum*
Dolphinfish	*Coryphaena hippurus*
King Mackerel	*Scomberomorus cavalla*
Little tunny	*Euthynnus alletteratus*
Spanish Mackerel	*Scomberomorus maculatus*

Caribbean Fishery Management Council	
Common Name	**Scientific Name**
Caribbean Reef Fish Fishery Management Plan	
Almaco Jack	*Seriola rivoliana*
Atlantic Spadefish	*Chaetodipterus faber*
Banded Butterflyfish[1]	*Chaetodon striatus*
Bar Jack	*Caranx ruber*
Batfish[1]	*Ogcocepahalus* spp.
Beaugregory[1]	*Pomacentrus leucostictus*
Bicolor Damselfish[1]	*Pomacentrus partitus*
Bigeye	*Priacanthus arenatus*
Black Durgon	*Melichthys niger*
Black Jack	*Caranx lugubris*
Black Snapper	*Apsilus dentatus*
Blackbar Soldierfish[1]	*Myripristis jacobus*
Blackfin Snapper	*Lutjanus buccanella*

[1] These species were deleted from the fishery management unit proposed in Section 4.1.1 in the Comprehensive Amendment of the Fishery Management Plans of the U.S. Caribbean to Address Required Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Caribbean Fishery Management Council 2004).

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

Caribbean Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Blackline Tilefish	*Caulolatilus cyanops*
Blue Chromis[1]	*Chromis cyanea*
Blue Parrotfish	*Scarus coeruleus*
Foureye Butterflyfish[1]	*Chaetodon capistratus*
French Angelfish[1]	*Pomacanthus paru*
French Grunt	*Haemulon flavolineatum*
Frogfish[1]	*Antennarius* spp.
Glasseye Snapper	*Priacanthus cruentatus*
Goldentail Moray[1]	*Gymnothorax miliaris*
Goldspotted Eel[1]	*Myrichthys ocellatus*
Goliath Grouper	*Epinephelus itajara*
Gray Angelfish	*Pomacanthus arcuatus*
Gray Snapper	*Lutjanus griseus*
Graysby	*Epinephelus cruentatus*
Greater Amberjack	*Seriola dumerili*
Greater Soapfish	*Rypticus saponaceus*
Green Moray[1]	*Gymnothorax funebris*
Green Razorfish[1]	*Hemipteronotus splendens*
Harlequin Bass[1]	*Serranus tigrinus*
High-Hat[1]	*Equetus acuminatus*
Hogfish	*Lachnolaimus maximus*
Honeycomb Cowfish	*Lactophrys polygonia*
Horse-Eye Jack	*Caranx latus*
Jackknife-Fish[1]	*Equetus lanceolatus*
Jolthead Porgy	*Calamus bajonado*
Lane Snapper	*Lutjanus synagris*
Lantern Bass	*Serranus baldwini*
Longsnout Butterflyfish[1]	*Chaetodon aculeatus*
Longspine Squirrelfish	*Holocentrus rufus*
Mahogany Snapper	*Lutjanus mahogani*
Margate	*Haemulon album*
Midnight Parrotfish	*Scarus coelestinus*
Misty Grouper	*Epinephelus mystacinus*
Mutton Snapper	*Lutjanus analis*
Nassau Grouper	*Epinephelus striatus*
Neon Goby[1]	*Gobiosoma oceanops*
Ocean Surgeonfish	*Acanthurus bahianus*
Ocean Triggerfish	*Canthidermis sufflamen*

[1] These species were deleted from the fishery management unit proposed in Section 4.1.1 in the Comprehensive Amendment of the Fishery Management Plans of the U.S. Caribbean to Address Required Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Caribbean Fishery Management Council 2004).

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

Caribbean Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Orangeback Bass	*Serranus annularis*
Peacock Flounder [1]	*Bothus lunatus*
Pearly Razorfish[1]	*Hemipteronotus novacula*
Pipefish[1]	*Syngnathus* spp.
Pluma	*Calamus pennatula*
Porcupinefish[1]	*Diodon hystrix*
Porkfish	*Anisotremus virginicus*
Princess Parrotfish	*Scarus taeniopterus*
Puddingwife[1]	*Halichoeres radiatus*
Queen Angelfish	*Holacanthus ciliaris*
Queen Parrotfish	*Scarus vetula*
Queen Snapper	*Etelis oculatus*
Queen Triggerfish	*Balistes vetula*
Rainbow Parrotfish	*Scarus guacamaia*
Red Grouper	*Epinephelus morio*
Red Hind	*Epinephelus guttatus*
Redband Parrotfish	*Sparisoma aurofrenatum*
Redfin Parrotfish	*Sparisoma rubripinne*
Redlip Blenny[1]	*Ophioblennius atlanticus*
Redspotted Hawkfish[1]	*Amblycirrhitus pinos*
Redtail Parrotfish	*Sparisoma chrysopterum*
Rock Beauty[1]	*Holacanthus tricolor*
Rock Hind	*Epinephelus adscensionis*
Royal Gramma[1]	*Gramma loreto*
Rusty Goby[1]	*Priolepis hipoliti*
Sand Diver	*Synodus intermedius*
Sand Tilefish	*Malacanthus plumieri*
Sargassum Triggerfish[1]	*Xanthichthys rigens*
Schoolmaster	*Lutjanus apodus*
Scrawled Cowfish	*Lactophrys quadricornis*
Scrawled Filefish	*Aluterus scriptus*
Sea Bream	*Archosargus rhomboidalis*
Seahorses[1]	*Hippocampus* spp.
Sergeant Major	*Abudefduf saxatilis*
Sharpnose Puffer[1]	*Canthigaster rostrata*
Sheepshead Porgy	*Calamus penna*
Silk Snapper	*Lutjanus vivanus*
Smooth Trunkfish	*Lactophrys triqueter*

[1] These species were deleted from the fishery management unit proposed in Section 4.1.1 in the Comprehensive Amendment of the Fishery Management Plans of the U.S. Caribbean to Address Required Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Caribbean Fishery Management Council 2004).

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

Caribbean Fishery Management Council (Continued)	
Common Name	**Scientific Name**
Spanish Hogfish[1]	*Bodianus rufus*
Spotfin Butterflyfish[1]	*Chaetodon ocellatus*
Spotted Drum[1]	*Equetus punctatus*
Spotted Goatfish	*Pseudupeneus maculatus*
Spotted Trunkfish	*Lactophrys bicaudalis*
Squirrelfish	*Holocentrus adscensionis*
Stoplight Parrotfish	*Sparisoma viride*
Striped Parrotfish	*Scarus croicensis*
Sunshinefish[1]	*Chromis insolata*
Swissguard Basslet[1]	*Liopropoma rubre*
Threespot Damselfish[1]	*Pomacentrus planifrons*
Tiger Grouper	*Mycteroperca tigris*
Tobaccofish	*Serranus tabacarius*
Tomtate	*Haemulon aurolineatum*
Trumpetfish[1]	*Aulostomus maculatus*
Trunkfish	*Lactophrys trigonus*
Vermilion Snapper	*Rhomboplites aurorubens*
Wenchman	*Pristipomoides aquilonaris*
White Grunt	*Haemulon plumieri*
Whitespotted Filefish	*Cantherhines macrocerus*
Yellow Goatfish	*Mulloidichthys martinicus*
Yellow jack	*Caranx bartholomaei*
Yellowcheek Wrasse[1]	*Halichoeres cyanocephalus*
Yellowedge Grouper	*Epinephelus flavolimbatus*
Yellowfin Grouper	*Mycteroperca venenosa*
Yellowhead Jawfish[1]	*Opistognathus aurifrons*
Yellowhead Wrasse[1]	*Halichoeres garnoti*
Yellowtail Damselfish[1]	*Microspathodon chrysurus*
Yellowtail Snapper	*Ocyurus chrysurus*

[1] These species were deleted from the fishery management unit proposed in Section 4.1.1 in the Comprehensive Amendment of the Fishery Management Plans of the U.S. Caribbean to Address Required Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Caribbean Fishery Management Council 2004).

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

National Marine Fisheries Service (Continued)	
Common Name	**Scientific Name**
Consolidated Highly Migratory Species Fishery Management Plan	
Tuna Fishery Management Unit	
Albacore Tuna	*Thunnus alalunga*
Bigeye Tuna	*Thunnus obesus*
Bluefin Tuna	*Thunnus thynnus*
Skipjack Tuna	*Katsuwonus pelamis*
Yellowfin Tuna	*Thunnus albacares*
Swordfish Fishery Management Unit	
Swordfish	*Xiphias gladius*
Billfish Fishery Management Unit	
Blue Marlin	*Makaira nigricans*
Longbill Spearfish	*Tetrapturus pfluegeri*
Sailfish	*Istiophorus platypterus*
White Marlin	*Tetrapturus albidus*
Large Coastal Sharks	
Blacktip Shark	*Carcharhinus limbatus*
Bull Shark	*Carcharhinus leucas*
Great Hammerhead Shark	*Sphyrna mokarran*
Nurse Shark	*Ginglymostoma cirratum*
Lemon Shark	*Negaprion brevirostris*
Sandbar Shark	*Carcharhinus plumbeus*
Scalloped Hammerhead Shark	*Sphyrna lewini*
Silky Shark	*Carcharhinus falciformis*
Smooth Hammerhead	*Sphyrna zygaena*
Spinner Shark	*Carcharhinus brevipinna*
Tiger Shark	*Galeocerdo cuvier*
Small Coastal Sharks	
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*
Blacknose Shark	*Carcharhinus acronotus*
Bonnethead Shark	*Sphyrna tiburo*
Finetooth Shark	*Carcharhinus isodon*
Pelagic Sharks	
Blue Shark	*Prionace glauca*
Common Thresher Shark	*Alopias vulpinus*
Oceanic Whitetip Shark	*Carcharhinus longimanus*
Porbeagle Shark	*Lamna nasus*
Shortfin Mako Shark	*Isurus oxyrhinchus*

Table 3.9-2: Federally Managed Fish Species within the Study Area, Listed by Regional Management Council under Each Fishery Management Plan (Continued)

National Marine Fisheries Service (Continued)	
Common Name	**Scientific Name**
Prohibited Species[2]	
Atlantic Angel Shark	*Squatina dumeril*
Basking Shark	*Cetorhinus maximus*
Bigeye Thresher Shark	*Alopias superciliosus*
Bigeye Sandtiger Shark	*Odontaspis noronhai*
Bigeye Sixgill Shark	*Hexanchus nakamurai*
Bignose Shark	*Carcharhinus altimus*
Caribbean Reef Shark	*Carcharhinus perezii*
Caribbean Sharpnose Shark	*Rhizoprionodon porosus*
Dusky Shark	*Carcharhinus obscurus*
Galapagos Shark	*Carcharhinus galapagensis*
Longfin mako Shark	*Isurus paucus*
Narrowtooth Shark	*Carcharhinus brachyurus*
Night Shark	*Carcharhinus signatus*
Sand tiger Shark	*Carcharias taurus*
Sevengill Shark	*Heptranchias perlo*
Sixgill Shark	*Hexanchus griseus*
Smalltail Shark	*Carcharhinus porosus*
Whale Shark	*Rhincodon typus*
White Shark	*Carcharodon carcharias*

[2] Prohibited species are those sharks listed that commercial or recreational anglers cannot possess under current regulations.

Table 3.9-3: Major Groups of Marine Fish in the Study Area

Major Marine Fish Groups[1]		Vertical Distribution within Study Area[2]		
Group Names	**Description**	**Open Ocean**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Jawless Fish (Order Myxiniformes and Order Petromyzontiformes)	Primitive jawless fish with an eel-like body shape that feed on dead fish or are parasitic on other fish.	Water column, seafloor	Seafloor	Water column, bottom
Sharks, Skates, Rays, and Chimaeras (Class Chondrichthyes)	Cartilaginous (nonbony) fish, many of which are open-ocean predators.	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, bottom
Sturgeons and Gars (Order Acipenseriformes and Order Lepisosteiformes)	Represent the oldest living group of bony fish; most sturgeon move into freshwater to spawn. Gars are primary freshwater fish that occasionally move into estuaries to feed.	None	Surface (occasional), water column, seafloor	Surface, water column, bottom
Eels and Bonefish (Order Anguilliformes and Order Elopiformes)	Undergo a unique willow leaf-shaped larval stage, with a small head and often an elongated body.	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, bottom
Herrings (Order Clupeiformes)	Commercially valuable schooling plankton eaters, such as herrings, sardines, menhaden, and anchovies. Some herrings migrate between marine and estuarine and freshwater habitats.	Surface, water column	Surface, water column	Surface, water column
Smelts and Salmonids (Orders Argentiniformes, Osmeriformes, and Salmoniformes)	Most salmon and smelts migrate between marine and estuarine and freshwater habitats; Argentiniformes occur in deep waters.	Seafloor (Argen-tiniforme s only), surface, water column	Surface, water column	Surface, water column
Dragonfish and Lanternfish (Orders Stomiiformes and Myctophiformes)	Largest group of deepwater fish; some have adaptations for low-light conditions, including light-emitting capabilities.	Water column, seafloor	Water column, seafloor	None
Greeneyes, Lizardfish, Lancetfish, and Telescopefish (Order Aulopiformes)	Have both primitive and advanced features of marine fish; includes both coastal and estuarine species, as well as deepsea fish that occur in midwaters and along the bottom.	Seafloor	Water column, seafloor	Water column, seafloor
Cods and Cusk-Eels (Orders Gadiformes and Ophidiiformes)	Important commercial fisheries; associated with bottom habitats; includes some deepwater groups. Most have a distinctive barbel (a slender tactile organ) below the mouth.	Water column, seafloor	Water column, seafloor	Surface, water column

[1] Groups are not strictly taxonomic, but are based on the organization applied by (Helfman et al. 2009; Moyle and Cech 1996; Nelson 2006).

[2] Presence in the Study Area includes open ocean areas (portions of the North Atlantic Subtropical Gyre, Labrador Current, and Gulf Stream Current) and coastal waters of several large marine ecosystems: West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea. Representative species from all taxonomic groups occur in each open ocean area and large marine ecosystem; therefore, those areas are not identified in this table, but their vertical distribution within these areas is identified.

Table 3.9-3: Major Groups of Marine Fish in the Study Area (Continued)

Major Marine Fish Groups[1]		Vertical Distribution within Study Area[2]		
Group Names	**Description**	**Open Ocean**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Toadfish and Anglerfish (Orders Batrachoidiformes and Lophiiformes)	Includes the sound-producing toadfish and the anglerfish, classic lie-in-wait predators.	Seafloor	Seafloor	Bottom
Mullets, Silversides, Needlefish, and Killifish (Orders Mugiliformes, Atheriniformes, Beloniformes, and Cyprinodontiformes)	Small nearshore (within 3 nm of shoreline) fish that primarily feed on organic debris; also includes the surface-oriented flyingfish.	Surface	Surface, water column, seafloor	Surface, water column, bottom
Oarfish, Squirrelfish, Dories (Orders Lampridiformes, Beryciformes, Zeiformes)	Primarily open-ocean or deepwater fish, except for squirrelfish, which are reef-associated.	Surface, water column, seafloor	Surface, water column, seafloor	None
Pipefish and Seahorses (Order Gasterosteiformes)	Small mouth, with tubular snout and armor-like scales; males care for young in nests or pouches.	None	Surface, water column, seafloor	Surface, water column, bottom
Scorpionfish (Order Scorpaeniformes)	Bottom dwelling with modified pectoral fins to rest on the bottom. Many are venomous.	Seafloor	Seafloor	Seafloor
Drums, Snappers, Snooks, Temperate Basses, and Reef Fish (Order Perciformes[3], with Representative Families; Sciaenidae, Lutjanidae, Centropomidae, Moronidae, Apogonidae, Chaetodontidae, Pomacanthidae, and Mullidae)	Important gamefish and common predators in all marine waters; sciaenids produce sounds with their swim bladders.	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, bottom
Groupers and Sea Basses (Order Perciformes[3], with Representative Families; Serranidae)	Important gamefish with vulnerable conservation status; in some species, individuals change from female to male as they mature.	Water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Wrasses and Parrotfish (Order Perciformes[3], with Representative Families; Labridae and Scaridae)	Primarily reef-associated fish; in some species, individuals change from female to make as they mature.	Water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor

[1] Groups are not strictly taxonomic, but are based on the organization applied by (Helfman et al. 2009; Moyle and Cech 1996; Nelson 2006).

[2] Presence in the Study Area includes open ocean areas (portions of the North Atlantic Subtropical Gyre, Labrador Current, and Gulf Stream Current) and coastal waters of several large marine ecosystems: West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea. Representative species from all taxonomic groups occur in each open ocean area and large marine ecosystem; therefore, those areas are not identified in this table, but their vertical distribution within these areas is identified.

[3] Order Perciformes includes approximately 40 percent of all bony fish and includes highly diverse fish. Representative families are included here to reflect this diversity.

Table 3.9-3: Major Groups of Marine Fish in the Study Area (Continued)

Major Marine Fish Groups[1]		Vertical Distribution within Study Area[2]		
Group Names	**Description**	**Open Ocean**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
Gobies, Blennies, Damselfish (Order Perciformes[3], with Representative Suborders: Gobioidei, Blennioidei, and Acanthuroidei)	Gobies are the largest and most diverse family of marine fish, mostly found in bottom habitats of coastal areas.	Seafloor	Seafloor	Bottom
Jacks, Tunas, Mackerels, and Billfish (Order Perciformes[3], with Representative Families: Carangidae, Scombridae, Xiphiidae, and Istiophoridae)	Highly migratory predators found near the surface; commercially valuable fisheries.	Surface	Surface, water column	Surface, water column
Flounders (Order Pleuronectiformes)	Flatfish lack swim bladders, are well camouflaged, and occur in bottom habitats throughout the world.	Seafloor	Seafloor	Bottom
Triggerfish, Puffers, and Molas (Order Tetraodontiformes)	Unique body shapes and characteristics to deter predators (e.g., spines); includes ocean sunfish, the largest bony fish.	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor

[1] Groups are not strictly taxonomic, but are based on the organization applied by Helfman et al. (2009); Moyle and Cech (1996); Nelson (2006).

[2] Presence in the Study Area includes open ocean areas (portions of the North Atlantic Subtropical Gyre, Labrador Current, and Gulf Stream Current) and coastal waters of several large marine ecosystems: West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea. Representative species from all taxonomic groups occur in each open ocean area and large marine ecosystem; therefore, those areas are not identified in this table, but their vertical distribution within these areas is identified.

[3] Order Perciformes includes approximately 40 percent of all bony fish and includes highly diverse fish. Representative families are included here to reflect this diversity.

3.9.2 AFFECTED ENVIRONMENT

Many factors impact the abundance and distribution of marine fish in the seven large marine ecosystems (West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean Sea) and three open ocean areas (Labrador Sea, North Atlantic Subtropical Gyre, and Gulf Stream Current) in the Study Area. The distribution of fish species in the Study Area is influenced primarily by temperature, salinity, pH, physical habitat, ocean currents, and latitudinal gradients (Helfman et al. 2009; Macpherson 2002; Nelson 2006). In general terms, the coastal-centered large marine ecosystems support a greater diversity of coastal species, while the open ocean areas support a lower diversity of oceanic and deep-sea species (Helfman et al. 2009; Nelson 2006). The warm waters of the Loop Current in the Gulf of Mexico promote the dispersal of tropical species from the Caribbean Sea into the Northern Gulf of Mexico (Shulman 1985). The circulation patterns of the Gulf Stream and the North Atlantic Subtropical Gyre also influence species distributions, particularly near Bermuda, where the northernmost occurrences of sizable tropical fish assemblages are found (Love and Chase 2007; Moyle and Cech 1996). The Gulf Stream, described in Section 3.0.3 (Ecological Characterization of the Study Area), carries warm water to northern latitudes, where it can support subtropical species. For example, approximately half

of the species occurrences in the Gulf of Maine are considered warm-water fish (Moyle and Cech 1996), although some of these are sporadic or rare.

Marine fish can also be broadly categorized into horizontal and vertical distributions within the water column. The primary ecological groups of fish that occur in the marine environment in the Study Area include the reef community, the unstructured seafloor community, and the surface community (Schwartz 1989). The highest number and diversity of fish typically occur where the habitat is most diverse, including structural complexity (reef systems, continental slopes, deep canyons, currents, temperature), biological productivity (areas of nutrient upwelling), and a variety of physical and chemical conditions (water flow, nutrients, dissolved oxygen, and temperature) (Bergstad et al. 2008; Helfman et al. 2009; Moyle and Cech 1996; Parin 1984; Reshetiloff 2004). Some of the marine fish that occur in the coastal zone migrate between marine and freshwater habitats (Helfman et al. 2009). Other distribution factors, including predator/prey relationships, water quality, and refuge (e.g., physical structure or vegetation cover) operate on more regional or local spatial scales (Reshetiloff 2004). Also, fish may move among habitats throughout their lives based on changing needs during different life stages (Schwartz 1989).

Many habitat and geographic factors impact the distribution of fish within the Study Area—including within range complexes, operating areas (OPAREAs), ports/shipyards, and testing ranges. In the Gulf of Mexico portion of the Study Area, water temperature, seafloor (benthic) habitat, and geographic location appear to be the primary factors (Bowen and Avise 1990), while in the Atlantic Ocean portion, latitudinal changes, temperature, and depth seem to be more important factors influencing species distribution (Gordon 2001; Love and Chase 2007; Macpherson 2002). Each major habitat type in the Study Area (e.g., coral reef, hard bottom, soft bottom, and aquatic beds) supports a fish community associated with it. Also, the number of fish species observed tends to increase with decreasing latitude (transition from north to south) on both sides of the Atlantic; however, this pattern is not as clear for wide-ranging open-ocean species (Macpherson 2002). The specific characteristics of the wide diversity of habitat types within the Study Area are discussed in Section 3.3 (Marine Habitats), Section 3.7 (Marine Vegetation), and Section 3.8 (Marine Invertebrates).

3.9.2.1 Hearing and Vocalization

All fish have two sensory systems to detect sound in the water: the inner ear, which functions very much like the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the fish's body (Popper and Schilt 2008). The inner ear generally detects relatively higher-frequency sounds, while the lateral line detects water motion at low frequencies (below a few hundred Hertz [Hz]) (Hastings and Popper 2005).

Many researchers have investigated hearing and vocalizations in fish species (e.g. Astrup 1999; Astrup and Møhl 1993; Casper et al. 2003; Casper and Mann 2006; Coombs and Popper 1979; Dunning et al. 1992; Egner and Mann 2005; Gregory and Clabburn 2003; Hawkins and Johnstone 1978; Higgs et al. 2004; Iversen 1967, 1969; Jørgensen et al. 2005; Kenyon 1996; Mann et al. 2001; Mann et al. 1997; Mann et al. 2005; Meyer et al. 2010; Myrberg 2001; Nestler 2002; Popper 1981; Popper 2008; Popper and Carlson 1998; Popper and Tavolga 1981; Ramcharitar et al. 2001; Ramcharitar and Popper 2004; Ramcharitar et al. 2004; Ramcharitar et al. 2006; Remage-Healey et al. 2006; Ross et al. 1996; Sisneros and Bass 2003; Song et al. 2006; Wright et al. 2005, 2007). Although hearing capability data only exist for fewer than 100 of the 32,000 fish species, current data suggest that most species of fish detect sounds from 50 to 1,000 Hz, with few fish hearing sounds above 4 kHz (Popper 2008). It is believed that most fish have their best hearing sensitivity from 100 – 400 Hz (Popper 2003). Additionally, some clupeids

(shad in the subfamily Alosinae) possess ultrasonic hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999).

The inner ears of fish are directly sensitive to acoustic particle motion rather than acoustic pressure (for a more detailed discussion of particle motion versus pressure, see Section 3.0.4 (Acoustic and Explosives Primer). Although a propagating sound wave contains both pressure and particle motion components, particle motion is most significant at low frequencies (less than a few hundred Hertz) and closer to the sound source. However, a fish's gas-filled swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear. Fish with swim bladders generally have better sensitivity and better high-frequency hearing than fish without swim bladders (Popper and Fay 2010). Some fish also have specialized structures such as small gas bubbles or gas-filled projections that terminate near the inner ear. These fish have been called "hearing specialists," while fish that do not possess specialized structures have been referred to as "generalists" (Popper et al. 2003). In reality many fish species possess a continuum of anatomical specializations that may enhance their sensitivity to pressure (versus particle motion), and thus higher frequencies and lower intensities (Popper and Fay 2010).

Past studies indicated that hearing specializations in marine fish were quite rare (Amoser and Ladich 2005; Popper 2003). However, more recent studies show there are more fish species than originally investigated by researchers, such as deep sea fish, that may have evolved structural adaptations to enhance hearing capabilities (Buran et al. 2005; Deng et al. 2011). Marine fish families Holocentridae (squirrelfish and soldierfish), Pomacentridae (damselfish), Gadidae (cod, hakes, and grenadiers), and Sciaenidae (drums, weakfish, and croakers) have some members that can potentially hear sound up to a few kHz. There is also evidence, based on the structure of the ear and the relationship between the ear and the swim bladder, that at least some deep-sea species, including myctophids, may have hearing specializations and thus be able to hear higher frequencies (Deng et al. 2011; Popper 1977; Popper 1980), although it has not been possible to do actual measures of hearing on these fish from great depths.

Several species of reef fish tested show sensitivity to higher frequencies (i.e., over 1000 Hz). The hearing of the shoulderbar soldierfish (*Myripristis kuntee*) has a high-frequency auditory range extending toward 3 kHz (Coombs and Popper 1979), while other species tested in this family have been demonstrated to lack this high frequency hearing ability (e.g., Hawaiian squirrelfish [*Adioryx xantherythrus*] and saber squirrelfish [*Sargocentron spiniferum*]). Some damselfish can hear frequencies of up to 2 kHz, but with best sensitivity well below 1 kHz (Egner and Mann 2005; Kenyon 1996; Wright et al. 2005, 2007).

Sciaenid research by Ramcharitar et al. (2006) investigated the hearing sensitivity of weakfish (*Cynoscion regalis*). Weakfish were found to detect frequencies up to 2 kHz. The sciaenid with the greatest hearing sensitivity discovered thus far is the silver perch (*Bairdiella chrysoura*), which has responded to sounds up to 4 kHz (Ramcharitar et al. 2004). Other species tested in the family Sciaenidae have been demonstrated to lack this higher frequency sensitivity.

It is possible that the Atlantic cod (*Gadus morhua,* Family: Gadidae) is also able to detect high-frequency sounds (Astrup and Mohl 1993). However, in Astrup and Møhl's (1993) study it is feasible that the cod was detecting the stimulus using touch receptors that were over driven by very intense fish-finding sonar emissions (Astrup 1999; Ladich and Popper 2004). Nevertheless, Astrup and Møhl (1993) indicated that cod have high frequency thresholds of up to 38 kHz at 185 to 200 decibels (dB) relative to (re)

1 micropascal (µPa), which likely only allows for detection of odontocete's clicks at distances no greater than 33 to 98 feet (ft.) (10 to 30 meters [m]) (Astrup 1999).

Experiments on several species of the Clupeidae (i.e., herrings, shads, and menhadens) have obtained responses to frequencies between 40 kHz and 180 kHz (Astrup 1999); however, not all clupeid species tested have demonstrated this very high-frequency hearing. Mann et al. (1998) reported that the American shad can detect sounds from 0.1 to 180 kHz with two regions of best sensitivity: one from 0.2 to 0.8 kHz, and the other from 25 kHz to 150 kHz. This shad species has relatively high thresholds (about 145 dB re 1 µPa), which should enable the fish to detect odontocete clicks at distances up to about 656 ft. (200 m) (Mann et al. 1997). Likewise, other members of the subfamily Alosinae, including alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and Gulf menhaden (*Brevoortia patronus*), have upper hearing thresholds exceeding 100 to 120 kHz. In contrast, the Clupeidae bay anchovy (*Anchoa mitchilli*), scaled sardine (*Harengula jaguana*), and Spanish sardine (*Sardinella aurita*) did not respond to frequencies over 4 kHz (Gregory and Clabburn 2003; Mann et al. 2001). Mann et al. (2005) found hearing thresholds of 0.1 kHz to 5 kHz for Pacific herring (*Clupyea pallasii*).

Two other groups to consider are the jawless fish (Superclass: Agnatha – lamprey) and the cartilaginous fish (Class: Chondrichthyes – the sharks, rays, and chimeras). While there are some lampreys in the marine environment, virtually nothing is known about their hearing capability. They do have ears, but these are relatively primitive compared to the ears of other vertebrates, and it is unknown whether they can detect sound (Popper and Hoxter 1987). While there have been some studies on the hearing of cartilaginous fish, these have not been extensive. However, available data suggest detection of sounds from 20 to 1,000 Hz, with best sensitivity at lower ranges (Casper et al. 2003; Casper and Mann 2006; Casper and Mann 2009; Myrberg 2001). It is likely that elasmobranchs only detect low-frequency sounds because they lack a swim bladder or other pressure detector.

Most other marine species investigated to date lack higher-frequency hearing (i.e., greater than 1,000 Hz). This notably includes sturgeon species tested to date that could detect sound up to 400 or 500 Hz (Lovell et al. 2005; Meyer et al. 2010) and Atlantic salmon that could detect sound up to about 500 Hz (Hawkins and Johnstone 1978; Kane et al. 2010). Both of these groups of fish have members within the Study Area listed under the ESA.

Bony fish can produce sounds in a number of ways and use them for a number of behavioral functions (Ladich 2008). Over 30 families of fish are known to use vocalizations in aggressive interactions, whereas over 20 families are known to use vocalizations in mating (Ladich 2008). Sound generated by fish as a means of communication is generally below 500 Hz (Slabbekoorn et al. 2010). The air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and radiates sound into the water (Zelick et al. 1999). Sprague and Luczkovich (2004) calculated that silver perch can produce drumming sounds ranging from 128 to 135 dB re 1 µPa. Female midshipman fish apparently use the auditory sense to detect and locate vocalizing males during the breeding season (Sisneros and Bass 2003). Sciaenids produce a variety of sounds, including calls produced by males on breeding grounds (Ramcharitar et al. 2001), and a "drumming" call produced during chorusing by reef fish (McCauley and Cato 2000a). Other sounds produced by chorusing reef fish include "popping," "banging," and "trumpet" sounds; altogether, these choruses produce sound levels 35 dB above background levels, at peak frequencies between 250 and 1,200 Hz, and source levels between 144 and 157 dB re 1 µPa (McCauley and Cato 2000a).

3.9.2.2 General Threats

This section covers the existing condition of marine fish as a resource and presents some of the major threats to that resource within the Study Area. Species-specific threats are addressed for each ESA-listed species. Human impacts are widespread throughout the world's oceans, such that very few habitats remain unaffected by human influence (Halpern et al. 2008b). Marine fish with large body sizes and late maturity ages are especially vulnerable to habitat losses and fishing pressure (Reynolds et al. 2005). For example, large sharks account for 60 percent of the marine fish of conservation concern (International Union for Conservation of Nature 2009). The conservation status of only 3 percent of the world's marine fish species has been evaluated, so the threats to the remaining species are unknown at this point (Reynolds et al. 2005).

Overfishing is the most serious threat that has led to the listing of ESA-protected marine species (Crain et al. 2009; Kappel 2005), with habitat loss also contributing to extinction risk (Cheung et al. 2007; Dulvy et al. 2003; Jonsson et al. 1999; Limburg and Waldman 2009; Musick et al. 2000). Approximately 30 percent of the fishery stocks managed by the United States are overfished (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009). Overfishing occurs when fish are harvested in quantities above a sustainable level. Overfishing impacts both targeted species and nontargeted species (or "bycatch" species) that are often important in marine food webs. Bycatch may also include seabirds, turtles, and marine mammals. In recent decades marine fisheries have targeted species lower on the food web as the abundance of higher-level predators has decreased; some entire marine food webs have collapsed as a result (Crain et al. 2009; Pauly and Palomares 2005). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kuparinen and Merila 2007). Fisheries-induced evolution is a change in genetic composition of the population, such as a reduction in the overall size and individual growth rates resulting from intense fishing pressure. Intrinsic vulnerability describes certain life history traits (e.g., large body size, late maturity age, low growth rate), which increases the susceptibility of a species to overfishing (Cheung et al. 2007).

Another general threat is pollution, which primarily impacts coastal fish near the pollution source. However, global oceanic circulation patterns result in a considerable amount of marine pollutants and debris scattered throughout the open ocean (Crain et al. 2009). Pollutants in the marine environment that may impact marine fish include organic contaminants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil), inorganic chemicals (e.g., heavy metals), and debris (e.g., plastics and waste from dumping at sea) (Pew Oceans Commission 2003). High chemical pollutant levels in marine fish may cause behavioral changes, physiological changes, or genetic damage in some species (Goncalves et al. 2008; Moore 2008; Pew Oceans Commission 2003; van der Oost et al. 2003). Bioaccumulation of metals and organic pollutants is also a concern, particularly in terms of human health, because people consume top predators with potentially high pollutant loads. Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism directly from contaminated water or sediment through the gills or skin, from ingesting food containing the substance (Newman 1998), or from ingestion of the substance itself (Moore 2008).

The physical presence of trash such as abandoned nets and lines also pose a threat to marine fish. Entanglement in abandoned commercial and recreational fishing gear has caused declines for some marine fish; some species, such as sawfish, are more susceptible to entanglement by marine debris than others (Musick et al. 2000).

The 2010 BP *Deepwater Horizon* oil spill in the Gulf of Mexico was a large-scale event that may have impacted marine fish. More than half of all fish species endemic to the Gulf of Mexico have distribution records that overlap the region of the spill (Chakrabarty et al. 2012). The full impacts of this spill are not yet known and federal agencies, along with academic and independent scientists, continue to monitor and evaluate the fate, transport, and impact of the oil (Lubchenco et al. 2010). The primary groups of fish impacted by the spill were surface-oriented species, nearshore (within 3 nm of the shoreline) species, and species whose spawning season coincided with the spill (National Oceanic and Atmospheric Administration 2010a). Fish can be impacted by the oil directly through the gills, or by consuming oil in *Sargassum* (a type of floating seaweed) or oiled prey. Potentially harmful effects include reduced growth, enlarged livers, heart and respiration rate changes, fin erosion, and reproductive impairment. The most damaging effects of oil on fish populations may be in harming eggs and larvae, because these stages of many fish species are highly sensitive to oil at the surface, in the water column, or on the seafloor, and are subject not only to increased mortality, but also to morphological changes (i.e., deformities) and impaired growth (Greer et al. 2012; Ingvarsdottir et al. 2012; Ocean Conservancy 2010a; Restore the Gulf 2010; Tag A Giant Foundation 2010). In addition, the application of dispersants to the oil spill may have caused a decrease in the production of zooplankton (a food source for fish) and fish on the Alabama Shelf by disrupting the flow of carbon to higher trophic levels (Ortmann et al. 2012).

Atlantic bluefin tuna (*Thunnus thynnus*) eggs and larvae were likely impacted by oil-contaminated waters from the *Deepwater Horizon* spill. Larvae and juvenile deaths could result in population declines for species where larvae and juvenile production is the primary limiting factor. However, less than 10 percent of bluefin tuna spawning habitat was covered by surface oil, and less than 12 percent of larval bluefin tuna was located within contaminated waters in the northern Gulf of Mexico during the 2010 spawning season (Muhling et al. 2012). Federally managed fish species in the Gulf of Mexico that were believed to be impacted by the *Deepwater Horizon* spill at the time of the publication of the National Commission Report (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011) are listed in Table 3.9-4.

Table 3.9-4: Federally Managed Fish Species Potentially Impacted by the *Deepwater Horizon* Oil Spill

Common Name	Genus/Species	Nature of *Deepwater Horizon* Oil Spill Impact				
		Damage to individual fish or their Essential Fish Habitat	Oil ingestion within *Sargassum* mats	Coastal nursery habitats	Overlap with peak spawning season	Potential impact to Endangered Species Act- listed species
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*			✓		
Bigeye Thresher Shark	*Alopias superciliosus*	✓				
Blacktip Shark	*Carcharhinus limbatus*			✓		
Bluefin Tuna	*Thunnus thynnus*				✓	
Blue Marlin	*Makaira nigricans*	✓	✓			
Bull Shark	*Carcharhinus leucas*			✓		
Cobia	*Rachycentron canadum*		✓			
Dolphinfish	*Coryphaena hippurus*		✓			
Gag	*Mycteroperca microlepis*	✓				
Gray Triggerfish	*Balistes capriscus*		✓			
Greater Amberjack	*Seriola dumerili*		✓			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*					✓
King Mackerel	*Scomberomorus cavalla*	✓				
Longbill Spearfish	*Tetrapturus pfluegeri*	✓	✓			
Longfin Mako Shark	*Isurus paucus*	✓				
Oceanic Whitetip Shark	*Carcharhinus longimanus*	✓				
Red Drum	*Sciaenops ocellatus*			✓		
Red Snapper	*Lutjanus campechanus*			✓		
Sailfish	*Istiophorus platypterus*		✓			
Sandbar Shark	*Carcharhinus plumbeus*	✓				
Scalloped Hammerhead Shark	*Sphyrna lewini*	✓				
Sailfish	*Istiophorus platypterus*	✓				
Shortfin Mako Shark	*Isurus oxyrhinchus*	✓				
Silky Shark	*Carcharhinus falciformis*	✓				
Smalltooth Sawfish	*Pristis pectinata*					✓
Spanish Mackerel	*Scomberomorus maculatus*	✓				
Spinner Shark	*Carcharhinus brevipinna*			✓		
Swordfish	*Xiphias gladius*	✓				
Tiger Shark	*Galeocerdo cuvier*	✓				
Vermilion Snapper	*Rhomboplites aurorubens*			✓		
Whale Shark	*Rhincodon typus*	✓				
White Marlin	*Tetrapturus albidus*	✓	✓			
Yellowfin Tuna	*Thunnus albacares*	✓				

Sources: (Fodrie and Heck 2011; Losada et al. 2010; National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011; National Oceanic and Atmospheric Administration 2010a, b; Restore the Gulf 2010; Tag A Giant Foundation 2010; U.S. Fish and Wildlife Service 2010).

Note: A checkmark indicates a potential impact from the BP *Deepwater Horizon* oil spill on that species.

Other human-caused stressors on marine fish are invasive species, climate change, aquaculture, energy production, vessel movement, and underwater noise:

- Non-native fish pose threats to native fish when they are introduced into an environment lacking natural predators and then compete with, and prey upon, native marine fish for resources (Crain et al. 2009; Whitfield et al. 2007), such as lionfish in the southeastern United States and the Caribbean.
- Global climate change is contributing to a shift in fish distribution from lower to higher latitudes (Brander 2010; Brander 2007; Dufour et al. 2010; Glover and Smith 2003; Limburg and Waldman 2009; Wilson et al. 2010).
- The threats of aquaculture operations on wild fish populations are reduced water quality, competition for food, predation by escaped or released farmed fish, spread of disease, and reduced genetic diversity (Hansen and Windsor 2006; Kappel 2005; Ormerod 2003). The National Oceanic and Atmospheric Administration is developing an aquaculture policy aimed at promoting sustainable marine aquaculture (National Oceanic and Atmospheric Administration 2011).
- Energy production and offshore activities associated with power-generating facilities results in direct and indirect fish injury or mortality from two primary sources, including cooling water withdrawal that results in entrainment mortality of eggs and larvae and impingement mortality of juveniles and adults (U.S. Environmental Protection Agency 2004) and offshore energy development that results in acoustic impacts (Madsen et al. 2006).
- Vessel strikes pose threats to some large, slow-moving fish at the surface, although this is not considered a major threat to most marine fish (Kappel 2005). Sturgeon, particularly Atlantic sturgeon, are vulnerable to ship strikes (Brown and Murphy 2010). Whale sharks (*Rhincodon typus*), basking sharks (*Cetorhinus maximus*), ocean sunfish (*Mola* species), and manta rays (*Manta birostris*) have also been struck by vessels (National Marine Fisheries Service 2010d; Rowat et al. 2007; Stevens 2007; The Hawaii Association for Marine Education and Research Inc. 2005).
- Underwater noise is a threat to marine fish. However, the physiological and behavioral responses of marine fish to underwater noise (Codarin et al. 2009; Popper 2003; Slabbekoorn et al. 2010; Wright et al. 2010) have been investigated for only a limited number of fish species (Popper and Hastings 2009a, b). In addition to vessels, other sources of underwater noise include pile-driving activity (California Department of Transportation 2001; Carlson et al. 2007b; Feist et al. 1992; Mueller-Blenkle et al. 2010; Nedwell et al. 2003; Popper et al. 2006) and seismic activity (Popper and Hastings 2009a). Information on fish hearing is provided in Section 3.9.2.1 (Hearing and Vocalization), with further discussion in Section 3.9.3.1 (Acoustic Stressors).

The discussion above represents general threats to fish. Additional threats to individual species within the Study Area are described in the accounts of those ESA-listed, ESA-proposed, and ESA-candidate species that follow.

3.9.2.3 Atlantic Salmon (*Salmo salar*)

3.9.2.3.1 Status and Management

The Gulf of Maine distinct population segment of Atlantic salmon was listed as federally endangered in 2000 (FR 65 (223): 69459-69462, November 17, 2000). During 2009, the Gulf of Maine distinct population segment was expanded to include Maine's Penobscot, Kennebec, and Androscoggin Rivers,

which support remnant wild populations of this species. The Atlantic salmon is managed jointly by NMFS and U.S. Fish and Wildlife Service because it occupies both marine and freshwater habitats. Although Atlantic salmon may occur elsewhere (primarily through stocking programs and aquaculture), only the Gulf of Maine distinct population segment of Atlantic salmon is protected under the ESA. For simplicity in the remainder of this document, "Atlantic salmon" refers to the Gulf of Maine distinct population segment. The species has a fishery management plan, and designated Essential Fish Habitat, managed by the New England Fisheries Management Council, but no landings of this species are allowed because of its endangered status.

In 2009, the National Oceanic and Atmospheric Administration recognized 45 areas as critical habitat for the Atlantic salmon, all in Maine, shown in Figure 3.9-1 (FR 73 (173): 51747-51781, September 5, 2008; FR 74 (152): 39903-39907, August 10, 2009). None of the designated areas are in marine waters beyond estuaries. Critical habitat includes all perennial rivers, streams, estuaries, and lakes connected to the marine environment in the 45 designated critical habitat areas, except those areas specifically excluded by tribal, economic, or military uses. The only critical habitat estuary within the Study Area is the Kennebec River Estuary, which has some military exclusions. Specifically, the contractor-owned shipyard at Bath, Maine, has been excluded from designation for reasons of national security (FR 73 (173): 51747-51781, September 5, 2008; FR 74 (152): 39903-39907, August 10, 2009). The primary constituent elements identified for Atlantic salmon critical habitat include: (1) sites for spawning and incubation, (2) sites for juvenile rearing, and (3) sites for migration. Although successful marine migration is also essential to the conservation of the species, NMFS was not able to identify the essential features of marine migration and feeding habitat. Therefore, marine habitat areas were not designated as critical habitat.

3.9.2.3.2 Habitat and Geographic Range

The Atlantic salmon is anadromous (born in freshwater, migrates into saltwater where it grows and matures, then moves back into freshwater as an adult to spawn). Atlantic salmon may occur in small schools in coastal waters primarily in the top 10 ft. (3 m) of the water column, although they may also occasionally move into deeper water (Hedger et al. 2009). Post-smolts (juveniles leaving freshwater rivers) enter the estuarine portion of the Study Area in the Gulf of Maine, primarily at night, during the late spring when water temperatures exceed 50°F (10°C) (Sheehan et al. 2012).

Labrador Current Large Marine Ecosystem. Atlantic salmon post-smolts move out of the Gulf of Maine along the Scotian Shelf Large Marine Ecosystem, reaching the Newfoundland-Labrador Shelf Large Marine Ecosystem and the Grand Banks by mid-summer (Fay et al. 2006; Saunders et al. 1965), as indicated by tag recoveries (McCormick et al. 1998). For much of their first summer at sea, they remain in the coastal waters of Canada, the Southern Grand Banks (Newfoundland-Labrador Shelf Large Marine Ecosystem), the Labrador Sea, and the northern Gulf of St. Lawrence (Reddin and Short 1991). Decreasing nearshore water temperatures in autumn appear to trigger offshore (greater than 3 nm from shoreline) movements of these fish (Dutil and Coutu 1988). They spend their first winter at sea in the Labrador Sea south of Greenland; then, most travel individually toward Greenland, although some may remain in groups. A small percentage of individuals return to Gulf of Maine coastal rivers after their first winter at sea (Fay et al. 2006).

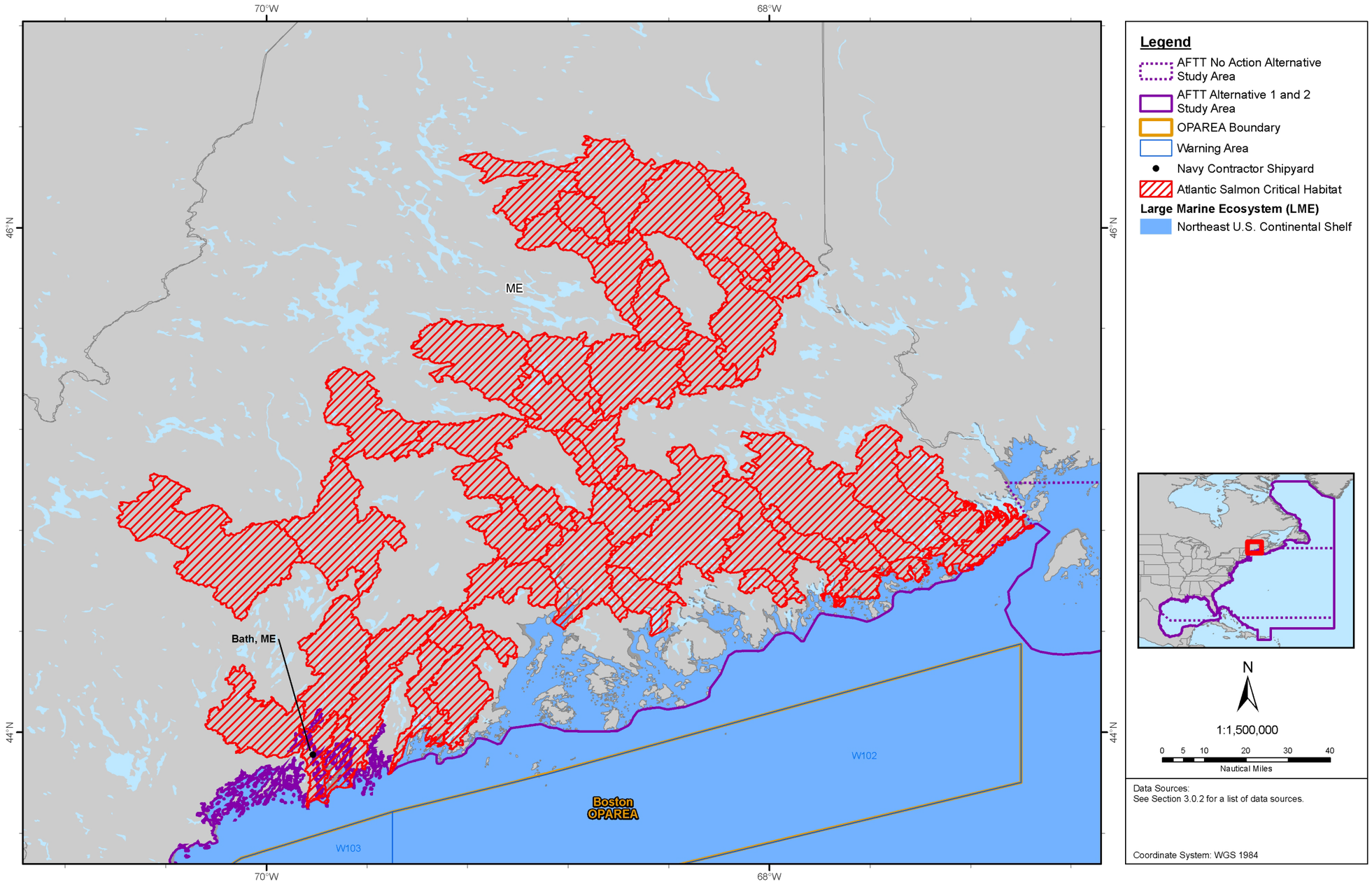

Figure 3.9-1: Critical Habitat Areas for Atlantic Salmon in the Study Area and Adjacent to the Study Area
AFTT: Atlantic Fleet Training and Testing; ME: Maine; OPAREA: Operating Area

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West Greenland Shelf Large Marine Ecosystem. Atlantic salmon migrate great distances in the open ocean to reach feeding areas in the West Greenland Shelf Large Marine Ecosystem and in the Davis Strait between Labrador and Greenland, which is nearly 2,500 miles (mi.) (more than 4,000 km) from their birth rivers (Fay et al. 2006; Reddin and Short 1991; Saunders et al. 1965). North American and European stocks of Atlantic salmon co-occur in these areas while feeding (Fay et al. 2006; Spares et al. 2007). They spend up to 2 years feeding before returning to Gulf of Maine coastal rivers to spawn (Reddin and Short 1991).

Northeast U.S. Continental Shelf Large Marine Ecosystem. The native range of Atlantic salmon in the northwestern Atlantic Ocean is in coastal drainages, from northern Quebec, Canada, to Connecticut. Smolts migrate into marine habitats during approximately 2 weeks each spring, usually during May (McCormick et al. 1998). Spawning adults move into freshwater rivers throughout the spring and summer, with peak movements during June (Fay et al. 2006).

3.9.2.3.3 Population and Abundance

The Gulf of Maine distinct population segment of Atlantic salmon is the last wild population of U.S. Atlantic salmon. Their abundance is low, and either stable or declining. Return rates of smolts to adults from monitored rivers have declined since the mid-to-late 1980s, and indicate low marine survival (Chaput 2012). Estimates of abundance have rarely exceeded 5,000 in any given year since 1967, whereas historical abundances in this same region (excluding the Penobscot River) may have exceeded 100,000 (Fay et al. 2006). Currently, only about 10 percent of the fish in any given river are of natural origin; the rest are escaped aquaculture stocks (Fay et al. 2006; Jonsson et al. 1999; Limburg and Waldman 2009). A conservation hatchery system has slowed the decline and helped stabilize populations at low levels, but it has not increased salmon abundance (FR 74 (117): 29344-29387, June 19, 2009).

3.9.2.3.4 Predator and Prey Interactions

Juvenile salmon feed on a variety of invertebrates in freshwater reaches of coastal rivers for 1 to 3 years before migrating to the ocean (Fay et al. 2006; Jonsson and Jonsson 2004; Lacroix et al. 2004). Mature Atlantic salmon primarily eat fish such as capelin, Atlantic herring, and sand lance (Hansen and Windsor 2006). A variety of organisms feed on Atlantic salmon in both freshwater and marine environments. In coastal waters, Atlantic salmon are particularly vulnerable to predation by seals and cormorants, especially as smolts (Fay et al. 2006; Suuronen and Lehtonen 2012).

3.9.2.3.5 Species-Specific Threats

Incremental increases in marine survival (survival from emigrating smolts to adult return) have a much greater impact on the population than comparable increases in freshwater survival (Legault 2005). However, the factors contributing to low marine survival are not well understood (FR 74 (117): 29344-29387, June 19, 2009). A review of existing studies indicates that mortality during early marine migration varies between 8 and 71 percent with predation being the most common cause in estuaries and river mouths (Thorstad et al. 2012). In recent decades, individuals have grown faster and migrated to sea at a younger age; these smaller smolts are subject to increased mortality at sea (Russell et al. 2012). For stocks feeding in the Norwegian Sea, fluctuations in the phytoplankton community structure may decrease marine survival (Trueman et al. 2012). Sea lice infestation of farmed fish is a major cause of mortality in adult Atlantic salmon (Gargan et al. 2012).

The primary threats impacting the freshwater stages of salmon include restricted fish passage (Baum 1997), degraded water quality and aluminum toxicity (Kroglund et al. 2007), commercial aquaculture (Hansen and Windsor 2006), and reduced spawning habitat (Fay et al. 2006). Increases in freshwater survival could enhance the probability of recovery, but only if marine survival is also improved (FR 74 (117): 29344-29387, June 19, 2009).

3.9.2.4 Largetooth Sawfish (*Pristis pristis*)

The genus *Pristis* includes the smalltooth and largetooth sawfish, both of which are protected under the ESA (Nelson et al. 2004).

3.9.2.4.1 Status and Management

In July 2011, NMFS listed the largetooth sawfish, a type of elasmobranch (shark), as endangered throughout its U.S. range, although the last confirmed record of this species in U.S. waters was from Port Aransas, Texas, in 1961 (FR 76 (133): 40822-40836, July 12, 2011). The largetooth sawfish has undergone severe range reduction in both the northern and southern limits of its former range in the United States (del Monte-Luna et al. 2009; National Marine Fisheries Service 2009a). NMFS determined that there is inadequate management of this species throughout most of its range (FR 74 (144): 37671-37674, July 29, 2009). Until a recovery plan is developed, the smalltooth sawfish recovery plan (National Marine Fisheries Service 2009c) may be used to manage the largetooth sawfish because the species are similar (Seitz and Poulakis 2006). Research has determined that largetooth sawfish recovery may take decades (Simpfendorfer 2000) because of a low rate of population growth. No critical habitat is designated for this species.

3.9.2.4.2 Habitat and Geographic Range

Gulf of Mexico Large Marine Ecosystem. The largetooth sawfish inhabits shallow, subtropical-tropical, estuarine and marine waters in the southwestern portion of the Gulf of Mexico Large Marine Ecosystem, but it is also known from freshwater habitats in large Central American rivers or lake systems outside the Study Area (Wild Earth Guardians 2009). This species moves between freshwater and marine habitats, and some type of dispersal between these systems may be assumed (Thorson 1982).

The largetooth sawfish typically remains close to the bottom of sand or muddy sand, generally in depths less than 35 ft. (11 m) (Charvet-Almeida et al. 2007). The largetooth sawfish can tolerate a range of salinities, moving freely between salinity gradients (FR 74 (144): 37671-37674, July 29, 2009), and is reported in brackish water near river mouths, large embayments, and partially enclosed systems. Largetooth sawfish may occupy deep holes or be found over mud and sand (FR 75 (88): 25174-25184, May 7, 2009). Red mangroves and shallow habitats of varying salinity are important nursery habitats for the largetooth sawfish; these shallow habitats support an abundance of prey (Wild Earth Guardians 2009). The complexity of such habitats also provides juveniles with refuges from larger shark species (FR 74 (144): 37671-37674, July 29, 2009).

3.9.2.4.3 Population and Abundance

The presence of this species in U.S. waters is under review because it has not been documented in the United States in several decades (FR 74 (144): 37671-37674, July 29, 2009). Some largetooth sawfish may rarely and briefly enter U.S. waters along the Texas coast (Wild Earth Guardians 2009). The 2011 decision to list the species as endangered indicates that a U.S. population is presumed to exist, although further research is needed to determine exactly where that population occurs (FR 75 (88): 25174-25184, May 7, 2009).

3.9.2.4.4 Predator and Prey Interactions

The largetooth sawfish uses its saw while foraging, either by stirring up the substrate to expose crustaceans or by stunning and slashing schooling fish (FR 75 (88): 25174-25184, May 7, 2009). Largetooth sawfish (juvenile) have been documented in the stomachs of bottlenose dolphins (Collette and Klein-MacPhee 2002) and bull sharks (Montoya and Thorson 1982).

3.9.2.4.5 Species-Specific Threats

Factors contributing to the decline of the largetooth sawfish include habitat degradation, commercial harvest, gear entanglements, fisheries bycatch, low productivity, and the market for rostral saws (Wild Earth Guardians 2009).

3.9.2.5 Smalltooth Sawfish (*Pristis pectinata*)

The genus *Pristis* includes both the smalltooth sawfish and largetooth sawfish, both of which are protected under the ESA (Nelson et al. 2004).

3.9.2.5.1 Status and Management

The smalltooth sawfish was once common in the Gulf of Mexico and along the east coast of the United States. Today, the severely depleted population is restricted mostly to southern Florida (Poulakis and Seitz 2004; Simpfendorfer 2002; Simpfendorfer and Wiley 2005, 2006). The distinct population segment of smalltooth sawfish in the United States, between Florida and Cape Hatteras, North Carolina, was listed as endangered under the ESA by NMFS in 2003 and by the U.S. Fish and Wildlife Service in 2005; it is co-managed by both agencies (National Marine Fisheries Service 2010b).

In 2009, NMFS designated critical habitat for smalltooth sawfish at two locations; the Charlotte Harbor Estuary and the Ten Thousand Islands portion of the Everglades (FR 74 (169): 45353-45359, September 2, 2009). Most of this designated critical habitat lies in the boundaries of the federally managed Everglades National Park, Rookery Bay Aquatic Preserve, and Cape Romano-Ten Thousand Islands Aquatic Preserve (National Marine Fisheries Service 2009c). The Key West Range Complex does not overlap these critical habitat areas; the northeastern boundary (W-174) of the Key West Range Complex is within approximately 9 nautical miles (nm) of critical habitat at its closest point, as shown in Figure 3.9-2.

The primary constituent elements of smalltooth sawfish critical habitat are designated as red mangroves and shallow habitats characterized by variable salinities with water depths between the mean high water line and 3 ft. (0.9 m) measured at mean lower low water (FR 74 (169): 45353-45359, September 2, 2009).

3.9.2.5.2 Habitat and Geographic Range

The smalltooth sawfish typically inhabits shallow subtropical or tropical estuarine and marine waters. It remains close to the bottom, in deep holes of sand or muddy sand, or over limestone hard bottom, coral reefs, and live bottoms (Poulakis and Seitz 2004). Nursery areas are in shallow nearshore regions and estuaries, especially in mangrove habitat (National Marine Fisheries Service 2010b; Seitz and Poulakis 2006; Simpfendorfer and Wiley 2005). Mangrove prop roots provide refuge from predators, and the sawfish's compressed body allows it to navigate very shallow waters (3 ft. [1 m]) that typically exclude large sharks (National Marine Fisheries Service 2009c). Young-of-the-year sawfish (less than 39 inches [in.] or 100 centimeters [cm]) have been observed swimming in only a few inches of water (National Marine Fisheries Service 2009c). Juvenile smalltooth sawfish exhibit a high site fidelity to nearshore

areas, often residing in one area between 15 and 55 days (Simpfendorfer 2006). Larger individuals may occur down to 400 ft. (120 m) (Poulakis and Seitz 2004; Simpfendorfer 2006), although tagging studies indicate that adults spend more time in shallow water than previously suspected, and are only occasionally found in deeper waters (Simpfendorfer and Wiley 2005). The smalltooth sawfish may also be associated with sea fans, artificial reefs, and offshore drilling platforms (Poulakis and Seitz 2004).

Southeast U.S. Continental Shelf Large Marine Ecosystem. The smalltooth sawfish occurs in large rivers and estuaries (e.g., St. Johns River) in the Southeast U.S. Continental Shelf Large Marine Ecosystem in the Study Area, but its present geographic range in this ecosystem is primarily limited to southern Florida. Historic records indicate that this species may have made seasonal migrations northward along the Atlantic coast during summer (Simpfendorfer et al. 2008). However, because encounters north of Florida are infrequent, the species is believed to no longer migrate (Simpfendorfer and Wiley 2006).

Gulf of Mexico Large Marine Ecosystem. The smalltooth sawfish also occurs in large rivers and estuaries in the Gulf of Mexico Large Marine Ecosystem in the Study Area (e.g., Mississippi River), particularly at river mouths FR 74 (169): 45353-45359, September 2, 2009 (National Marine Fisheries Service 2009c; Simpfendorfer 2002).

3.9.2.5.3 Population and Abundance

No estimates of the size of the smalltooth sawfish population are available. The best available data suggest that the current population is a small fraction of its historical size (National Marine Fisheries Service 2010b; Simpfendorfer 2006). Limited scientific survey data are available for this species, but dockside surveys of recreational anglers in Everglades National Park, beginning in 1972, suggest that the population there has at least stabilized, and may be increasing. Between 1989 and 2004, the population increased by approximately 5 percent per year (Carlson et al. 2007a).

3.9.2.5.4 Predator and Prey Interactions

The smalltooth sawfish feeds primarily at night (National Marine Fisheries Service 2009c) and uses its saw while feeding to stir the substrate to expose crustaceans or to stun and slash schooling fish (FR 74 (169): 45353-45359, September 2, 2009). Smalltooth sawfish, particularly juveniles, are preyed upon by bull sharks and other sharks occurring in shallow coastal waters.

3.9.2.5.5 Species-Specific Threats

Factors contributing to the decline of the smalltooth sawfish are the same as for the largetooth sawfish (Section 3.9.2.4.5, Species-Specific Threats): habitat degradation, commercial harvest, gear entanglements, fisheries bycatch, low productivity, and the market for rostral saws (Wild Earth Guardians 2009). Sawfish are easily entangled in abandoned or derelict fishing gear and other plastic debris is an ongoing major threat to the species (National Marine Fisheries Service 2009c). Incidental take as bycatch in various fisheries (especially gill nets) has also contributed to their decline (Musick et al. 2000). People continue to kill smalltooth sawfish by removing the rostral saw or shooting them with firearms (Seitz and Poulakis 2006).

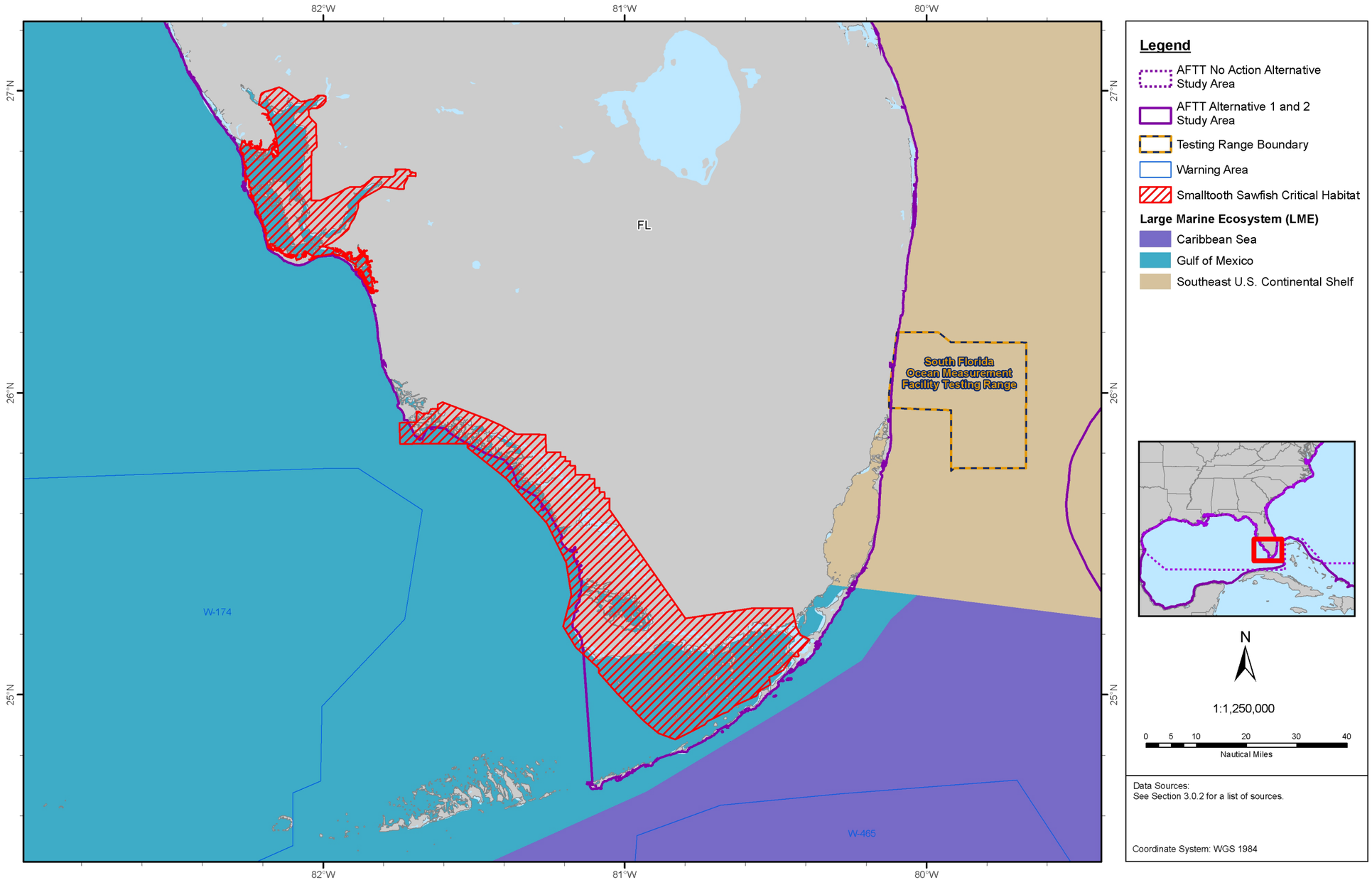

Figure 3.9-2: Critical Habitat Areas for Smalltooth Sawfish in the Study Area and Adjacent to the Study Area
AFTT: Atlantic Fleet Training and Testing; FL: Florida

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3.9.2.6 Shortnose Sturgeon (*Acipenser brevirostrum*)

3.9.2.6.1 Status and Management

In 1967, the shortnose sturgeon was listed as endangered under the Endangered Species Preservation Act of 1966, which predated the ESA; this species remains on the list as endangered throughout its range along the Atlantic coast (National Marine Fisheries Service 1998). No critical habitat is designated for this species.

NMFS manages 19 distinct population segments of the anadromous shortnose sturgeon (National Marine Fisheries Service 1998); those occurring in rivers and estuaries of the Study Area are listed below:

- Kennebec River System (including the Sheepscot, Kennebec, and Androscoggin Rivers), Maine
- Hudson River, New York
- Delaware River, Delaware, New Jersey, New York, and Pennsylvania
- Chesapeake Bay and Potomac River, Maryland and Virginia
- St. Marys River, Georgia
- St. Johns River, Florida

3.9.2.6.2 Habitat and Geographic Range

After hatching in upstream reaches of rivers, shortnose sturgeon larvae orient into the river current and away from light sources, generally staying near the bottom and seeking cover. By two weeks of age, the larvae emerge from cover and swim in the water column, moving downstream from the spawning site. By two months, juvenile behavior becomes similar to adults, with active swimming in a wide range of thermal conditions (Deslauriers and Kieffer 2012) and foraging at night along the bottom (Richmond and Kynard 1995).

The shortnose sturgeon primarily occurs in freshwater rivers and coastal estuaries of the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems, occasionally moving short distances to the mouths of estuaries and into the nearshore coastal waters (Dadswell 2006; National Marine Fisheries Service 1998). In estuarine systems, juveniles and adults occupy areas with little or no current over a bottom composed primarily of mud and sand (Secor et al. 2000). Adults are found in deep water (35–100 ft. [10 –30 m]) in winter and in shallow water (7–35 ft. [2–10 m]) during summer (Welsh et al. 2002). Individual shortnose sturgeon do not disperse far along the coastline beyond their home river estuaries (National Marine Fisheries Service 1998). Based on this information, the shortnose sturgeon is not expected to occur in the open-ocean portion of the Study Area, and its potential occurrence in the Study Area is concentrated within the bays and estuaries associated with each distinct population segment.

3.9.2.6.3 Population and Abundance

Certain subpopulations of the shortnose sturgeon have increased substantially in recent years, particularly in the Hudson River (Bain 1997; Stein et al. 2004). Several strong cohorts had higher than expected survival during the 1980s and 1990s, then recovery slowed during the late 1990s (Woodland and Secor 2007). Abundances in the Hudson River population exceed recovery criteria (Bain et al. 2007; Woodland and Secor 2007). The Delaware River supports a well-documented population (8,445 individuals) (Welsh et al. 2002), but the abundance of the Chesapeake Bay and Potomac River population is not known.

3.9.2.6.4 Predator and Prey Interactions

Feeding patterns of the shortnose sturgeon vary seasonally between northern and southern river systems. In northern rivers, some sturgeon feed in freshwater during summer and over sand-mud bottoms in the lower estuary during fall, winter, and spring (National Marine Fisheries Service 1998). In contrast, in southern rivers, feeding has been observed during winter at or just downstream of where saltwater and freshwater meet (Kynard 1997). Shortnose sturgeon in the Southeast U.S. Continental Shelf Large Marine Ecosystem reduce their feeding activity during summer months (National Marine Fisheries Service 1998; Sulak and Randall 2002).

The shortnose sturgeon feeds by suctioning polychaetes (marine worms), crustaceans, molluscs, and small fish from the bottom (National Marine Fisheries Service 1998; Stein et al. 2004). Young-of-the-year sturgeon (individuals less than one year old) have been found in the stomachs of yellow perch (National Marine Fisheries Service 1998); predation on older sturgeon is not well-documented, although sharks likely prey on them in the marine environment (National Marine Fisheries Service 1998).

3.9.2.6.5 Species-Specific Threats

Principal causes of the shortnose sturgeon's decline include pollution, overharvesting in commercial fisheries (including bycatch in the shad fishery), and its resemblance to the formerly commercially valuable Atlantic sturgeon (Bain et al. 2007; National Marine Fisheries Service 1998). Other risk factors include poaching (northern rivers); accidental introduction of exotic species; very low productivity; freshwater spawning and nursery areas destroyed or degraded because of human-caused dissolved oxygen reductions; contaminants (e.g., heavy metals, pesticides, and organochlorine compounds); siltation from dredging, bridge construction, and demolition; impingement on power plant cooling water intake screens; impoundment operations; and hydraulic dredging operations (Collins et al. 2000; National Marine Fisheries Service 1998).

3.9.2.7 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

The Gulf sturgeon and the Atlantic sturgeon are members of the same species but do not overlap geographically. The ESA-listed Atlantic sturgeon is discussed in Section 3.9.2.8 (Atlantic Sturgeon [*Acipenser oxyrinchus oxyrinchus*]).

3.9.2.7.1 Status and Management

The Gulf sturgeon was federally listed in 1991 as threatened throughout its entire range in the Gulf of Mexico Large Marine Ecosystem (Florida, Alabama, Louisiana, and Mississippi) and is managed by both NMFS and U.S. Fish and Wildlife Service. All U.S. fisheries for the species have been closed since its listing. A recovery plan published for the Gulf sturgeon in 1995 reported that, bycatch along the gulf coast was a major source of mortality (U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission 1995). Management efforts to reduce this bycatch include requiring gear modifications in nearshore trawl fisheries (Smith and Clugston 1997). In a five-year review published in 2009, NMFS and U.S. Fish and Wildlife Service concluded that the Gulf sturgeon was stable, indicating that 26 to 50 percent of recovery objectives have been achieved (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009).

In 2003, NMFS designated critical habitat for Gulf sturgeon. Primary constituent elements that were identified for the conservation of the Gulf sturgeon include the following:

- Abundant food items, such as detritus, aquatic insects, worms, or molluscs, within riverine habitats for larval and juvenile life stages; and abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs or crustaceans, within estuarine and marine habitats, and substrates for subadult and adult life stages.
- Riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay.
- Riverine aggregation areas, also referred to as resting, holding, and staging areas, used by adults, subadults, or juveniles, generally, but not always, located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during freshwater residency and possibly for osmoregulatory functions.
- A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment, including migration, breeding site selection, courtship, egg fertilization, resting, and staging, and for maintaining spawning sites in suitable condition for egg attachment, egg sheltering, resting, and larval staging.
- Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.
- Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.
- Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage).

Most of these primary constituent elements are not applicable to the marine portions of the Study Area. Only the Panama City OPAREA overlaps with Gulf sturgeon critical habitat (Figure 3.9-3). This critical habitat (Unit 11) encompasses Florida nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida. Unit 11 is important because it provides migration habitat for Gulf sturgeon *en route* from Gulf of Mexico winter and feeding grounds to their spring and summer natal (hatching) rivers (the Yellow, Choctawhatchee, and Apalachicola Rivers). Gulf sturgeon remain within 1 mi. (1.6 km) of the coastline between Pensacola Bay and Apalachicola Bay, in depths of less than 20 ft. (6 m) during the winter (Fox et al. 2000; Fox et al. 2002; U.S. Fish and Wildlife Service 2009).

3.9.2.7.2 Habitat and Geographic Range

Gulf of Mexico Large Marine Ecosystem. The anadromous Gulf sturgeon occurs only in the Gulf of Mexico Large Marine Ecosystem in rivers, bays, and estuaries from Florida to Louisiana (National Marine Fisheries Service 2010a). Telemetry studies suggest that the Gulf sturgeon occurs in nearshore marine waters from about October to February (Robydek and Nunley 2012); its distribution is likely influenced by the availability of preferred prey (Ross et al. 2009), particularly within the Suwannee River estuary and vicinity (Harris et al. 2005). Young-of-the-year use rivers as nursery areas, especially sandbars and sand shoals in shallow areas (Carr and Carr 1996). Juveniles also prefer habitats consisting of sand or vegetated areas (Wakeford 2001). While juveniles can tolerate high salinities for extended durations, they appear to make only infrequent use of estuarine waters (Sulak et al. 2009). Inshore areas are likely important nursery habitats for younger fish (Ross et al. 2009).

Adult Gulf sturgeon leave the Study Area and return to the freshwater reaches of their natal rivers to spawn (Edwards et al. 2003; Heise et al. 2004; Rogillio et al. 2007). They migrate in spring from the estuarine and marine waters of the northern Gulf of Mexico to riverine habitat (including the Suwannee River, other major Florida rivers [e.g., Apalachicola, Escambia, and Choctawhatchee Rivers], and the Pascagoula River drainage system [Mississippi]) as water temperatures begin to warm from 64°F to 72°F (18°C to 22°C) (Chapman and Carr 1995; Craft et al. 2001; Fox et al. 2000; Wooley and Crateau 1985). Gulf sturgeon may also spawn during autumn in some river systems, such as the Suwannee (Randall and Sulak 2012). They migrate downstream when waters once again cool (September to November); by December, all except the young-of-the-year Gulf sturgeon have returned to the Gulf of Mexico (Carr and Carr 1996; Foster and Clugston 1997; Smith and Clugston 1997). Some studies in the Mississippi Sound have reported a fall migration into marine waters during October and November (Heise et al. 2004; Rogillio et al. 2007; Ross et al. 2009).

Once Gulf sturgeon leave freshwater rivers, they are typically found within 1,000 m (3,280 ft.) of the shoreline (Robydek and Nunley 2012) and they often remain in estuaries and nearshore bays in water less than 35 ft. (10 m) deep (Ross et al. 2009). Coastal foraging grounds include barrier island inlets with strong tidal currents and estuaries less than 7 ft. (2 m) deep with clean sand substrate (Fox et al. 2002; Harris et al. 2005; Ross et al. 2009). Some individuals, particularly females between spawning years (Fox et al. 2002; Ross et al. 2009), move into deeper offshore waters for short periods during cold weather (Sulak et al. 2009). No tagged individuals have been detected in offshore waters deeper than 33 ft. (10 m). However, some individuals may move offshore without being detected (Ross et al. 2009).

Tagging data from December 2003 to April 2004 indicate that Gulf sturgeon spent the winter near beaches of northwestern Florida. Two individuals were tracked moving along the coast southeast of the mouth of St. Andrew Bay (U.S. Fish and Wildlife Service 2004). Relocation data from December 2005 to April 2006 indicate Gulf sturgeon movements northeast of the mouth of St. Andrew Bay. Relocated fish occurred in water depths ranging from 12 to 40 ft. (4 to 12 m) and from 0.5 to 2 mi. (from 0.8 to 3.2 km) offshore (U.S. Fish and Wildlife Service 2006). Researchers suspected that the relocated fish were feeding on prey associated with fine sand and shell hash substrates (U.S. Fish and Wildlife Service 2006).

3.9.2.7.3 Population and Abundance

Overall, Gulf sturgeon populations are either stable or are slowly increasing, with seven river systems containing reproducing populations; the Suwannee River in particular seems to be recovering well (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009). Population size in the Escambia River system may have declined following a hurricane. Population estimates in the western end of the Gulf sturgeon's range—such as the Pearl and Pascagoula Rivers—are lacking because research has been limited in those systems since hurricanes Ivan (2004) and Katrina (2005) (Rogillio et al. 2007).

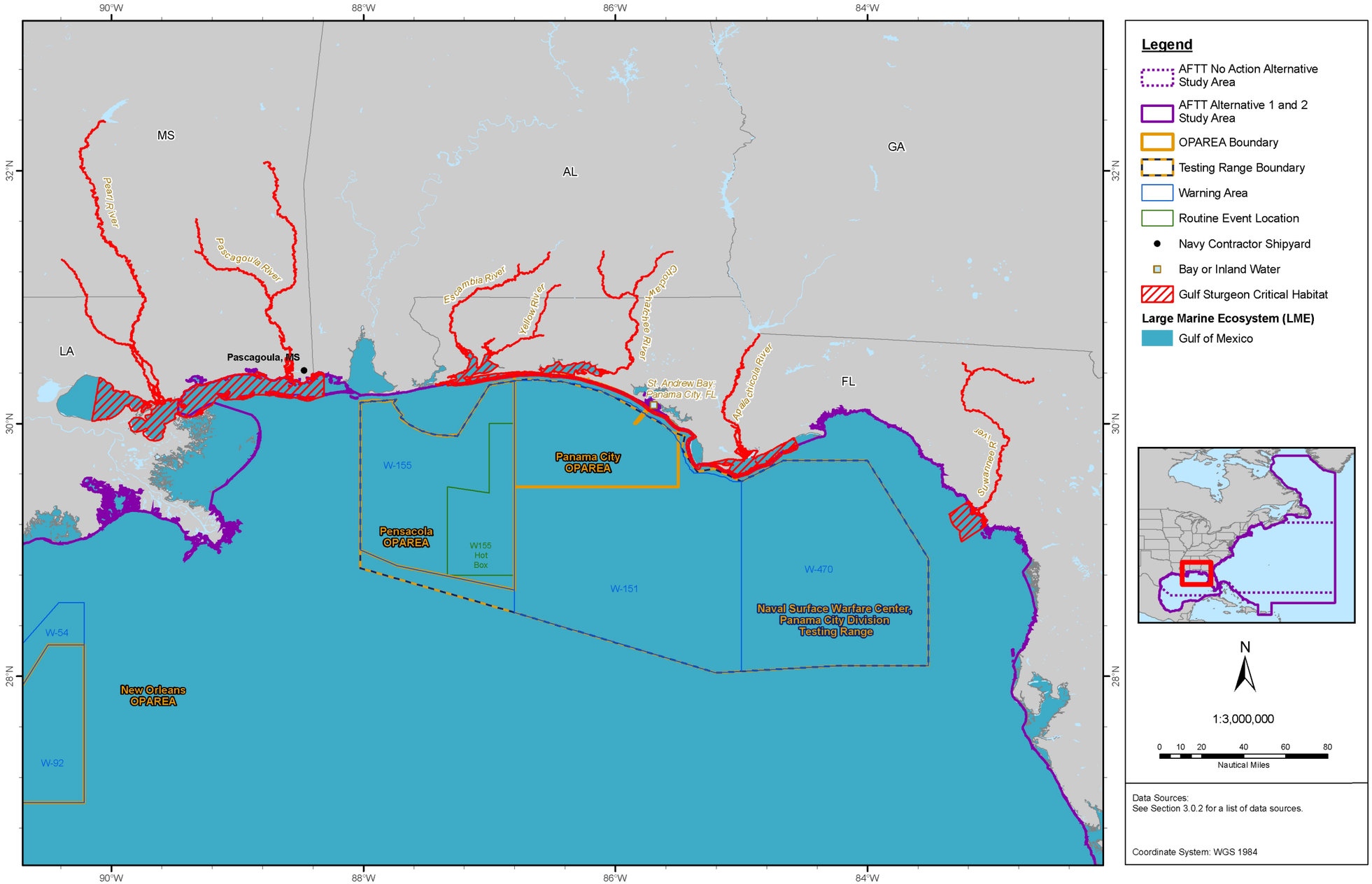

Figure 3.9-3: Critical Habitat Areas for Gulf Sturgeon in and Adjacent to the Study Area

AFTT: Atlantic Fleet Training and Testing; AL: Alabama; FL: Florida; GA: Georgia; LA: Louisiana; MS: Mississippi; OPAREA: Operating Area

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3.9.2.7.4 Predator and Prey Interactions

Feeding habits vary depending on life stage, but in general the Gulf sturgeon is considered an opportunistic feeder (feeding on whatever food is available). Subadults and adults typically do not feed while in freshwater, and may lose from 12 to 30 percent of their body weight during their freshwater stay. However, Sulak et al. (2012) presented evidence of feeding in freshwater systems (Suwannee River) using carbon isotopes. In estuarine and marine habitats, they eat a wide range of invertebrates associated with the bottom, including amphipods, lancelets, polychaetes, gastropods, shrimp, crabs, isopods, molluscs, and crustaceans (U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission 1995; U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009). Sand dollars and annelids may also be preyed upon during winter off the barrier islands of Mississippi Sound (Ross et al. 2009). Off the Suwannee River, adults primarily feed on brachiopods, brittle stars, amphipods, and ghost shrimp (Carr et al. 1996; Harris et al. 2005).

Sharks likely prey on all species of sturgeon while they are in the marine environment (National Marine Fisheries Service 1998).

3.9.2.7.5 Species-Specific Threats

Overfishing, habitat loss, and degradation have contributed to the current status of this subspecies. Habitat threats include damming of major rivers (e.g., Pearl, Alabama, and Apalachicola) that prevents upstream spawning, dredged material disposal, channel maintenance, oil and gas exploration, shrimp trawling, and water quality degradation (pesticides, heavy metals, and other agricultural and industrial contaminants) (Smith and Clugston 1997; U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission 1995; U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009). Other threats include potential hybridization with nonnative sturgeon from aquaculture farms and diseases spread by farmed sturgeon (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009).

3.9.2.8 Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

The Atlantic and Gulf sturgeon are conspecific subspecies (members of the same species). The two fish have similar reproductive and feeding life history but do not overlap geographically. The Atlantic sturgeon is described below.

3.9.2.8.1 Status and Management

NMFS was petitioned to list the Atlantic sturgeon under the ESA in 2009. In 2010, NMFS found that the petition presented substantial scientific or commercial information indicating that listing may be warranted (FR 75 (3): 838-841, January 6, 2010). After completing an ESA status review of the Atlantic sturgeon, NMFS issued two final rules on 6 February 2012—one for the Southeast Region, listing the Carolina and South Atlantic distinct population segments as endangered (FR 77 (24): 5914-5982, February 6, 2012); the other for the Northeast Region, listing the Gulf of Maine distinct population segment as threatened and the Chesapeake and New York Bight distinct population segments as endangered (FR 77 (24): 5880-5912, February 6, 2012).

The Atlantic sturgeon is also managed under a fishery management plan implemented by the Atlantic States Marine Fisheries Commission, but a coast-wide moratorium on its harvest is in effect (Greene et al. 2009). NMFS augmented the Atlantic States Marine Fisheries Commission moratorium with a similar moratorium for federal waters. Amendment 1 to Atlantic States Marine Fisheries Commission's Atlantic Sturgeon Fishery Management Plan also includes measures for preservation of existing habitat, habitat

restoration and improvement, monitoring of bycatch and stock recovery, and breeding and stocking protocols (FR 75 (3): 838-841, January 6, 2010).

3.9.2.8.2 Habitat and Geographic Range

As an anadromous fish, mature Atlantic sturgeon undergo seasonal migrations between freshwater habitats, where they spawn, and marine waters, where they forage and grow. During nonspawning years, adults remain in marine waters either year-round or seasonally (Bain 1997). Spawning adults migrate upriver in spring, beginning in February in the south, April in the mid-Atlantic, and May in Canadian waters (Dadswell 2006). After spawning in freshwater in the spring and early summer, adults migrate back into estuarine and marine waters. Tagging data indicate that immature Atlantic sturgeon disperse widely once they move into coastal waters (Secor et al. 2000). Dispersal is extensive: north and south along the Atlantic coast and seaward to the edge of the continental shelf (Bain 1997).

In the United States, Atlantic sturgeon can occur as far north as the St. Croix River in Maine, and as far south as the St. Johns River in Florida. Atlantic sturgeon juveniles in the Northeast U.S. Continental Shelf and Scotian Shelf Large Marine Ecosystems may occur in salinities ranging from 5 to 25 parts per thousand in estuaries, usually over a mud-sand bottom (Dadswell 2006). Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (35–165 ft. [10–50 m]) inshore areas of the continental shelf where they feed (FR 75 (3): 838-841, January 6, 2010). In a 2004 study using fisheries bycatch data, Atlantic sturgeon were found to be strongly associated with specific coastal areas, such as the mouths of Narragansett Bay and Chesapeake Bay and the inlets of the North Carolina Outer Banks; most fish were caught within a narrow range of depths (30–160 ft. [10–50 m]) over gravel and sand, and to lesser extent, silt and clay (Stein et al. 2004).

3.9.2.8.3 Population and Abundance

Between 7 and 10 genetically distinct populations along the U.S. Atlantic coast can be statistically differentiated (Stein et al. 2004). Abundance estimates are available for only two of these populations — the Hudson River (New York) (9,500 juveniles) and the Altamaha River (Georgia) (2,000 subadults)— although these data are from 1995 (National Marine Fisheries Service 2009a). The mean annual spawning stock size has been estimated at 870 individuals, although about half of the Hudson River population may be of hatchery origin (National Marine Fisheries Service 2007). The Altamaha River supports one of the healthiest Atlantic sturgeon populations in the southeast, which appears to be stable (Peterson et al. 2008). The status of the other Atlantic sturgeon populations varies widely, from the large but possibly declining Hudson River population, to small groups of survivors of a once robust population that has undergone considerable decline (Delaware River), to apparently locally extinct (Maryland tributaries of Chesapeake Bay and St. Johns River, Florida) (National Marine Fisheries Service 2007; Waldman and Wirgin 1998).

3.9.2.8.4 Predator and Prey Interactions

Like all sturgeon, the Atlantic sturgeon feeds along the bottom on invertebrates such as isopods, crustaceans, worms, and molluscs (National Marine Fisheries Service 2010c). It has also been documented to feed on fish (Bain 1997). Evidence of predation on sturgeon is scarce, but some researchers believe they are taken by the American alligator (*Alligator mississippiensis*), alligator gar (*Atractosteus spatula*), and striped bass (*Morone saxatilis*) (Dadswell 2006). Sharks likely prey on all species of sturgeon in the marine environment (National Marine Fisheries Service 1998).

3.9.2.8.5 Species-Specific Threats

Historical overfishing resulted in declines in Atlantic sturgeon abundance. Atlantic sturgeon bycatch is the most substantial threat in the ocean environment (National Marine Fisheries Service 2009a). Other threats include the marine parasitic copepod (*Dichelesthium oblongum*), which has been observed on up to 93 percent of the sturgeon sampled in the New York Bight during 2007 to 2008. Substantially higher parasite burdens, stress, and reduced physiological condition associated with Atlantic sturgeon in areas of sewage contamination may have negative impacts on juvenile Atlantic sturgeon (Fast et al. 2009). Vessel strikes (Brown and Murphy 2010) and degraded water quality (Collins et al. 2000) have also been noted as threats to this species.

3.9.2.9 Cusk (*Brosme brosme*)

3.9.2.9.1 Status and Management

The cusk was designated as a candidate species under the ESA in 2007, largely based on survey data indicating a declining trend in abundance (O'Brien 2006). Since the 1960s, cusk landings have declined by approximately 90 percent, and the mean length of cusk has decreased from 25.2 in. (64 cm) to 19.7 in. (50 cm) (O'Brien 2006). However, because the status review for this species is still underway, no conservation or management plans are in place for cusk in the United States (National Marine Fisheries Service 2009b).

3.9.2.9.2 Habitat and Geographic Range

The cusk is limited geographically by its need for cold water; it ranges only as far south as the Northeast U.S. Continental Shelf Large Marine Ecosystem around New Jersey (National Marine Fisheries Service 2009b). The cusk also occurs around the Scotian Shelf Large Marine Ecosystem (National Marine Fisheries Service 2009b), the Strait of Belle Isle and on the Grand Banks of Newfoundland in the Newfoundland-Labrador Shelf Large Marine Ecosystem (National Marine Fisheries Service 2009b), and infrequently at the southern tip of Greenland in the Labrador Current Open Ocean Area (National Marine Fisheries Service 2009b).

Cusk inhabit small shoals on rock, pebble, and gravel bottoms at depths between 60 and 1,805 ft. (20 and 550 m) (Collette and Klein-MacPhee 2002) and temperatures ranging from 32°F to 50°F (0°C to 10°C) (National Marine Fisheries Service 2009b). Cusk eggs are buoyant; after hatching, larvae remain near the surface, then settle to the bottom as 2 in. (5 cm) juveniles (Fisheries and Oceans Canada 2004). Adult cusk are solitary and remain in offshore waters; they are rarely captured in waters less than 65 to 100 ft. (20 to 30 m) deep (Knutsen et al. 2009). Unlike other cods, cusk rarely leave the seafloor, and do not disperse very far once settled into a particular habitat area (Collette and Klein-MacPhee 2002).

3.9.2.9.3 Population and Abundance

Fisheries data indicate substantial decreases in biomass and abundance of cusk, most likely because of fishery harvest; U.S. landings dropped from approximately 4,200 tons (3,800 metric tons) in the early 1980s to 87 tons (79 metric tons) in 2004 (Collette and Klein-MacPhee 2002; National Marine Fisheries Service 2009b). Very little fisheries-independent data exists for this species.

3.9.2.9.4 Predator and Prey Interactions

The cusk feeds primarily on crustaceans and shellfish, fish (including flatfish and gurnard), and occasionally on sea stars. However, little information is available on its diet because most cusk have emptied their stomach contents by the time they reach the surface, making stomach-content analysis

very difficult (Fisheries and Oceans Canada 2004). The primary food composition (by percent weight) is crustaceans (51 percent), fishes (16 percent), and echinoderms (15 percent), with some variation by region (Collette and Klein-MacPhee 2002). The most frequent predator of cusk are spiny dogfish (*Squalus acanthias*), but other fish (cods, hakes, skates, and flounders) and marine mammals (hooded seal [*Cystophora cristata*] and gray seal [*Halichoerus grypus*]) also feed on cusk (Collette and Klein-MacPhee 2002).

3.9.2.9.5 Species-Specific Threats

Threats to cusk are poorly understood. Bycatch of cusk by commercial fisheries targeting cod and haddock is likely the primary cause of decline in both the United States and Canada (Fisheries and Oceans Canada 2004; National Marine Fisheries Service 2009b). Canada established a bycatch limit of 1,000 tons of cusk in 1999, and reduced the limit to 750 tons of cusk in 2003 (Crozier et al. 2004). Deepwater seismic testing within cusk habitat by the oil and gas industry could impact fish closely associated with the seafloor (Fisheries and Oceans Canada 2011).

3.9.2.10 American Eel (*Anguilla rostrata*)

3.9.2.10.1 Status and Management

American eel are currently under petition as a candidate for listing under the ESA by the U.S. Fish and Wildlife Service because they have undergone substantial declines throughout their range (FR 76 (189): 60431-60444, September 29, 2011). Determining status trends is challenging because the available data are limited to a few locations that may not represent the entire range for this species (Wirth and Bernatchez 2003). In 2007, NMFS and the U.S. Fish and Wildlife Service determined that the American eel population appeared stable for the long term and listing was not warranted (72 FR 4967). However, new information in the 2011 petition prompted the U.S. Fish and Wildlife Service to begin a new status review. The Atlantic States Marine Fisheries Commission has had a fishery management plan for the American eel since 1999 (Atlantic States Marine Fisheries Commission 2000).

3.9.2.10.2 Habitat and Geographic Range

The American eel ranges throughout all large marine ecosystems in the Study Area, from Greenland south along the Atlantic Coast and into the Caribbean (U.S. Fish and Wildlife Service 2011). The American eel is catadromous, meaning it is born in saltwater and migrates into freshwater to mature (Jessop et al. 2002), although evidence suggests that some populations never migrate into fresh water and inhabit only estuarine and brackish water (Arai and Chino 2012).

North Atlantic Subtropical Gyre. Spawning of the U.S. population of American eel is believed to occur in the Sargasso Sea of the Atlantic Ocean. From there, eggs, larvae, and juveniles are dispersed largely via the Gulf Stream and other oceanic currents as they feed at the surface of the ocean. As juveniles, or "glass eels," they enter coastal waters where they further mature into ''elvers'' and then a late juvenile stage known as ''yellow eels" (U.S. Fish and Wildlife Service 2011). Older juveniles and adults occupy estuarine and freshwater habitats, often swimming far upriver into lakes, ponds, and headwater streams, where they may spend up to 30 years as adults. Mature adults, or "silver eels," migrate to the Sargasso Sea to spawn and die (U.S. Fish and Wildlife Service 2011).

3.9.2.10.3 Population and Abundance

The American eel exists as a single population that disperses widely from its spawning grounds in the Sargasso Sea, making abundance difficult to determine (Haro et al. 2000). Demographic structure is

difficult to determine because nonbreeding individuals are spread over an extremely large geographic range (U.S. Fish and Wildlife Service 2011).

3.9.2.10.4 Predator and Prey Interactions

The American eel feeds on a wide variety of prey items including benthic invertebrates, insects, crustaceans, molluscs, worms, and finfish. It is preyed upon by a wide variety of species including fish, seabirds, sharks, and rays (Dalton et al. 2009; U.S. Fish and Wildlife Service 2011).

3.9.2.10.5 Species-Specific Threats

The most important threat to the American eel is thought to be freshwater habitat loss due to urban development, water pollution, and poor fish passage through hydroelectric facilities (U.S. Fish and Wildlife Service 2011). Overfishing of American eel in commercial marine fisheries has also contributed to substantial population declines (Knights 2003). All life stages of eels are harvested and overfishing is currently occurring in the United States (Council for Endangered Species Act Reliability 2010). Disease, introduced via aquaculture facilities also threatens this species. An Asian parasite (*Anguillicola crassus*) infests and damages the eel's swim bladder, resulting in mortality of pre-migratory adults (U.S. Fish and Wildlife Service 2011).

3.9.2.11 Dwarf Seahorse (*Hippocampus zosterae*)

3.9.2.11.1 Status and Management

In April 2011, NMFS received a petition to list the dwarf seahorse as threatened or endangered under the ESA and to designate critical habitat concurrently with the listing (FR 77 (87): 26478-26486, May 4, 2012). In its 90-day review, NMFS concluded that the species may warrant listing under the ESA, resulting in the initiation of a formal status review (FR 77 (87): 26478-26486, May 4, 2012).

Dwarf seahorses are harvested in Florida's commercial seahorse fishery to support the aquaria trade, primarily in the southeast portion of the state through diving, seining, or dredging (Bruckner 2005). The state imposes a commercial bag limit of 400 dwarf seahorses per person or per vessel per day, whichever is less, and a recreational bag limit of five dwarf seahorses per person, per day. There are no seasonal restrictions or closures for this fishery (FR 77 (87): 26478-26486, May 4, 2012).

3.9.2.11.2 Habitat and Geographic Range

The dwarf seahorse has a restricted geographic range within the Study Area, inhabiting tropical and subtropical/warm-temperate waters of Florida, the Gulf of Mexico, and the Caribbean (Masonjones and Lewis 1996). It primarily occurs in south Florida estuaries and in the Florida Keys. The dwarf seahorse prefers protected bays/lagoons with low water flow, high organic content, mid- to high-salinities and depths less than 6 ft. (2 m) (Bruckner 2005; Foster and Vincent 2004). The species is almost exclusively associated with seagrass beds, particularly eelgrass (*Zostera* sp.) (Bruckner 2005). It is more abundant in areas with higher seagrass density, canopy cover, and seagrass shoot density (Bruckner 2005; Sogard et al. 1987). Other habitats used by the dwarf seahorse include mangrove areas, unattached algae, and inshore drifting vegetation (Center for Biological Diversity 2011; Hoese and Moore 1998; Tabb and Manning 1961).

While most seahorse species exhibit strong site-fidelity, in terms of home ranges and spawning habitat (Curtis and Vincent 2006; Masonjones and Lewis 1996), Masonjones et al. (2010) suggest that further seahorse dispersal outside of home ranges may occur. Dispersal may be enhanced by clinging to drifting

Sargassum or floating debris within inshore habitats (Foster and Vincent 2004; Masonjones and Lewis 1996). Spawning occurs between February and November (Foster and Vincent 2004).

Southeast U.S. Continental Shelf Large Marine Ecosystem. The dwarf seahorse's primary range includes south Florida estuaries and the Florida Keys (FR 77 (87): 26478-26486, May 4, 2012).

Gulf of Mexico Large Marine Ecosystem. Bruckner et al. (2005) report that the dwarf seahorse is uncommon in many areas in the Gulf of Mexico (FR 77 (87): 26478-26486, May 4, 2012), with fewer than 20 independent collection records from the following locations: Lower Laguna Madre, South Apalachee Bay, North Apalachee Bay, Corpus Christi Bay, St. George Sound, East Mississippi Sound, Aransas Bay, Terrebonne/Timbalier Bays, Chandeleur Sound, Perdido Bay, and Pensacola Bay (Beck and Odaya 2001).

Caribbean Sea Large Marine Ecosystem. The dwarf seahorse's primary range includes all portions of the Caribbean (FR 77 (87): 26478-26486, May 4, 2012).

3.9.2.11.3 Population and Abundance

There are no published data on current global population trends or total numbers of mature dwarf seahorses; however, some population data exist in Florida based on numbers derived from the commercial seahorse fishery. NMFS reported a five-fold increase in seahorse landings between 1991 and 1992 (from 14,000 harvested in 1991 to 83,700 harvested in 1992), with the increased landings primarily attributed to dwarf seahorses (FR 77 (87): 26478-26486, May 4, 2012). Over a longer period, the number of dwarf seahorses landed during 1990–2003 ranged from 2,142 to 98,779 individuals per year (Bruckner 2005). Additional density data are from ichthyoplankton tows conducted in portions of southern Florida and range from 0 to 6 seahorses per 100 cubic meters in subtidal pools, seagrass beds, in channels, and along restored marsh edges (Masonjones et al. 2010; Powell et al. 2002; Thayer et al. 1999).

3.9.2.11.4 Predator and Prey Interactions

Seahorses are ambush predators, consuming primarily live, mobile nekton, such as small amphipods and other invertebrates (Bruckner 2005).

3.9.2.11.5 Species-Specific Threats

Dwarf seahorses are the second most sought after fish exported from Florida in the aquarium trade (FR 77 (87): 26478-26486, May 4, 2012). They are dried and sold at curio shops as souvenirs (Bruckner 2005) and also are in high demand in the traditional Chinese medicine trade (FR 77 (87): 26478-26486, May 4, 2012).

The petition for listing (Center for Biological Diversity 2011) describes other natural or manmade factors that may be threatening the dwarf seahorse, including life history characteristics, bycatch mortality, illegal fishing, hurricanes or tropical storms, and invasive species. The petition also suggests that the current status of the dwarf seahorse may be related to low frequency boat motor noise, based on a single lab study (FR 77 (87): 26478-26486, May 4, 2012). However, the actual negative impacts of boat motor noise on the health, behavior, and reproductive success of wild populations of dwarf seahorses in their natural habitat remain unclear at this time (FR 77 (87): 26478-26486, May 4, 2012).

In addition to species-specific threats, threats to the dwarf seahorse's primary habitat of seagrass are further described in Section 3.7.2.8 (Seagrasses, Cordgrasses, and Mangroves). Additional information

on threats to dwarf seahorses are detailed by NMFS and Center for Biological Diversity (Center for Biological Diversity 2011).

3.9.2.12 Nassau Grouper (*Epinephelus striatus*)

3.9.2.12.1 Status and Management

In August 2010, NMFS received a petition to list Nassau grouper as threatened or endangered under the ESA and designate critical habitat concurrently with the listing (FR 77 (196): 61559-61562, October 10, 2012). In its 90-day review, NMFS concluded that the species may warrant listing under the ESA, resulting in the initiation of a formal status review (FR 77 (196): 61559-61562, October 10, 2012).

Between 1986 and 1991, Nassau grouper commercial and recreational landings declined substantially in both pounds landed and average size. As a result, the fishery management councils of the Caribbean, South Atlantic, and Gulf of Mexico, as well as the state of Florida, all implemented moratoriums on take and possession by 1996 (National Marine Fisheries Service 2009d). Estimates by the International Union for the Conservation of Nature suggest that by 2000, species abundance had decreased approximately 60 percent over the last three generations (Cornish and Eklund 2003). This substantial decline is thought to be in large part due to intensive harvesting of spawning aggregations, which concentrate the fish in a spatially and temporally predictable fashion (Beets and Hixon 1994; Colin 1992). Failure of the species to rebound in response to fishing bans, combined with concerns over habitat degradation, have yielded new management efforts which now focus on the establishment of shelf-reef reserves (i.e., marine protected areas) as a more effective means of preserving both the species and its habitat (Koenig et al. 2000). The reserves are typically near current and historical spawning aggregation sites (Albins et al. 2009).

3.9.2.12.2 Habitat and Geographic Range

The Nassau grouper primarily occurs in association with high-relief coral reefs and rocky bottoms from inshore to a depth of approximately 330 ft. (100 m). Nassau grouper tend to rest on or near the bottom, and juveniles are most often encountered in seagrass beds and patch reefs close to shore (Bester 2012). These fish also occupy caves and large overhangs (National Marine Fisheries Service 2009d). Spawning habitat is typically at depths ranging from 65 to 130 ft. (20 to 40 m) on the edge of outer reef shelves (Science and Conservation of Reef Fish Aggregations 2012).

Southeast U.S. Continental Shelf Large Marine Ecosystem. The geographic range of Nassau grouper within this large marine ecosystem is limited to the southeast coast of Florida (FR 77 (196): 61559-61562, October 10, 2012).

Gulf of Mexico Large Marine Ecosystem. Nassau grouper generally do not occur in the Gulf of Mexico, except in the Campeche Bank; Flower Gardens Bank; Dry Tortugas National Park; and Key West, Florida (Bester 2012).

Caribbean Sea Large Marine Ecosystem. The Nassau grouper's primary range includes Bermuda, Florida, the Bahamas, Yucatan Peninsula, and throughout the Caribbean (FR 77 (196): 61559-61562, October 10, 2012). The waters around the Cayman Islands still sustain active Nassau grouper spawning aggregations which is rare for the region (Kobara and Heyman 2008; Semmens et al. 2006). Assessments of the ocean bottom at spawning aggregations in the Cayman Islands indicate that Nassau grouper occupy reef crests and shelf-edge drop-offs into deep water. These areas are thought to provide relief from predators and assist with egg dispersal (Kobara and Heyman 2008).

3.9.2.12.3 Population and Abundance

Nassau grouper congregate in large numbers at site-specific areas to spawn after the appropriate temperature and moon phase cues (usually within a period of 10 days overlapping the full moon) between January and February (Archer et al. 2012; Science and Conservation of Reef Fish Aggregations 2012; Semmens et al. 2006). Spawning aggregations of several thousand individuals have been reported in the Bahamas (Bester 2012). This species is a solitary fish apart from spawning aggregations (Starr et al. 2007).

Researchers have estimated that the current worldwide population of Nassau grouper is approximately 10,000 individuals (FR 77 (196): 61559-61562, October 10, 2012). The most recent data suggest that subpopulations are likely to either be stable (e.g., the United States) or in decline (e.g., Cuba and Belize). However, it is likely that the global population of Nassau grouper continues to decline (Cornish and Eklund 2003). Tissue analyses of individuals from Florida, Cuba, Belize, and the Bahamas indicate no evidence of genetically distinct subpopulations; thus, Nassau grouper are considered as a single population (Bernard et al. 2012; Cornish and Eklund 2003).

3.9.2.12.4 Predator and Prey Interactions

Information on predation of groupers is lacking; however, Nassau grouper are generally preyed upon by barracuda (*Sphyraena barracuda*), king mackerel (*Scomberomorus cavalla*), moray eels (*Gymnothorax* spp.) and—although rare—other groupers (Bester 2012). Sharks also feed on Nassau grouper, including sandbar sharks (e.g., *Carcharhinus plumbeus*) and great hammerhead sharks (e.g., *Sphyrna mokarran*) (Olsen and LaPlace 1978). The marine isopod *Excorallana tricornis tricornis* is a known parasite of the Nassau grouper, sometimes resulting in infestations immediately following spawning (Semmens et al. 2006).

Adult Nassau grouper are opportunistic ambush predators, feeding on a variety of fishes, shrimps, crabs, lobsters, and octopuses (see review in (Sadovy and Eklund 1999)). In contrast, juveniles show a high degree of trophic plasticity (flexibility in their diet) and incorporate filter feeding, particulate feeding, and piscivory (i.e., feeding on other fishes) in their foraging strategy. Early juveniles consume primarily dinoflagellates (greater than 99 percent by number) and fish larvae and mysids (28–79 percent by volume) (Sadovy and Eklund 1999).

3.9.2.12.5 Species-Specific Threats

Nassau grouper are especially sensitive to over-exploitation due to their slow growth, late reproduction (5+ years of age), large size, and long life-spans (Morris et al. 2000; Sadovy and Eklund 1999). The dramatic decline in Nassau grouper abundance is thought to be the result of the overharvest and subsequent collapse of spawning aggregations (Aguilar-Perera 2006; Ehrhardt and Deleveaux 2007), which predictably concentrate fish both spatially and temporally. Extirpation (i.e., local extinction) can occur quickly, sometimes within just a few years following overharvest, and can pose a more substantial risk to the population than simply overfishing the stock's overall abundance (FR 77 (196): 61559-61562, October 10, 2012). These effects are particularly evident throughout the Caribbean (Aguilar-Perera 2006; Morris et al. 2000), where they are exacerbated by indirect impacts from coastal development (Stallings 2009).

The loss of macroalgae and seagrass beds is particularly damaging to Nassau grouper populations, as it often results in lower recruitment rates (Sadovy and Eklund 1999). Similarly, physical damage to spawning sites limits reproductive success of adults if alternative habitats are not available.

To date, fishing moratoriums and regulations have been ineffective at preventing illegal harvest—which has been occurring in Puerto Rico since the inception of the moratorium in 1992, and which may also be occurring in other U.S. waters (National Marine Fisheries Service 2009d). Severe declines have also resulted from overfishing with spear guns and exploitation of juveniles in fine mesh nets (FR 77 (196): 61559-61562, October 10, 2012).

3.9.2.13 River Herring: Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*)

Alewife and blueback herring are being evaluated jointly as "river herring" by NMFS and are, therefore, combined and referred to as river herring in this document.

3.9.2.13.1 Status and Management

Alewife and blueback herring exhibit very similar life histories, and they are often harvested and managed together because of the difficulty in distinguishing between the two species; they are currently managed by the Atlantic States Marine Fisheries Commission. Commercial harvest is on-going in Maine, New Hampshire, New York, New Jersey, Delaware, Maryland, Virginia, and South Carolina. In 2011, NMFS determined that substantial scientific information exists that listing may be warranted and is therefore conducting a status review (FR 76 (212): 67652-67656, November 2, 2011). To protect the remaining populations, the states of Massachusetts, Rhode Island, Connecticut, and North Carolina have enacted moratoriums on the harvest and possession of river herrings. The North Carolina Division of Marine Fisheries wrote a River Herring Fisheries Management Plan that outlines the recovery methods to rebuild North Carolina's river herring populations (National Marine Fisheries Service 2009e).

3.9.2.13.2 Habitat and Geographic Range

River herring typically occur over the continental shelf in waters less than 100 m (328 ft.) (Neves 1981). River herring spawn in a variety of habitats, ranging from swift moving rivers to small tributaries above the tidal zone (National Marine Fisheries Service 2009e).

Northeast U.S. Continental Shelf Large Marine Ecosystem and Southeast U.S. Continental Shelf Large Marine Ecosystem. The alewife ranges throughout the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems from Newfoundland to North Carolina (historically to South Carolina) (National Marine Fisheries Service 2009e). The blueback herring also ranges throughout the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems from Nova Scotia to the St. Johns River, Florida (McBride et al. 2010). River herring are anadromous, migrating during the spring months to spawn in their natal rivers on the U.S. east coast then returning to coastal waters in the summer. Juveniles mature for several years in coastal waters before making their first spawning run. The highly migratory river herring travel in large schools near the surface (National Marine Fisheries Service 2009e).

3.9.2.13.3 Population and Abundance

River herring have undergone substantial declines throughout most of their range. At Holyoke Dam on the Connecticut River, the total migration has dropped from about 600,000 individuals in 1985 to only 1,300 individuals in 2003 (National Marine Fisheries Service 2009e). Similar trends have been observed in Rhode Island, Massachusetts, and North Carolina. The Rhode Island Department of Environmental Management reported a 95 percent decline in river herring runs between 2000 and 2004. Similarly, alewife runs in the St. Croix River were reduced from a high of 2,624,000 fish in 1987 to 1,299 fish in 2004 (National Marine Fisheries Service 2009e).

3.9.2.13.4 Predator and Prey Interactions

All life stages of river herring feed primarily on phytoplankton and zooplankton, but adults also eat mysids, small finfish, and benthic crustaceans (National Marine Fisheries Service 2009e). River herring are preyed on by a number of marine species, including striped bass, bluefish, tunas, cod, haddock, halibut, American eel, seabirds, and mammals.

3.9.2.13.5 Species-Specific Threats

River herring have been species of concern, and now ESA candidates, because of substantial declines in populations throughout their ranges. Hydroelectric facilities (dams) with poor fish passage restrict their access to spawning and forage areas. Fish are also injured or killed by hydroelectric turbines. Degradation of water quality by toxic pollutants, nutrient discharge, and sediment loads may have also contributed to the decline of river herring. In addition, commercial marine fishing pressure exacerbates the riverine threats to the river herring (FR 76 (212): 67652-67656, November 2, 2011).

3.9.2.14 Scalloped Hammerhead Shark (*Sphyrna lewini*)

3.9.2.14.1 Status and Management

In August 2011, NMFS received a petition to list the scalloped hammerhead shark as threatened or endangered under the ESA and to designate critical habitat concurrently with the listing (FR 76 (228): 72891-72896, November 28, 2011). In its 90-day review, NMFS concluded that substantial scientific information may warrant listing under the ESA, thus initiating a status review for the scalloped hammerhead shark (FR 76 (228): 72891-72896, November 28, 2011). In April 2013, NMFS proposed listing the central and southwest Atlantic distinct population segment as threatened (FR 78 (66): 20718-20753, April 5, 2013). The scalloped hammerhead shark is managed under the Large Coastal Shark Management Unit by NMFS through the Final Consolidated Atlantic Highly Migratory Species Fisheries Management Plan (National Marine Fisheries Service 2009f). The species has a fishery management plan and designated Essential Fish Habitat.

3.9.2.14.2 Habitat and Geographic Range

The scalloped hammerhead shark is circumglobal, occurring in all temperate to tropical waters (Duncan and Holland 2006) of the Study Area from the surface to depths of 275 m (902 ft.). It typically inhabits nearshore waters of bays and estuaries where water temperatures are at least 22°C (72°F) (Castro 1983; Compagno 1984). The scalloped hammerhead shark remains close to shore during the day and moves to deeper waters at night to feed (Bester 1999). A genetic marker study suggests that females typically remain close to coastal habitats, while males are more likely to disperse across larger open ocean areas (Daly-Engel et al. 2012).

In the western Atlantic, the scalloped hammerhead's range extends from New Jersey to Brazil, including the Gulf of Mexico and the Caribbean Sea (Bester 1999). The scalloped hammerhead migrates seasonally along the eastern United States, where it may rear in coastal nursery areas (Duncan and Holland 2006). Tagging data indicate that this species may occur in the Gulf Stream, but does not typically occur in the open ocean (Kohler and Turner 2001).

Northeast U.S. Continental Shelf Large Marine Ecosystem. Juveniles inhabit shallow coastal waters of this ecosystem, from the shoreline to the 200 m (656 ft.) isobath, south of 39° N (National Marine Fisheries Service 2009). Adults range farther north to Long Island, New York, in coastal waters at depths from 25 to 200 m (82 to 656 ft.) (National Marine Fisheries Service 2009f).

Southeast U.S. Continental Shelf Large Marine Ecosystem. Neonates and young-of-the-year depend on coastal nursery areas within this ecosystem, particularly waters extending from the shoreline to 22 nm offshore of South Carolina to Florida (west of 79.5° W and north of 30° N). Juveniles depend on shallow coastal waters from the shoreline to the 200 m (656 ft.) isobath, extending south of 39° N to the vicinity of the Florida Keys (82° W) and Dry Tortugas. Adults depend on coastal waters from 25 to 200 m (82 to 656 ft.) from 36.5° N to 33° N; from 33° N south to 30° N from the 50 to 200 m (164 to 656 ft.) isobath; and from 25 to 200 m (82 to 656 ft.) from 30° N south to 28° N (National Marine Fisheries Service 2009f).

Gulf of Mexico Large Marine Ecosystem. Neonates and young-of-the-year depend on coastal nursery areas, particularly from the shoreline to 22 nm offshore of Texas to the southwest coast of Florida. Juveniles depend on shallow coastal waters, from the shoreline to the 200 m (656 ft.) isobath, extending from the southern to mid-coast of Texas, eastern Louisiana to the southwest coast of Florida. Adults depend on coastal waters from 25 to 200 m (82 to 656 ft.) along the southern Texas coast and from eastern Louisiana to the Florida Keys. Offshore areas beyond 200 m (656 ft.) depths are also important between southern Texas and eastern Louisiana (National Marine Fisheries Service 2009f).

3.9.2.14.3 Population and Abundance

NMFS data and information provided in the listing petition suggest that the scalloped hammerhead shark has undergone substantial declines throughout its range (FR 76 (228): 72891-72896, November 28, 2011). Data from 1986 to 2000 from the U.S. pelagic longline fleet indicates a decreasing trend in the abundance of the scalloped hammerhead shark (Baum et al. 2003). However, during that same timeframe, there was also some evidence of population increases or rebuilding stocks in the Southeast U.S. Continental Shelf Large Marine Ecosystem (Ward-Paige et al. 2012). Food and Agriculture Organization catch data indicate that similar fishing efforts in 2002 and 2009 achieved catches of scalloped hammerhead sharks that peaked at 8,000 metric tons in 2002 and fell to 1,000 metric tons in 2009 (Food and Agriculture Organization of the United Nations 2005, 2009).

3.9.2.14.4 Predator and Prey Interactions

Scalloped hammerhead sharks follow daily vertical movement patterns within their home range (Holland et al. 1993; Klimley and Nelson 1984), and feed primarily at night (Compagno 1984). They are a high trophic level predator, and feed opportunistically on all types of teleost fish, cephalopods, crustaceans, and rays (Bethea et al. 2011; Compagno 1984; Torres-Rojas et al. 2010; Vaske et al. 2009).

3.9.2.14.5 Species-Specific Threats

The primary threat to the scalloped hammerhead shark is direct take, especially by the foreign commercial shark fin market (FR 76 (228): 72891-72896, November 28, 2011). Scalloped hammerheads are a principal component of the total shark bycatch in the swordfish and tuna longline fishery and shrimp trawls in the Gulf of Mexico (Branstetter 2002), and are particularly susceptible to overfishing and bycatch in gillnet fisheries because of schooling habits (Food and Agriculture Organization of the United Nations 2012). Longline mortality for this species is estimated between 91 and 94 percent (FR 76 (228): 72891-72896, November 28, 2011).

3.9.2.15 Jawless Fish (Orders Myxiniformes and Petromyzontiformes)

Hagfish (Myxiniformes) are the most primitive fish group (Nelson 2006). In fact, recent taxonomic revisions suggests that Myxiniformes are not fish at all but are a “sister” group to all vertebrates (Nelson 2006). However, jawless fish are generally thought of as fish and are therefore included in this section. Hagfish occur exclusively in marine habitats, and include 70 species worldwide in temperate marine

locations. This group feeds on dead or dying fish, and have few of the external features often associated with fish, such as fins and scales (Helfman et al. 2009). The members of this group are important scavengers that recycle nutrients back through the ecosystem.

Lampreys (Petromyzontiformes) are represented by 11 known marine or freshwater species distributed primarily throughout the temperate regions of the Northern Hemisphere. Lampreys typically are parasitic, feeding on other live fish. The most striking feature of the lampreys is the oral disc mouth, by which they attach themselves to other fish to feed on their blood (Moyle and Cech 1996; Nelson 2006).

Hagfish and lampreys occur in the seafloor habitats of all open ocean areas and coastal waters of the Study Area (Paxton and Eshmeyer 1998). Hagfish are typically found at depths greater than 80 ft. (25 m) and temperatures below 55°F (13°C).

3.9.2.16 Sharks, Skates, Rays, and Chimaeras (Class Chondrichthyes)

The cartilaginous (nonbony) marine fish of the class Chondrichthyes are distributed throughout the world's oceans, occupying all areas of the water column (Paxton and Eshmeyer 1998). This group is mainly predatory, and contains many of the top predators found in the ocean, such as the white shark (*Carcharodon carcharias*), mako shark (*Isurus oxyrinchus*), and tiger shark (*Galeocerdo cuvier*) (Helfman et al. 2009). As filter-feeders, the whale shark, manta ray, and basking shark are notable exceptions.

Very little is known about the Holocephali subclass, which contains 58 marine species of chimaeras (Nelson 2006). Chimaeras are cool-water marine fish that are found at depths between 260 and 8,500 ft. (80 and 2,600 m) (Nelson 2006). They occur in the open-ocean portions of the Study Area, up to the lower continental shelf (Paxton and Eshmeyer 1998).

The subclass Elasmobranchii contains more than 850 marine species, including sharks, skates, and rays spread across nine orders (Nelson 2006). Elasmobranchs (sharks, skates, and rays) have protective tooth-like scales called placoid scales and no swim bladder. Specialized sensory systems (electroreception and mechanoreception) allow these (and other) fish to detect and respond to electrical or mechanical impulses (Jordan et al. 2011). Elasmobranchs also bear young in a variety of life history strategies, including live birth, egg-laying, or a combination of live birth and egg laying (Moyle and Cech 1996).

Sharks, skates, and rays occupy relatively shallow temperate and tropical waters throughout the world. More than half of these species occur in less than 655 ft. (200 m) of water, and nearly all are found at depths less than 6,560 ft. (2,000 m) (Nelson 2006). The dusky shark (*Carcharhinus obscurus*), night shark (*Carcharhinus signatus*), porbeagle shark (*Lamna nasus*), sand tiger shark (*Carcharias taurus*), and thorny skate (*Amblyraja radiata*) are species of concern that occur in the open-ocean and coastal waters of the Study Area, as listed in Table 3.9-1. A candidate species, the scalloped hammerhead shark (Section 3.9.2.14, Scalloped Hammerhead Shark [*Sphyrna lewini]*), also occurs in the Study Area.

3.9.2.17 Sturgeons and Gars (Orders Acipenseriformes and Lepisosteiformes)

Sturgeon (order Acipenseriformes) and gars (order Lepisosteiformes) are the most primitive orders in the class Actinopterygii (Nelson 2006). Twenty-seven species of sturgeon are found worldwide, most of which migrate between freshwater and saltwater. The Atlantic sturgeon, Gulf sturgeon, and shortnose sturgeon are ESA-listed species that occur in the Study Area (Sections 3.9.2.6, Shortnose Sturgeon [*Acipenser brevirostrum*]; 3.9.2.7, Gulf Sturgeon [*Acipenser oxyrinchus desotoi*]; and 3.9.2.8, Atlantic Sturgeon [*Acipenser oxyrinchus oxyrinchus*]).

Gars are primarily freshwater fish with a great tolerance for salinity. The most common gars in estuaries of the Study Area are the longnose gar (*Lepisosteus osseus*) and alligator gar (*Atractosteus spatula*. These top predators eat crabs, fish, and ducks in the estuaries of the Southeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems (Nelson 2006; Rulifson 1991).

3.9.2.18 Eels and Bonefish (Orders Anguilliformes and Elopiformes)

These fish have a unique willow leaf-shaped leptocephalus larval stage (small head and a long, thin body). The eels (Anguilliformes) have an elongated snakelike body; most of the 780 eel species do not inhabit the deep ocean. Eels generally feed on fish or on small bottom-dwelling invertebrates, but will also take larger organisms (Helfman et al. 2009). Moray eels, snake eels, and conger eels occur in the Study Area (Paxton and Eshmeyer 1998). The order Elopiformes include two distinct groups with very different forms: the bonefish, predators in shallow tropical waters, and the little-known spiny eels, elongated seafloor feeders which feed on decaying organic matter in deep ocean areas (Paxton and Eshmeyer 1998).

Most eels inhabit shallow subtropical or tropical marine waters, although some species occur in all marine habitat types, (Paxton and Eshmeyer 1998) in the Study Area. An ESA candidate species, the American eel is described in Section 3.9.2.10 (American Eel [*Anguilla rostrata*]).

The bonefish are distributed throughout shallow tropical waters. Some common species in the Study Area are tarpon (*Atractosteus spatula*), ladyfish (*Elops saurus*), and bonefish (*Albula vulpes*). These surface-oriented predators support an important recreational fishery in the southeastern United States and the Caribbean (Froese and Pauly 2010). In contrast, the halosaurs and spiny eels are abundant, but rarely seen or captured (Bergstad et al. 2012). These fish occur at 400 to 16,000 ft. (120 to 4,900 m) in the open-ocean throughout the North Atlantic Subtropical Gyre, both on the seafloor and in the water column (Paxton and Eshmeyer 1998).

3.9.2.19 Herrings (Order Clupeiformes)

Many of the 364 species of the order Clupeiformes are in the Indo-West Pacific Ocean or the western Atlantic Ocean. Herring, menhaden, sardine, and anchovy species are well-known as valuable targets of commercial fisheries (Nelson 2006). Most clupeids form schools to help conserve energy and minimize predation (Brehmer et al. 2007) and may also facilitate some level of communication during predator avoidance (Marras et al. 2012). Herring account for a large portion of the total worldwide fish catch (Food and Agriculture Organization of the United Nations 2005, 2009) and also support complex marine food webs as a forage fish that sustains predatory fish, birds, and mammals. River herring migrate up rivers to spawn in freshwater, while Atlantic herring spawn in coastal waters. Clupeids feed on decaying organic matter and plankton while swimming in the water column (Moyle and Cech 1996). Two river herring species (alewife and blueback herring) are ESA-candidate species, as described in Section 3.9.2.13 (River Herring: Alewife [*Alosa aestivalis*] and Blueback Herring [*Alosa pseudoharengus*]).

Herring commonly swim in large schools near the surface. They are common in the coastal waters of all the large marine ecosystems in the Study Area (Paxton and Eshmeyer 1998).

3.9.2.20 Smelts and Salmonids (Orders Argentiniformes, Osmeriformes, and Salmoniformes)

The deepwater smelts of the order Argentiniformes differ from the true smelts of the order Osmeriformes in that the true smelts inhabit coastal areas. The true smelts are abundant in coastal areas throughout the Northern Hemisphere, while the deepwater smelts are limited mainly to deep

ocean regions. Smelts are an important forage fish for predatory fish, birds, and marine mammals. The rainbow smelt (*Osmerus mordax*) is a species of concern in the coastal waters in the northern portion of the Study Area, as listed in Table 3.9-1.

The native distribution of Salmoniformes is restricted to the cold waters of the Northern Hemisphere. Most salmon spawn in freshwater and live in the sea; they are among the most thoroughly studied and commercially valuable fish groups in the world. Only the Atlantic salmon occurs in the Study Area, as described in Section 3.9.2.3 (Atlantic salmon [*Salmo salar*]).

3.9.2.21 Dragonfish and Lanternfish (Orders Stomiiformes and Myctophiformes)

At more than 500 species, the orders Stomiiformes and Myctophiformes make up one of the largest groups of deepwater fish, comprising nearly 60 percent of the total biomass in the deep sea (Nelson 2006). Many of the species in these orders are not very well described in the scientific literature (Nelson 2006), nor is their ecological role well understood (Helfman et al. 2009). These fish are known for their unique body forms and light-producing capabilities. Other adaptations to the deepwater habitats in which they occur include large mouths, sharp teeth, and sensory systems that allow them to find prey and avoid predators in total darkness (Haedrich 1996; Koslow 1996; Marshall 1996; Rex and Etter 1998; Warrant and Locket 2004).

The dragonfish and lanternfish typically occur from 3,280 to 16,000 ft. (1,000 to 4,900 m) in the open-ocean portions of the Study Area and throughout the North Atlantic Subtropical Gyre (Paxton and Eshmeyer 1998). Some myctophids do occur closer to the surface, where they may become prey for marine mammals.

3.9.2.22 Greeneyes, Lizardfish, Lancetfish, and Telescopefish (Order Aulopiformes)

The order Aulopiformes includes a diverse group of fish characterized by both primitive features (adipose fin, abdominal pelvic fins, rounded scales, and absence of fin spines) and advanced features (unique swim bladder and jawbone) (Paxton and Eshmeyer 1998). They are common from estuarine and coastal waters to the deep ocean. The lizardfish (Synodontidae), Bombay ducks (Harpadontidae), and greeneyes (Chlorophthalmidae) primarily occur over the continental shelf, where they rest on the bottom and ambush smaller prey fish and invertebrates (Paxton and Eshmeyer 1998). Lancetfish (Alepisauridae) are primarily mid-water column fish, but are known from the surface to deep water. Telescopefish are primarily found in deep waters from 1,640 to 3,280 ft. (500 to 1,000 m), but they can also be found at shallower depths and may approach the surface at night (Paxton and Eshmeyer 1998).

In general, greeneyes, lizardfish, and lancetfish occur in the coastal waters of the Study Area and the western portion of the Caribbean Sea Large Marine Ecosystem. Lizardfish are common coastal species of the Gulf of Mexico and figure prominently in shrimp trawls as bycatch (Cruz-Escalona et al. 2005) and telescopefish occur primarily in the deeper waters associated with the open oceans of the Study Area (Paxton and Eshmeyer 1998).

3.9.2.23 Cods and Cusk-Eels (Orders Gadiformes and Ophidiiformes)

The cods and cusk-eels include more than 900 species, several of which are important target species of commercial fisheries. The cods, or groundfish, account for a substantial portion of the world's commercial fishery landings (Food and Agriculture Organization of the United Nations 2005). Gadiforms, such as cods, are almost exclusively marine fish, inhabiting the seafloor from temperate to arctic regions, including the West Greenland Shelf, Newfoundland-Labrador Shelf, Scotian Shelf, and Northeast

U.S. Continental Shelf Large Marine Ecosystems. Cods are generally found near the bottom in these continental shelf areas, feeding on benthic organisms (Paxton and Eshmeyer 1998). The cusk (a relative of the cod, not to be confused with the cusk-eels described below) is an ESA-candidate species, described in Section 3.9.2.9 (Cusk [*Brosme brosme*]).

The order Ophidiiformes includes cusk-eels and brotulas, which have long eel-like tapering bodies and are distributed in deepwater areas throughout the tropical and temperate oceans. The characteristics of ophidiiforms are similar to those of the other deepwater groups, described in Section 3.9.2.21 (Dragonfish and Lanternfish [Orders Stomiiformes and Myctophiformes]). In addition, there are several cusk-eel species that are open-ocean or are found on the continental shelves and slopes. Cusk-eels occur near the seafloor of the tropical and temperate coastal waters of the Study Area (Paxton and Eshmeyer 1998).

3.9.2.24 Toadfish and Anglerfish (Orders Batrachoidiformes and Lophiiformes)

The toadfish and anglerfish include nearly 400 species. Many toadfish produce sounds by vibrating their swim bladders. They spawn in and around bottom structures and invest a substantial amount of parental care by defending their nests, a trait uncommon in most marine fish (Paxton and Eshmeyer 1998). The order Lophiiformes includes all of the world's anglerfish, goosefish, frogfish, batfish, and deepwater anglerfish, most of which occur in seafloor habitats of all oceans. Females of some deepwater anglerfish use highly modified "lures," containing light-emitting organs to attract prey (Helfman et al. 2009; Koslow 1996). The males of these species are small and parasitic, spending their lives attached to the side of the female (Helfman et al. 2009). These fish are also an important predator among the deepwater seafloor habitats of the Study Area (Nelson 2006). Ten families of anglerfish live in deep water and five families live on the bottom or attached to drifting seaweed in shallow water.

Toadfish occur in coastal seafloor habitats in all of the large marine ecosystems. Anglerfish are also found in seafloor habitats but across a deeper range throughout the Study Area (Froese and Pauly 2010).

3.9.2.25 Mullets, Silversides, Needlefish, and Killifish (Orders Mugiliformes, Atheriniformes, Beloniformes, and Cyprinodontiformes)

Mugiliformes (mullets) include 71 marine species that occur in coastal marine and estuarine waters of all tropical and temperate oceans. Mullets feed on decaying organic matter in estuaries using a filter-feeding mechanism with a gizzard-like digestive tract. They feed on the bottom by scooping up food and retaining it in their very small gill rakers (Moyle and Cech 1996). Atherinomorpha contains the silversides (Atheriniformes), needlefish and flyingfish (Beloniformes), and killifish (Cyprinodontiformes). Most species in these groups are important prey in all estuarine habitats in the Study Area (Paxton and Eshmeyer 1998). The key silverside (*Menidia conchorum*), mangrove rivulus (*Rivulus marmoratus*), and saltmarsh topminnow (*Fundulus jenkinsi*) are species of concern that occur in the temperate and tropical coastal waters of the Study Area, as listed in Table 3.9-1.

Most of these fish inhabit shallow surface areas near the coasts. Exceptions to this nearshore distribution are the flyingfish and halfbeaks, which occur in tropical to warm-temperate regions to the depth of light penetration. The silversides are a small inshore species often found in intertidal habitats. The Cyprinodontiformes include the killifish, which are often associated with intertidal zones and salt marsh habitats, and are highly tolerant of pollution. These fish occur in all coastal waters and open ocean areas of the Study Area (Froese and Pauly 2010).

3.9.2.26 Oarfish, Squirrelfish, and Dories (Orders Lampridiformes, Beryciformes, and Zeiformes)

Nineteen species of oarfish comprise the order Lampridiformes (Nelson 2006). They exhibit diverse body shapes, and some have a protruding mouth that allows for a suction feeding technique while feeding on plankton. Other species, including the crestfish, possess grasping teeth used to catch prey. They occur only in the mid-water column of the open ocean, and are rarely observed (Nelson 2006). Fish in the order Beryciformes are primarily poorly described nocturnal species. There are a few shallow-water exceptions, including squirrelfish, that are distributed throughout reef systems in tropical and subtropical marine regions (Nelson 2006). Squirrelfish are an important food source for subsistence fisheries in portions of the Caribbean (Froese and Pauly 2010). Squirrelfish have specialized eyes and large mouths, and primarily feed on bottom-dwelling crustaceans (Goatley and Bellwood 2009). Very little is known about the order Zeiformes, or dories, which includes some very rare families, many containing only a single species (Paxton and Eshmeyer 1998). Even general information on their biology, ecology, and behavior is limited.

Squirrelfish are common in coral reef systems in the Study Area, primarily in the Caribbean, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems. Most of the Lampridiformes and Zeiformes are confined to seafloor regions in all coastal waters of the Study Area, as well as the open ocean areas at depths of 130–330 ft. (40–100 m) (Moyle and Cech 1996).

3.9.2.27 Pipefish and Seahorses (Order Gasterosteiformes)

Gasterosteiformes include sticklebacks, pipefish, and seahorses, many of which are common in the Study Area. Most of these species are found in brackish water throughout the world (Nelson 2006) and occur in surface, water column, and seafloor habitats. Small mouths on a long snout and armor-like scales are characteristic of this group. Most of these species exhibit a high level of male parental care, either through nest-building (sticklebacks) or brooding pouches (seahorses and pipefish), which result in relatively few young being produced (Helfman et al. 2009). This group also includes the trumpetfish and cornetfish, which are ambush predators, with large mouths used to capture smaller fish. The opossum pipefish (*Microphis brachyurus lineatus*) is a species of concern that occurs in the coastal waters in the temperate and tropical portions of the Study Area, and the dwarf seahorse is a candidate for ESA listing (Table 3.9-1 and Section 3.9.2.11, Dwarf seahorse [*Hippocampus zosterae*]).

This group is associated with tropical and temperate reef systems. They are found in the coastal waters of the Study Area in the large marine ecosystems, but not in the open ocean (Froese and Pauly 2010).

3.9.2.28 Scorpionfish (Order Scorpaeniformes)

The order Scorpaeniformes is a diverse group of more than 1,400 marine species, all with bony plates or spines near the head. This group contains the scorpionfish, waspfish, rockfish, velvetfish, pigfish, sea robins, gurnards, sculpins, snailfish, and lumpfish (Paxton and Eshmeyer 1998). Many of these fish have modified pectoral fins or suction discs adapted for inhabiting the seafloor of the marine environment, where they feed on smaller crustaceans and fish. Many of the scorpaenids boast venomous spines on their fins. Sea robins are capable of generating sounds with their swim bladders, and are among the noisiest of all fish species in the northwestern Atlantic Ocean (Moyle and Cech 1996). Lumpfish have an odd box-shaped body, and are typically found attached to the seafloor. They are also a preferred prey of sperm whales, seals, and some shark species (Moyle and Cech 1996).

Scorpionfish are widely distributed in open-ocean and coastal habitats, at all depths, throughout the world. They occur in all waters of the Study Area. Most occur in depths of less than 330 ft. (100 m), but others are found in deepwater habitat, down to 7,000 ft. (2,200 m) (Paxton and Eshmeyer 1998).

3.9.2.29 Drums, Snappers, Snooks, Temperate Basses, and Reef Fish (Families Sciaenidae, Lutjanidae, Centropomidae, Moronidae, Apogonidae, Chaetodontidae, Pomacanthidae, and Mullidae)

Perciformes is the largest order of vertebrates (Nelson 2006), including approximately 40 percent of all bony fish. Representative families are discussed in several subsections below.

The families Sciaenidae and Lutjanidae include mainly predatory coastal marine fish, including the recreationally important snappers, drums, and croakers. These fish sometimes move in schools as juveniles, and then become more solitary as they grow larger. They feed on fish and crustaceans. Drums and croakers (Sciaenidae) produce drumming sounds via their swim bladders and, like the sea robin, are among the noisiest of all fish species in the Study Area. The striped croaker is a species of concern in the coastal waters in the temperate and tropical portions of the Study Area. The snappers (Lutjanidae) are generally associated with the seafloor, and tend to congregate near structured habitats, including natural and artificial reefs and oil platforms (Moyle and Cech 1996). Snappers also generate sound (Luczkovich et al. 2008). The snooks and temperate basses are among the most popular saltwater gamefish of recreational anglers occurring primarily in nearshore coastal waters of southern Florida. Temperate basses include striped bass (*Morone saxatilis*) distributed throughout coastal portions of the Study Area. Snooks include the common snook (*Centropomus undecimalis*), which are limited to southern Florida and the southern Gulf of Mexico. Other representative families in this group include the brightly colored and diverse forms of reef-associated cardinalfish (Apogonidae), butterflyfish (Chaetodontidae), some of which generate sound, angelfish (Pomacanthidae), and goatfish (Mullidae) (Paxton and Eshmeyer 1998).

Like the scorpionfish, the drums, snappers, snooks, and temperate basses are widely distributed in open-ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated and exhibit the most varieties in depths of less than 330 ft. (100 m). They are often associated with natural or artificial reef systems in the temperate and tropical coastal waters of the Study Area (Froese and Pauly 2010).

3.9.2.30 Groupers and Sea Basses (Family Serranidae)

Sea basses and groupers are found in the coastal and offshore reef and hard bottom systems in the tropical and temperate portions of the Study Area (Burge et al. 2012). They have large eyes and mouths, and feed mostly on bottom-dwelling fish and crustaceans (Goatley and Bellwood 2009). Some groupers and sea basses are especially active foragers at twilight (Rickel and Genin 2005), while others are active during the day (Wainwright and Richard 1995). Many species of grouper use shelf-edge habitat for spawning, which may occur year-round, but peaks during two seasons: late winter and late summer through early fall (Marancik et al. 2012). Some of the serranids begin life as female and then become male as they grow larger (Moyle and Cech 1996). Their slow maturation makes them vulnerable to overharvest (International Union for Conservation of Nature 2009). The Nassau grouper (*Epinephelus striatus*) is a candidate for ESA listing (Section 3.9.2.12, Nassau grouper [*Epinephelus striatus*]) and the speckled hind (*Epinephelus drummondhayi*) and Warsaw grouper (*Epinephelus nigritus*) are species of concern; all three species occur in the coastal waters in the temperate and tropical portions of the Study Area (Table 3.9-3).

3.9.2.31 Wrasses and Parrotfish (Families Labridae and Scaridae)

Perciform fish in the suborder Labroidei include the diverse wrasses (Labridae), and parrotfish (Scaridae), many of which are associated with nearshore reefs or structures. Wrasses include both brightly colored coral reef fish and less conspicuous temperate species. Most are active during the day, and feed by ambush or other predatory methods (Wainwright and Richard 1995). Parrotfish are habitat engineers in that they convert hard coral structures to coarse sediments and release nutrients and minerals to the water (Goatley and Bellwood 2009). Similar to the Serranidae, many wrasses and parrotfish begin life as female but change into male as they grow larger, and they exhibit a variety of reproductive strategies (Moyle and Cech 1996). This group has a similar distribution as the other perciform fish described in Section 3.9.2.29 (Drums, Snappers, Snooks, Temperate Basses, and Reef Fish [Families Sciaenidae, Lutjanidae, Centropomidae, Moronidae, Apogonidae, Chaetodontidae, Pomacanthidae, and Mullidae]) and the groupers and sea basses described in Section 3.9.2.30 (Groupers and Sea Basses [Family Serranidae]).

3.9.2.32 Gobies, Blennies, and Damselfish (Suborders Gobioidei, Blennioidei, and Acanthuroidei)

Another general group of Perciform is composed of gobies, blennies, and damselfish. The seafloor-dwelling gobies make up the largest family of marine fish, the Gobiidae (Nelson 2006); these fish have modified pelvic fins that allow them to adhere to various bottom surfaces (Helfman et al. 2009). Fish of the suborder Blennioidei occur in intertidal zones throughout the world (Mahon et al. 1998; Moyle and Cech 1996; Nelson 2006). Both blennies and gobies primarily feed on seafloor detritus. The suborder Acanthuroidei contains the surgeonfish, moorish idols, butterflyfish, and rabbitfish of tropical reef systems. They scrape algae from coral reefs with small, elongated mouths. These grazers provide an important function to the reef system by controlling the growth of algae on the reef (Goatley and Bellwood 2009). Some of these species are adapted to target particular prey species; for example, the elongated snouts of butterflyfish allow them to bite off exposed parts of invertebrates (Leysen et al. 2010).

This group is widely distributed throughout the world, primarily in coastal habitats. The fish occur in all coastal waters of the Study Area, but they are mostly concentrated in depths of less than 100 ft. (31 m) (Froese and Pauly 2010).

3.9.2.33 Jacks, Tunas, Mackerels, and Billfish (Families Carangidae, Scombridae, Xiphiidae, and Istiophoridae)

The suborder Scombroidei contains some of the most voracious open-ocean predators, besides sharks: the jacks, mackerels, barracudas, billfish, and tunas (Estrada et al. 2003; Sibert et al. 2006). These fish are the fastest members of the order Perciformes. Many jacks are known to ambush their prey either at night or at twilight (Goatley and Bellwood 2009; Rickel and Genin 2005; Sancho 2000). The highly migratory tunas, mackerels, and billfish constitute a large component of the total annual worldwide catch by weight, with tunas and swordfish as the most important species (Food and Agriculture Organization of the United Nations 2005, 2009). These fish breathe by ram ventilation, in which the motion of the fish pushes oxygenated water past the gills to increase respiratory efficiency (Wegner et al. 2006). Many fish in this group undertake large-scale migrations to follow a seasonally variable prey base (Pitcher 1995). The Atlantic bluefin tuna is a NMFS Species of Concern that occurs in the Study Area, as listed in Table 3.9-1.

These fish occupy the largest area of ocean, but make up only about 2 percent of the total marine fish (Froese and Pauly 2010; Helfman et al. 2009). They are mostly found near the surface or in the upper

portion of the water column, in all coastal waters and open ocean areas of the Study Area, including all of the large marine ecosystems, the Gulf Stream, and portions of the North Atlantic Subtropical Gyre.

3.9.2.34 Flounders (Order Pleuronectiformes)

The order Pleuronectiformes includes flatfish (flounders, sand dabs, soles, and tonguefish) in all marine seafloor habitats throughout the world (Nelson 2006). Fish in this group have eyes on either the left side or the right side of the head, and are not symmetrical like other fish (Saele et al. 2004). Flounders do not have swimbladders and are therefore not expected to be sensitive to underwater sounds, as discussed in Section 3.9.3 (Environmental Consequences). All flounder species are ambush predators, feeding mostly on other fish and bottom-dwelling invertebrates (Drazen and Seibel 2007; Froese and Pauly 2010). The Atlantic halibut (*Hippoglossus hippoglossus*) is a representative of this group, and is also a Species of Concern in the coastal waters in the Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, and West Greenland Shelf Large Marine Ecosystems of the Study Area. This group is widely distributed on the seafloor of open-ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated and diverse in depths of less than 330 ft. (100 m). This habitat is often associated with sandy bottoms in the coastal waters and open-ocean portions of the Study Area (Paxton and Eshmeyer 1998).

3.9.2.35 Triggerfish, Puffers, and Molas (Order Tetraodontiformes)

The Tetraodontiformes, including the triggerfish, filefish, puffers, and ocean sunfish, are the most highly evolved group of modern bony fish (Nelson 2006). Like the flounders, this group exhibits unusual body shapes with modified spines or other structures to deter predators. The bodies of some species are so boxlike that they cannot swim using the typical body propulsion style, but instead are propelled at slow speeds by rudimentary fins (Wainwright and Richard 1995). The ocean sunfish (*Mola* species) are the largest bony fish (Moyle and Cech 1996). They live very close to the surface, where they feed on a variety of plankton, jellyfish, crustaceans, and fish (Froese and Pauly 2010). The only natural predators of the large ocean sunfish in the Study Area are sharks and orcas (Helfman et al. 2009).

Most other fish in this group are associated with reef systems. This group is widely distributed in tropical and temperate bottom or mid-water column habitats (open-ocean and coastal) throughout the world. They occur in all waters of the Study Area, but are particularly concentrated and diverse in depths of less than 330 ft. (100 m). This habitat is often associated with natural or artificial reefs in the coastal waters and open-ocean portions of the Study Area (Paxton and Eshmeyer 1998). One major exception is the molas (ocean sunfish), which occur at the surface in all open ocean areas (Helfman et al. 2009).

3.9.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine fish known to occur within the Study Area. Tables 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of activities and ordnance expended). General characteristics of all U.S. Department of the Navy (Navy) stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). The stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to marine fish discussed in Section 3.9.2 (Affected Environment), the stressors applicable to marine fish in the Study Area and analyzed below include the following:

- Acoustic (sonar and other non-impulsive acoustic sources, and explosives and other impulsive acoustic sources),
- Energy (electromagnetic devices, high energy lasers),
- Physical disturbance and strikes (vessels and in-water devices, military expended materials, seafloor devices),
- Entanglement (fiber optic cables and guidance wires, parachutes),
- Ingestion (munitions, fragments from munitions, military expended materials other than munitions),
- Secondary stressors.

Each component was carefully analyzed for potential impacts on fish within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components within the context of geographic location and overlap of marine fish resources. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis), and detailed in Appendix A (Navy Activities Descriptions).

3.9.3.1 Acoustic Stressors

The following sections analyze potential impacts to fish from proposed activities that involve acoustic stressors (sonar and other non-impulsive sources, and explosives and other impulsive sources).

3.9.3.1.1 Analysis Background and Framework

This section is largely based on a technical report prepared for the Navy: *Effects of Mid- and High-Frequency Sonars on Fish* (Popper 2008). Additionally, Popper and Hastings (2009b) provide a critical overview of some of the most recent research regarding potential effects of anthropogenic sound on fish. The methods used in this EIS/OEIS to predict acoustic effects on marine fish build upon the *Conceptual Framework for Assessing Effects from Sound Producing Activities* (Section 3.0.5.7.1). Additional research specific to marine fish is presented below.

Studies of the effects of human-generated sound on fish have been reviewed in numerous places (e.g. Hastings and Popper 2005; National Research Council 1994, 2003; Popper 2003; Popper 2008; Popper and Hastings 2009b; Popper et al. 2004). Most investigations, however, have been in the gray literature (non peer-reviewed reports—see (Hastings and Popper 2005; Popper 2008; Popper and Hastings 2009a) for extensive critical reviews of this material).

Fish have been exposed to short-duration, high-intensity signals such as those that might be found near high-intensity sonar, pile driving, or a seismic airgun survey. Such studies examined short-term effects that could result in death to the exposed fish, as well as hearing loss and long-term consequences. Recent experimental studies have provided additional insight into the issues (e.g.,Doksaeter et al. 2009; Govoni et al. 2003; Kane et al. 2010; McCauley et al. 2003; Popper et al. 2007; Popper et al. 2005).

3.9.3.1.1.1 Direct Injury

Non-Impulsive Acoustic Sources

Potential direct injuries from non-impulsive sound sources, such as sonar, are unlikely because of the relatively lower peak pressures and slower rise times than potentially injurious sources such as explosives. Non-impulsive sources also lack the strong shock wave such as that associated with an explosion. Therefore, direct injury is not likely to occur from exposure to non-impulsive sources such as

sonar, vessel noise, or subsonic aircraft noise. The theories of sonar-induced acoustic resonance, neurotrauma, and lateral line system injury are discussed below. These phenomena are difficult to recreate under real-world conditions and are therefore very unlikely to occur in the natural environment.

Two studies examined the effects of mid-frequency sonar-like signals (1.5 to 6.5 kHz) on larval and juvenile fish of several species (Jørgensen et al. 2005; Kvadsheim and Sevaldsen 2005). In the first study, Jørgensen et al. (2005) exposed larval and juvenile fish to various sounds to investigate potential effects on survival, development, and behavior. The study used herring (*Clupea harengus*) (standard lengths 2 to 5 cm [0.8 to 2 inches]), Atlantic cod (*Gadus morhua*) (standard length 2 and 6 cm [0.8 to 2.3 inches]), saithe (*Pollachius virens*) (4 cm [1.6 inches]), and spotted wolffish (*Anarhichas minor*) (4 cm [1.6 inches]) at different developmental stages. The researchers placed the fish in plastic bags 10 ft. (3 m) from the sound source and exposed them to between 4 and 100 pulses of one-second duration of pure tones at 1.5, 4, and 6.5 kHz. The fish in only two groups out of the 82 tested exhibited any adverse effects. These two groups were both composed of herring and were tested with sound pressure levels of 189 dB re 1 µPa, which resulted in a post-exposure mortality of 20 to 30 percent. While statistically significant losses were documented in the two groups impacted, the researchers only tested that particular sound level once, so it is not known if this increased mortality was due to the level of the test signal or to other unknown factors. In the remaining 80 groups tested, 42 of which were replicates of herring only, there were no observed effects on growth (length and weight) or the survival of fish that were kept as long as 34 days post exposure. Direct injury effects from swim bladder resonance as a result of Navy sonar exposure have not been observed.

As reviewed in Popper and Hastings (2009a), Hastings (1990; 1995) found 'acoustic stunning' (loss of consciousness) in blue gouramis (*Trichogaster trichopterus*) following an 8-minute exposure to a 150 Hz pure tone with a peak sound pressure level of 198 dB re 1 µPa. This species of fish has an air bubble in the mouth cavity directly adjacent to the animal's braincase that may have caused this injury. Hastings (1990; 1995) also found that goldfish exposed to two hours of continuous wave sound at 250 Hz with peak pressures of 204 dB re 1 µPa, and fathead minnows exposed to 0.5 hours of 150 Hz continuous wave sound at a peak level of 198 dB re 1 µPa did not survive.

The only study on the effect of exposure of the lateral line system to continuous wave sound (conducted on one freshwater species, the Oscar [*Astronatus ocellatus*]) suggests no effect on these sensory cells by intense pure tone signals (Hastings et al. 1996).

Explosions and Other Impulsive Acoustic Sources

The greatest potential for direct, non-auditory tissue effects is primary blast injury and barotrauma following exposure to explosions. Primary blast injury refers to those injuries that result from the initial compression of a body exposed to a blast wave. Primary blast injury is usually limited to gas-containing structures (e.g., swim bladder) and the auditory system. Barotrauma refers to injuries caused when the swim bladder or other gas-filled structures vibrate in response to the signal, particularly if there is a relatively sharp rise-time and the walls of the structure strike near-by tissues and damage them.

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (U.S. Department of the Navy 1998, 2001c). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (i.e., heat and light) and are therefore the most likely source of negative effects to marine life from underwater explosions

(Scripps Institution of Oceanography and National Science Foundation 2005; U.S. Department of the Navy 2001b, 2006).

The shock wave from an underwater explosion is lethal to fish at close range causing massive organ and tissue damage and internal bleeding (Keevin and Hempen 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Keevin and Hempen 1997; Wright 1982). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Edds-Walton and Finneran 2006; O'Keeffe 1984; O'Keeffe and Young 1984; Wiley et al. 1981; Yelverton et al. 1975). Species with gas-filled organs have higher mortality than those without them (Continental Shelf Associates Inc. 2004; Goertner et al. 1994).

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton 2002). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky 1998). Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten 1998). Oscillating pressure waves might also burst gas-containing organs. The swim bladder, the gas-filled organ used by most fish to control buoyancy, is the primary site of damage from explosives (Wright 1982; Yelverton et al. 1975). Gas-filled swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of many bony fish but are not present in sharks and rays.

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Hubbs and Rechnitzer ; Yelverton et al. 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fish collected during these types of studies have mostly been recovered floating on the water's surface. Gitschlag et al. (2001) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that 3 to 87 percent (46 percent average) of the specimens killed during a blast might float to the surface. Other impediments to accurately characterizing the magnitude of fish mortality included currents and winds that transported floating fish out of the sampling area and predation by seabirds or other fish.

There have been few studies of the impact of underwater explosions on early life stages of fish (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fish, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fish (Settle et al. 2002). Shock wave trauma to internal organs of larval pinfish and spot from shock waves was documented by Govoni et al. (2003).

It has been suggested that impulsive sounds, such as those produced by seismic airguns, may cause damage to the cells of the lateral line in fish larvae and juveniles when in proximity (5 m [16 ft.]) to the sound source (Booman et al. 1996).

There have been a number of studies that suggest that the sounds from impact pile driving, and particularly from driving of larger piles, kill fish that are very close to the source. The source levels in such cases often reach peak sound pressure levels of 193 to 212 dB re 1 µPa and there is some evidence of tissue damage accompanying exposure (e.g., Abbott and Reyff 2004; California Department of Transportation 2001) reviewed in (Hastings and Popper 2005). However, there is reason for concern in analysis of such data since; in many cases the only dead fish observed were those that came to the surface. It is not clear whether fish that did not come to the surface survived the exposure to the sounds, or died and were carried away by currents.

There are also a number of non-peer reviewed experimental studies that placed fish in cages at different distances from the pile driving operations and attempted to measure mortality and tissue damage as a result of sound exposure. However, in most cases the studies' (Abbott et al. 2002; Abbott and Reyff 2004; Abbott et al. 2005; California Department of Transportation 2001; Nedwell et al. 2003) work was done with few or no controls, and the behavioral and histopathological observations done very crudely (the exception being Abbott et al. 2005). As a consequence of these limited and unpublished data, it is not possible to know the real effects of pile driving on fish.

Interim criteria for injury of fish were discussed in Stadler and Woodbury (2009). The onset of physical injury would be expected if either the peak sound pressure level exceeds 206 dB re 1 µPa, or the cumulative sound exposure level, accumulated over all pile strikes generally occurring within a single day, exceeds 187 dB referenced 1 micropascal squared second (dB re 1 μPa^2-s) for fish 2 grams or larger, or 183 dB re 1 μPa^2-s for smaller fish (Stadler and Woodbury 2009). A more recent study by Halvorsen et al. (2011) used carefully controlled laboratory conditions to determine the level of pile driving sound that may cause a direct injury to the fish tissues (barotrauma). The investigators found that juvenile Chinook salmon (*Oncorhynchus tshawytscha*) that received less than a single strike sound exposure level of 179 to 181 dB re 1 μPa^2-s and cumulative sound exposure level of less than 211 dB re 1 μPa^2-s over the duration of the pile driving event would sustain no more than mild, non-life-threatening injuries.

3.9.3.1.1.2 Hearing Loss

Exposure to high intensity sound can cause hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller 1974). A temporary threshold shift (TTS) is a temporary, recoverable loss of hearing sensitivity. A TTS may last several minutes to several weeks and the duration may be related to the intensity of the sound source and the duration of the sound (including multiple exposures). A PTS is non-recoverable, results from the destruction of tissues within the auditory system, and can occur over a small range of frequencies related to the sound exposure. As with temporary threshold shift, the animal does not become deaf but requires a louder sound stimulus (relative to the amount of PTS) to detect a sound within the affected frequencies; however, in this case, the effect is permanent.

Permanent hearing loss, or PTS has not been documented in fish. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al. 1993; Smith et al. 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (e.g., Smith et al. 2006).

Non-Impulsive Acoustic Sources

Studies of the effects of long-duration sounds with sound pressure levels below 170–180 dB re 1 µPa indicate that there is little to no effect of long-term exposure on species that lack notable anatomical hearing specialization (Amoser and Ladich 2003; Scholik and Yan 2001; Smith et al. 2004a, b; Wysocki et al. 2007). The longest of these studies exposed young rainbow trout (*Onorhynchus mykiss*), to a level of noise equivalent to one that fish would experience in an aquaculture facility (e.g., on the order of 150 dB re 1 µPa) for about nine months. The investigators found no effect on hearing (i.e., TTS) as compared to fish raised at 110 dB re 1 µPa.

In contrast, studies on fish with hearing specializations (i.e., greater sensitivity to lower sound pressures and higher frequencies) show there is some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., (Scholik and Yan 2002; Smith et al. 2006; Smith et al. 2004a). Smith et al. (2006; 2004b) exposed goldfish to noise at 170 dB re 1 µPa and found a clear relationship between the amount of hearing loss (TTS) and the duration of exposure until maximum hearing loss occurred after 24 hours of exposure. A ten-minute exposure resulted in a 5 dB TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al. 2004a) (Note: recovery time not measured by investigators for shorter exposure durations).

Similarly, Wysocki and Ladich (2005) investigated the influence of noise exposure on the auditory sensitivity of two freshwater fish with notable hearing specializations, the goldfish and the lined Raphael catfish (*Platydoras costatus*), and on a freshwater fish without notable specialization, the pumpkinseed sunfish (*Lepomis gibbosus*). Baseline thresholds showed greatest hearing sensitivity around 0.5 kHz in the goldfish and catfish and at 0.1 kHz in the sunfish. For the goldfish and catfish, continuous white noise of approximately 130 dB re 1 µPa at 1 m resulted in a significant TTS of 23 to 44 dB. In contrast, the auditory thresholds in the sunfish declined by 7 to 11 dB. The duration of exposure and time to recovery was not addressed in this study. Scholik and Yan (2001) demonstrated TTS in fathead minnows (*Pimephales promelas*) after a 24-hour exposure to white noise (0.3–2.0 kHz) at 142 dB re 1 µPa, that did not recover as long as 14 days post-exposure.

Studies have also examined the effects of the sound exposures from Surveillance Towed Array Sensor System Low-Frequency Active sonar on fish hearing (Kane et al. 2010; Popper et al. 2007). Hearing was measured both immediately post exposure and for several days thereafter. Maximum received sound pressure levels were 193 dB re 1 µPa for 324 or 628 seconds. Catfish and some specimens of rainbow trout showed 10-20 dB of hearing loss immediately after exposure to the low-frequency active sonar when compared to baseline and control animals; however, another group of rainbow trout showed no hearing loss. Recovery in trout took at least 48 hours, but studies were not completed. The different results between rainbow trout groups is difficult to understand, but may be due to developmental or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency active sonar. Furthermore, examination of the inner ears of the fish during necropsy (note: maximum time fish were held post exposure before sacrifice was 96 hours) revealed no differences from the control groups in ciliary bundles or other features indicative of hearing loss (Kane et al. 2010).

The study of mid-frequency active sonar by the same investigators also examined potential effects on fish hearing and the inner ear (Halvorsen et al. 2012; Kane et al. 2010). Out of the four species tested (rainbow trout, channel catfish, largemouth bass, and yellow perch) only one group of channel catfish, tested in December, showed any hearing loss after exposure to mid-frequency active sonar. The signal

consisted of a 2-second-long, 2.8–3.8 kHz frequency sweep followed by a 3.3 kHz tone of 1 second duration. The stimulus was repeated five times with a 25 second interval. The maximum received sound pressure level was 210 dB re 1 µPa. These animals, which have the widest hearing range of any of the species tested, experienced approximately 10 dB of threshold shift that recovered within 24 hours. Channel catfish tested in October did not show any hearing loss. The investigators speculated that the difference in hearing loss between catfish groups might have been due to the difference in water temperature of the lake where all of the testing took place (Seneca Lake, New York) between October and December. Alternatively, the observed hearing loss differences between the two catfish groups might have been due to differences between the two stocks of fish (Halvorsen et al. 2012). Any effects on hearing in channel catfish due to sound exposure appear to be transient (Halvorsen et al. 2012; Kane et al. 2010). Investigators observed no damage to ciliary bundles or other features indicative of hearing loss in any of the other fish tested including the catfish tested in October (Kane et al. 2010).

Some studies have suggested that there may be some loss of sensory hair cells due to high intensity sources; however, none of these studies concurrently investigated effects on hearing. Enger (1981) found loss of ciliary bundles of the sensory cells in the inner ears of Atlantic cod (*Gadus morhua*) following 1-5 hours of exposure to pure tone sounds between 50 and 400 Hz with a sound pressure level of 180 dB re 1 µPa. Hastings (1995) found auditory hair-cell damage in a species with notable anatomical hearing specializations, the goldfish (*Carassius auratus*) exposed to 250 Hz and 500 Hz continuous tones with maximum peak levels of 204 dB re 1 µPa and 197 dB re 1 µPa, respectively, for about two hours. Similarly, Hastings et al. (1996) demonstrated damage to some sensory hair cells in oscars (*Astronotus ocellatus*) following a one hour exposure to a pure tone at 300 Hz with a peak pressure level of 180 dB re 1 µPa. In none of the studies was the hair cell loss more than a relatively small percent (less than a maximum of 15 percent) of the total sensory hair cells in the hearing organs.

Explosions and Other Impulsive Acoustic Sources

Popper et al. (2005) examined the effects of a seismic airgun array on a fish with hearing specializations, the lake chub (*Couesius plumbeus*), and two species that lack notable specializations, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*) (a salmonid). In this study the average received exposure levels were a mean peak pressure level of 207 dB re 1 µPa; sound pressure level of 197 dB re 1 µPa; and single-shot sound exposure level of 177 dB re 1 μPa^2-s. The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 airgun shots, but not for the broad whitefish. Hearing loss was approximately 20 to 25 dB at some frequencies for both the northern pike and lake chub, and full recovery of hearing took place within 18 hours after sound exposure. Examination of the sensory surfaces of the ears by an expert on fish inner ear structure showed no damage to sensory hair cells in any of the fish from these exposures (Song et al. 2008).

McCauley et al. (2003) showed loss of a small percent of sensory hair cells in the inner ear of the pink snapper (*Pagrus auratus*) exposed to a moving airgun array for 1.5 hours. Maximum received levels exceeded 180 dB re 1 μPa^2-s for a few shots. The loss of sensory hair cells continued to increase for up to at least 58 days post exposure to 2.7 percent of the total cells, with disproportionate damage (approximately 15 percent of hair cells) in the caudal portion of the ear. It is not known if this hair cell loss would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in the inner ear (Lombarte and Popper 1994; Popper and Hoxter 1984) and only a small portion were affected by the sound. The question remains as to why McCauley et al. (2003) found damage to sensory hair cells while Popper et al. (2005) did not. There are many differences between the studies, including species, precise sound source, and spectrum of the sound that it is hard to speculate.

Hastings et al. (2008) exposed the pinecone soldierfish (*Myripristis murdjan*), a fish with anatomical specializations to enhance their hearing; and three species without notable specializations: the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*) to an airgun array. Fish in cages in 5 m (16 ft.) of water were exposed to multiple airgun shots with a cumulative sound exposure level of 190 dB re 1 μPa^2-s. The authors found no hearing loss in any fish following exposures.

As with other impulsive sound sources, it is assumed that sound from pile driving may cause hearing loss in fish located near the site (Popper and Hastings 2009a); however, research definitively demonstrating this is lacking.

3.9.3.1.1.3 Auditory Masking

Auditory masking refers to the presence of a noise that interferes with a fish's ability to hear biologically relevant sounds. Fish use sounds to detect predators and prey, and for schooling, mating, and navigating, among other uses (Myrberg 1980; Popper et al. 2003). Masking of sounds associated with these behaviors could have impacts to fish by reducing their ability to perform these biological functions.

Any noise (i.e., unwanted or irrelevant sound, often of an anthropogenic nature) detectable by a fish can prevent the fish from hearing biologically important sounds including those produced by prey or predators (Myrberg 1980; Popper et al. 2003). Auditory masking may take place whenever the noise level heard by a fish exceeds ambient noise levels, the animal's hearing threshold, and the level of a biologically relevant sound. Masking is found among all vertebrate groups, and the auditory system in all vertebrates, including fish, is capable of limiting the effects of masking noise, especially when the frequency range of the noise and biologically relevant signal differ (Fay 1988; Fay and Megela-Simmons 1999).

The frequency of the sound is an important consideration for fish because many marine fish are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and Ladich 2005). The frequency of the acoustic stimuli must first be compared to the animal's known or suspected hearing sensitivity to establish if the animal can potentially detect the sound.

One of the problems with existing fish auditory masking data is that the bulk of the studies have been done with goldfish, a freshwater fish with well-developed anatomical specializations that enhance hearing abilities. The data on other species are much less extensive. As a result, less is known about masking in marine species, many of which lack the notable anatomical hearing specializations. However, Wysocki and Ladich (2005) suggest that ambient sound regimes may limit acoustic communication and orientation, especially in animals with notable hearing specializations.

Tavolga (1974a, b) studied the effects of noise on pure-tone detection in two species without notable anatomical hearing specializations, the pin fish (*Lagodon rhomboids*) and the African mouth-breeder (*Tilapia macrocephala*), and found that the masking effect was generally a linear function of masking level, independent of frequency. In addition, Buerkle (1968, 1969) studied five frequency bandwidths for Atlantic cod in the 20 to 340 Hz region and showed masking across all hearing ranges. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean has masking effects in cod, *Gadus morhua*, haddock, *Melanogrammus aeglefinus*, and pollock, *Pollochinus pollachinus*, and similar results were suggested for several sciaenid species by Ramcharitar and Popper (2004). Thus, based on

limited data, it appears that for fish, as for mammals, masking may be most problematic in the frequency region near the signal.

There have been a few field studies that may suggest masking could have an impact on wild fish. Gannon et al. (2005) showed that bottlenose dolphins (*Tursiops truncatus*) move toward acoustic playbacks of the vocalization of Gulf toadfish (*Opsanus beta*). Bottlenose dolphins employ a variety of vocalizations during social communication including low-frequency pops. Toadfish may be able to best detect the low-frequency pops since their hearing is best below 1 kHz, and there is some indication that toadfish have reduced levels of calling when bottlenose dolphins approach (Remage-Healey et al. 2006). Silver perch have also been shown to decrease calls when exposed to playbacks of dolphin whistles mixed with other biological sounds (Luczkovich et al. 2000). Results of the Luczkovich et al. (2000) study, however, must be viewed with caution because it is not clear what sound may have elicited the silver perch response (Ramcharitar et al. 2006). Astrup (1999) and Mann et al. (1998) hypothesized that high frequency detecting species (e.g., clupeids) may have developed sensitivity to high frequency sounds to avoid predation by odontocetes. Therefore, the presence of masking noise may hinder a fish's ability to detect predators and therefore increase predation.

Of considerable concern is that human-generated sounds could mask the ability of fish to use communication sounds, especially when the fish are communicating over some distance. In effect, the masking sound may limit the distance over which fish can communicate, thereby having an impact on important components of their behavior. For example, the sciaenids, which are primarily inshore species, are one of the most active sound producers among fish, and the sounds produced by males are used to "call" females to breeding sights (Ramcharitar et al. 2001) reviewed in (2006). If the females are not able to hear the reproductive sounds of the males, there could be a significant impact on the reproductive success of a population of sciaenids. Since most sound production in fish used for communication is generally below 500 Hz (Slabbekoorn et al. 2010), sources with significant low-frequency acoustic energy could affect communication in fish.

Also potentially vulnerable to masking is navigation by larval fish, although the data to support such an idea are still exceedingly limited. There is indication that larvae of some reef fish (species not identified in study) may have the potential to navigate to juvenile and adult habitat by listening for sounds emitted from a reef (either due to animal sounds or non-biological sources such as surf action) (e.g., Higgs 2005). In a study of an Australian reef system, the sound signature emitted from fish choruses was between 0.8 and 1.6 kHz (Cato 1978) and could be detected by hydrophones 3 to 4 nm from the reef (McCauley and Cato 2000b). This bandwidth is within the detectable bandwidth of adults and larvae of the few species of reef fish, such as the damselfish, *Pomacentrus partitus,* and bicolor damselfish, *Eupomacentrus partitus,* that have been studied (Kenyon 1996; Myrberg 1980). At the same time, it has not been demonstrated conclusively that sound, or sound alone, is an attractant of larval fish to a reef, and the number of species tested has been very limited. Moreover, there is also evidence that larval fish may be using other kinds of sensory cues, such as chemical signals, instead of, or alongside of, sound (Atema et al. 2002).

3.9.3.1.1.4 Physiological Stress and Behavioral Reactions

As with masking, a fish must first be able to detect a sound above its hearing threshold for that particular frequency and the ambient noise before a behavioral reaction or physiological stress can occur. There are little data available on the behavioral reactions of fish, and almost no research conducted on any long-term behavioral effects or the potential cumulative effects from repeated exposures to loud sounds (Popper and Hastings 2009a).

Stress refers to biochemical and physiological responses to increases in background sound. The initial response to an acute stimulus is a rapid release of stress hormones into the circulatory system, which may cause other responses such as elevated heart rate and blood chemistry changes. Although an increase in background sound has been shown to cause stress in humans, only a limited number of studies have measured biochemical responses by fish to acoustic stress (e.g., Remage-Healey et al. 2006; Smith et al. 2004b; Wysocki et al. 2007; Wysocki et al. 2006) and the results have varied. There is evidence that a sudden increase in sound pressure level or an increase in background noise levels can increase stress levels in fish (Popper and Hastings 2009a). Exposure to acoustic energy has been shown to cause a change in hormone levels (physiological stress) and altered behavior in some species such as the goldfish (*Carassius auratus*) (Pickering 1981; Smith et al. 2004a, b), but not all species tested to date, such as the rainbow trout (*Oncorhynchus mykiss*) (Wysocki et al. 2007).

Behavioral effects to fish could include disruption or alteration of natural activities such as swimming, schooling, feeding, breeding, and migrating. Sudden changes in sound level can cause fish to dive, rise, or change swimming direction. There is a lack of studies that have investigated the behavioral reactions of unrestrained fish to anthropogenic sound. Studies of caged fish have identified three basic behavioral reactions to sound: startle, alarm, and avoidance (McCauley et al. 2000; Pearson et al. 1992; Scripps Institution of Oceanography and National Science Foundation 2008). Changes in sound intensity may be more important to a fish's behavior than the maximum sound level. Sounds that fluctuate in level tend to elicit stronger responses from fish than even stronger sounds with a continuous level (Schwartz 1985).

Non-Impulsive Acoustic Sources

Remage-Healey et al. (2006) found elevated cortisol levels, a stress hormone, in Gulf toadfish (*Opsanus beta*) exposed to low frequency bottlenose dolphin sounds. Additionally, the toadfish' call rates dropped by about 50 percent, presumably because the calls of the toadfish, a primary prey for bottlenose dolphins, give away the fish's location to the dolphin. The researchers observed none of these effects in toadfish exposed to an ambient control sound (i.e., low-frequency snapping shrimp 'pops').

Smith et al. (2004b) found no increase in corticosteroid, a stress hormone, in goldfish (*Carassius auratus*) exposed to a continuous, band-limited noise (0.1 – 10 kHz) with a sound pressure level of 170 dB re 1 µPa for one month. Wysocki et al. (2007) exposed rainbow trout (*Onorhynchus mykiss*) to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for nine months with no observed stress effects. Growth rates and effects on the trout's immune system were not significantly different from control animals held at sound pressure level of 110 dB re 1 µPa.

Gearin et al. (2000) studied responses of adult sockeye salmon (*Oncorhynchus nerka*) and sturgeon (*Acipenser* sp.) to pinger sounds produced by acoustic devices designed to deter marine mammals from gillnet fisheries. The pingers produced sounds with broadband energy with peaks at 2 kHz or 20 kHz. They found that fish did not exhibit any reaction or behavior change to the pingers, which demonstrated that the alarm was either inaudible to the salmon and sturgeon, or that neither species was disturbed by the mid-frequency sound (Gearin et al. 2000). Based on hearing threshold data, it is highly likely that the salmonids did not hear the sounds.

Culik et al. (2001) did a very limited number of experiments to determine the catch rate of herring (*Clupea harengus*) in the presence of pingers producing sounds that overlapped with the frequency range of hearing for herring (base frequency of 2.7 kHz with harmonics to 19 kHz). They found no change in catch rates in gill nets with or without the higher frequency (greater than 20 kHz) sounds

present, although there was an increase in the catch rate with the signals from 2.7 kHz to 19 kHz (a different source than the higher frequency source). The results could mean that the fish did not "pay attention" to the higher frequency sound or that they did not hear it, but that lower frequency sounds may be attractive to fish. At the same time, it should be noted that there were no behavioral observations on the fish, and so how the fish actually responded when they detected the sound is not known.

Doksæter et al. (2009) studied the reactions of wild, overwintering herring to Royal Netherlands Navy experimental mid-frequency active sonar and killer whale feeding sounds. The behavior of the fish was monitored using upward looking echosounders. The received levels from the 1-2 kHz and 6-7 kHz sonar signals ranged from 127-197 dB re 1 µPa and 139-209 dB re 1 µPa, respectively. Escape reactions were not observed upon the presentation of the mid-frequency active sonar signals; however, the playback of the killer whale sounds elicited an avoidance reaction. The authors concluded that these mid-frequency sonars could be used in areas of overwintering herring without substantially affecting the fish.

There is evidence that elasmobranchs respond to human-generated sounds. Myrberg and colleagues did experiments in which they played back sounds and attracted a number of different shark species to the sound source (e.g., Myrberg et al. 1969; Myrberg et al. 1976; Myrberg et al. 1972; Nelson and Johnson 1972). The results of these studies showed that sharks were attracted to low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey. However, sharks are not known to be attracted by continuous signals or higher frequencies (which they presumably cannot hear because their best hearing sensitivity is around 20 Hz, and drops off above 1,000 Hz (Casper and Mann 2006; 2009)).

Studies documenting behavioral responses of fish to vessels show that Barents Sea capelin (*Mallotus villosus*) may exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Misund (1997) found that fish ahead of a ship, that showed avoidance reactions, did so at ranges of 160 to 490 ft. (49–150 m). When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance or downward compression of the school.

In a study by Chapman and Hawkins (1973) the low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses by herring. Avoidance ended within 10 seconds after the vessel departed. Twenty-five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of small boats.

Explosions and Other Impulsive Acoustic Sources

Pearson et al. (1992) exposed several species of rockfish (*Sebastes* spp.) to a seismic airgun. The investigators placed the rockfish in field enclosures and observed the fish's behavior while firing the airgun at various distances for 10 minute trials. Dependent upon the species, rockfish exhibited startle or alarm reactions between peak to peak sound pressure level of 180 dB re 1 µPa and 205 dB re 1 µPa. The authors reported the general sound level where behavioral alterations became evident was at about 161 dB re 1 µPa for all species. During all of the observations, the initial behavioral responses only lasted for a few minutes, ceasing before the end of the 10-minute trial.

Similarly, Skalski et al. (1992) showed a 52 percent decrease in rockfish (*Sebastes* spp.) caught with hook-and-line (as part of the study – fisheries independent) when the area of catch was exposed to a

single airgun emission at 186-191 dB re 1 µPa (mean peak level) (See also Pearson et al. 1987, 1992). They also demonstrated that fish would show a startle response to sounds as low as 160 dB re 1 µPa, but this level of sound did not appear to elicit decline in catch. Wright (1982) also observed changes in fish behavior as a result of the sound produced by an explosion, with effects intensified in areas of hard substrate.

Wardle et al. (2001) used a video system to examine the behaviors of fish and invertebrates on reefs in response to emissions from seismic airguns. The researchers carefully calibrated the airguns to have a peak level of 210 dB re 1 µPa at 16 m and 195 dB re 1 µPa at 109 m from the source. There was no indication of any observed damage to the marine organisms. They found no substantial or permanent changes in the behavior of the fish or invertebrates on the reef throughout the course of the study, and no marine organisms appeared to leave the reef.

Engås et al. (1996) and Engås and Løkkeborg (2002) examined movement of fish during and after a seismic airgun study by measuring catch rates of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) as an indicator of fish behavior using both trawls and long-lines as part of the experiment. These investigators found a significant decline in catch of both species that lasted for several days after termination of airgun use. Catch rate subsequently returned to normal. The conclusion reached by the investigators was that the decline in catch rate resulted from the fish moving away from the airgun sounds at the fishing site. However, the investigators did not actually observe behavior, and it is possible that the fish just changed depth.

The same research group showed, more recently, parallel results for several additional pelagic species including blue whiting and Norwegian spring spawning herring (Slotte et al. 2004). However, unlike earlier studies from this group, the researchers used fishing sonar to observe behavior of the local fish schools. They reported that fish in the area of the airguns appeared to go to greater depths after the airgun exposure compared to their vertical position prior to the airgun usage. Moreover, the abundance of animals 30–50 km away from the ensonification increased, suggesting that migrating fish would not enter the zone of seismic activity.

Alteration in natural behavior patterns due to exposure to pile driving noise has not been well studied. However, one study (Mueller-Blenkle et al. 2010) demonstrated behavioral reactions of cod (*Gadus morhua*) and Dover sole (*Solea solea*) to pile driving sounds. Sole showed a significant increase in swimming speed. Cod reacted, but not significantly, and both species showed directed movement away from the sources with signs of habituation after multiple exposures. For sole, reactions were seen with peak sound pressure levels of 144 – 156 dB re 1 µPa; and cod showed altered behavior at peak sound pressure levels of 140 – 161 dB re 1 µPa. For both species, this corresponds to a peak particle motion between 6.51×10^{-3} and 8.62×10^{-4} m/s^2.

3.9.3.1.2 Impacts from Sonar and Other Non-Impulsive Acoustic Sources

Non-impulsive sources from the Proposed Action include sonar and other active acoustic sources, vessel noise, and subsonic aircraft noise. Potential acoustic effects to fish from non-impulsive sources may be considered in four categories, as detailed above in Section 3.9.3.1.1 (Analysis Background and Framework): (1) direct injury; (2) hearing loss; (3) auditory masking; and (4) physiological stress and behavioral reactions.

As discussed in Section 3.9.3.1.1.1 (Direct Injury), direct injury to fish as a result of exposure to non-impulsive sounds is highly unlikely to occur. Therefore, direct injury as a result of exposure to non-impulsive sound sources is not discussed further in this analysis.

Research discussed in Section 3.9.3.1.1.2 (Hearing Loss), indicates that exposure of fish to transient, non-impulsive sources is unlikely to result in any hearing loss. Most sonar sources are outside of the hearing and sensitivity range of most marine fish, and noise sources such as vessel movement and aircraft overflight lack the duration and intensity to cause hearing loss. Furthermore, PTS has not been demonstrated in fish as they have been shown to regenerate lost sensory hair cells. Therefore, hearing loss as a result of exposure to non-impulsive sound sources is not discussed further in this analysis.

3.9.3.1.2.1 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), training activities under the No Action Alternative include activities that produce in-water noise from the use of sonar and other active acoustic sources. Activities could occur throughout the Study Area but would be concentrated in Virginia Capes (VACAPES), Navy Cherry Point, and Jacksonville (JAX) Range Complexes, with lesser numbers of events in the Gulf of Mexico (GOMEX) and Northeast Range Complexes. These Navy range complexes are within the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Sonar and other active acoustic sources proposed for use are transient in most locations as active sonar activities pass through the Study Area. A few activities involving sonar and other active acoustic sources occur in inshore water (within bays, rivers, and estuaries), specifically at pierside locations. Sonar maintenance activities that would occur at pierside locations occur infrequently and typically emit only a few pings per event.

Only a few species of shad within the Clupeidae family (herrings) are known to be able to detect high-frequency sonar and other active acoustic sources (greater than 10,000 Hz). Other marine fish would probably not detect these sounds and would therefore experience no stress, behavioral disturbance, or auditory masking. Shad species, especially in nearshore and inland areas where mine warfare activities take place that often employ high-frequency sonar systems, could have behavioral reactions and experience auditory masking during these events. However, mine warfare activities are typically limited in duration and geographic extent. Furthermore, sound from high-frequency systems may only be detectable above ambient noise regimes in these coastal habitats from within a few kilometers. Behavioral reactions and auditory masking if they occurred for some shad species are expected to be transient. Long-term consequences for the population would not be expected.

Most marine fish species are not expected to be able to detect sounds in the mid-frequency range of the operational sonars. The fish species that are known to detect mid-frequencies (some sciaenids [drum], most clupeids [herring], and potentially deep-water fish such as myctophids [lanternfish]) do not have their best sensitivities in the range of the operational sonars. Thus, these fish may only detect the most powerful systems, such as hull mounted sonar within a few kilometers; and most other, less powerful mid-frequency sonar systems, for a kilometer or less. Due to the limited time of exposure due to the moving sound sources, most mid-frequency active sonar used in the Study Area would not have the potential to substantially mask key environmental sounds or produce sustained physiological stress or behavioral reactions. Furthermore, although some species may be able to produce sound at higher frequencies (greater than 1 kHz), vocal marine fish, such as sciaenids, largely communicate below the range of mid-frequency levels used by most sonars. Other marine species probably cannot detect mid-frequency sonar (1,000 – 10,000 Hz) and therefore impacts are not expected for these fish. However,

any such effects would be temporary and infrequent as a vessel operating mid-frequency sonar transits an area. As such, sonar use is unlikely to impact fish species. Long-term consequences for fish populations due to exposure to mid-frequency sonar and other active acoustic sources are not expected.

A large number of marine fish species may be able to detect low-frequency sonars and other active acoustic sources. However, low-frequency active usage is rare and most low-frequency active operations are conducted in deeper waters, usually beyond the continental shelf break. The majority of fish species, including those that are the most highly vocal, exist on the continental shelf and within nearshore, estuarine areas. Fish within a few tens of kilometers around a low-frequency active sonar could experience brief periods of masking, physiological stress, and behavioral disturbance while the system is used, with effects most pronounced closer to the source. However, overall effects would be localized and infrequent. Based on the low level and short duration of potential exposure to low-frequency sonar and other active acoustic sources, long-term consequences for fish populations are not expected.

As discussed in Section 3.0.5.3.1.6 (Vessel Noise), training activities under the No Action Alternative include vessel movement in many events. Navy vessel traffic could occur anywhere within the Study Area; however, it would be concentrated near the Norfolk and Mayport Navy ports and within the VACAPES, Cherry Point, and JAX Range Complexes. In a study of Navy vessel traffic, traffic was heaviest just offshore of Norfolk and Jacksonville, as well as along the coastal waters between the two ports (Mintz and Filadelfo 2011). Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Additionally, a variety of smaller craft would be operated within the Study Area. Small craft types, sizes and speeds vary. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. Vessel movements involve transit to and from ports to various locations within the Study Area, and many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels).

Vessel noise has the potential to expose fish to sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate). Training and testing events involving vessel movements occur intermittently and range in duration from a few hours up to a few weeks. These activities are widely dispersed throughout the Study Area. While vessel movements have the potential to expose fish occupying the water column to sound and general disturbance, potentially resulting in short-term behavioral or physiological responses, such responses would not be expected to compromise the general health or condition of individual fish. In addition, most activities involving vessel movements are infrequent and widely dispersed throughout the Study Area. The exception is for pierside activities, although these areas are located in inshore, these are industrialized areas that are already exposed to high levels of anthropogenic noise due to numerous waterfront users (e.g., industrial and marinas). Therefore, impacts from vessel noise would be temporary and localized. Long-term consequences for the population are not expected.

As described in Section 3.0.5.3.1.7 (Aircraft Overflight Noise), training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. A detailed description of aircraft noise as a stressor is provided in Section 3.0.5.3.1.7 (Aircraft Overflight Noise). Aircraft produce extensive airborne noise from either turbofan or turbojet engines. A severe but infrequent type of aircraft noise is the sonic boom, produced

when the aircraft exceeds the speed of sound. Rotary wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al. 2003).

Fish may be exposed to aircraft-generated noise wherever aircraft overflights occur; however, sound is primarily transferred into the water from air in a narrow cone under the aircraft. Most of these sounds would occur near airbases and fixed ranges within each range complex. Some species of fish could respond to noise associated with low-altitude aircraft overflights or to the surface disturbance created by downdrafts from helicopters. Aircraft overflights have the potential to affect surface waters and, therefore, to expose fish occupying those upper portions of the water column to sound and general disturbance potentially resulting in short-term behavioral or physiological responses. If fish were to respond to aircraft overflights, only short-term behavioral or physiological reactions (e.g., swimming away and increased heart rate) would be expected. Therefore, long-term consequences for individuals would be unlikely and long-term consequences for the populations are not expected.

Atlantic Salmon (Endangered Species Act-Listed)

Atlantic salmon, as summarized in Section 3.9.2.3 (Atlantic salmon [*Salmo salar*]), are anadromous and spend a portion of their lives in both the marine environment as well as in the riverine and estuarine systems of the northeast United States and Canada. Atlantic salmon have the potential to be exposed to non-impulsive sound associated with training activities under the No Action Alternative in the Northeast Range Complexes within the Northeast U.S. Continental Shelf Large Marine Ecosystem.

As discussed previously, Atlantic salmon are unable to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources (Section 3.9.2.1, Hearing and Vocalization). Therefore acoustic impacts from these sources are not expected.

Low-frequency active sonar and other active acoustic sources are not typically operated in the Northeast Range Complexes or in coastal or nearshore waters. If low frequency sources are used in the Northeast Range Complexes, then adult Atlantic salmon in the open ocean could be exposed to sound within their hearing range within these areas. If this did occur, salmon could experience behavioral reactions, physiological stress, and auditory masking, although these impacts would be expected to be short-term and infrequent based on the low probability of co-occurrence between the activity and species. Long-term consequences for the populations would not be expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose Atlantic salmon to sound and general disturbance, potentially resulting in short-term behavioral responses. Atlantic salmon are more susceptible to encounters with these sounds since they typically travel in schools within the top 10 ft. (3 m) of the water column (Hedger et al. 2009). However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

While the entire Kennebec River system surrounding the shipyard is considered critical habitat for the species as a result of its use as a spawning and nursery area, the shipyard in Bath, Maine has been excluded for national security reasons. The designated primary constituent elements (sites for spawning and incubation, sites for juvenile rearing, and sites for migration) for Atlantic salmon critical habitat do not occur within the Study Area and therefore, the proposed training activities would not affect the critical habitat.

Largetooth Sawfish (Endangered Species Act-Listed)

The historical range of the largetooth sawfish in the waters of the United States originally included the shallow waters of the entire Gulf of Mexico, as reviewed in Section 3.9.2.4.2 (Habitat and Geographic Range). However, confirmed sightings of these fish have not occurred in U.S. waters since 1961 (FR 74 (144): 37671-37674, July 29, 2009). As noted, due to the overall lack of any confirmed largetooth sawfish sightings in U.S. waters over the last five decades, it is highly unlikely that largetooth sawfish will co-occur with any Navy training activities.

Due to their preference for shallow, nearshore waters (less than 33 ft. [10 m]) (FR 74 (144): 37671-37674, July 29, 2009), it is unlikely that largetooth sawfish would encounter any use of mid-frequency active sonar during training activities in the GOMEX Range Complex. It is possible that if there were largetooth sawfish present, exposure to mid-frequency active sonar may occur during pierside surface ship maintenance activities occurring at naval ports within the Gulf of Mexico. As discussed previously (Section 3.9.2.1, Hearing and Vocalization), largetooth sawfish are unlikely to be able to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources. Therefore, acoustic impacts from these sources are not expected.

Low-frequency active sonar and other active acoustic sources are typically used in deeper water beyond the shelf break, well beyond preferred largetooth sawfish habitat. In addition, given the absence of any sightings of this species in U.S. waters over the last five decades, it is highly unlikely that any largetooth sawfish would be present in areas where low-frequency active sonar and other active acoustic sources would be in use. Nevertheless, in the unlikely event that it were to occur, in the open ocean these fish could be exposed to sound within their hearing range. If this did occur, they could experience behavioral reactions, physiological stress, and auditory masking, although these impacts would be expected to be short-term and infrequent based on the low probability of co-occurrence between the activity and species. Long-term consequences for the population would not be expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose largetooth sawfish to sound and general disturbance, potentially resulting in short-term behavioral responses as the sound source quickly passes. However, as discussed above, largetooth sturgeon are believed to be largely absent from the Northern Gulf of Mexico based onhistorical sightings and are therefore unlikely to be exposed to these noises. If this were to occur, however, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for the population are not expected.

Smalltooth Sawfish (Endangered Species Act-Listed)

The distribution of the smalltooth sawfish has contracted greatly over the past several decades and is believed to be restricted now primarily to Florida waters (Simpfendorfer 2006; Simpfendorfer and Wiley 2006), as described in Section 3.9.2.5.2 (Habitat and Geographic Range). However, verified encounters over the past 15 years have been noted within the Panama City OPAREA and the Key West Range Complex in the Gulf of Mexico; in the JAX Range Complex along the east coast of the United States; and at the Naval Surface Warfare Center, Panama City Division Testing Range (Simpfendorfer 2006). Typically, smalltooth sawfish prefer nearshore, coastal habitats, but it is not uncommon for larger adults to occur in deeper waters ranging from 230 to 400 ft. (70 to 120 m) in depth (Poulakis and Seitz 2004; Simpfendorfer 2006).

While unlikely, due to their preference for shallow, nearshore habitats, smalltooth sawfish may occur in areas that coincide with training activities involving active high- and mid-frequency sonar, particularly in the JAX and Key West Range Complexes and in the Panama City OPAREA. Smalltooth sawfish may also be exposed to sonar noise during pierside mid-frequency sonar maintenance activities occurring at the Naval Base Mayport in Jacksonville, Florida and Port Canaveral in Port Canaveral, Florida. As discussed previously (Section 3.9.2.1, Hearing and Vocalization), smalltooth sawfish are unlikely to be able to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources. Therefore, acoustic impacts from these sources are not expected.

Low-frequency active sonar is used in the JAX Range Complex and could co-occur with the habitat of the smalltooth sawfish in the deeper waters near and seaward of the continental shelf break. The low frequency sound emitted by these sonars may be within the hearing range of smalltooth sawfish. Consequently, it is possible that exposure to the sound may result in an increase in the stress level of the fish, elicit a behavioral response, or cause auditory masking. However, any exposure to low-frequency active noise would be infrequent and brief.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose smalltooth sawfish to sound and general disturbance, potentially resulting in short-term behavioral responses as the sound source quickly passes. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

As discussed in Section 3.9.2.5.1 (Status and Management), the Key West Range Complex does not overlap critical habitat areas; the northeastern boundary (W-174G) of the Key West Range Complex is within approximately 9 nm of critical habitat at its closest point. Therefore proposed training activities are unlikely to take place within smalltooth sawfish critical habitat, although sound from activities involving non-impulsive sound sources that take place near the Key West Range Complex boundary may be present within the critical habitat. The primary constituent elements (i.e., red mangroves and shallow water less than 3 ft. [0.9 m] deep) would not be affected.

Shortnose Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.6.2 (Habitat and Geographic Range), shortnose sturgeon, which primarily inhabit rivers and estuaries, are not expected to occur in portions of the Study Area located in the Atlantic Ocean (Dadswell 2006; National Marine Fisheries Service 1998). Individuals generally remain within their natal river or estuary, only occasionally moving to marine environments (Dadswell et al. 1984). In addition, shortnose sturgeon rarely occur in the lower Chesapeake Bay portion of the Study Area. The current Chesapeake Bay system population appears to be centered in the upper Chesapeake Bay (Welsh et al. 2002). However, the species is known to frequent other inshore portions of the Study Area, including the Kennebec River in Maine, St. Johns River in Florida, and Kings Bay in Georgia.

As a result of their preference for inshore and nearshore environments (Dadswell 2006; National Marine Fisheries Service 1998), shortnose sturgeon would be exposed to activities associated with the proposed action very infrequently. However, shortnose sturgeon could be exposed to mid-frequency sonar during pierside surface ship sonar maintenance activities occurring at the Naval Submarine Base Kings Bay in Kings Bay, Georgia, and the Naval Base Mayport in Jacksonville, Florida. As discussed previously (Section 3.9.2.1, Hearing and Vocalization), shortnose sturgeon are unlikely to be able to detect the

sound produced by mid- or high-frequency sonar and other active acoustic sources. Therefore, acoustic impacts from these sources are not expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose shortnose sturgeon to sound and general disturbance, potentially resulting in short-term behavioral responses as the sound source quickly passes. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

Gulf Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.7.2 (Habitat and Geographic Range), Gulf sturgeon, when not spawning in the rivers, are found in the Gulf of Mexico in nearshore and inshore waters. They typically range in distribution from Louisiana through the panhandle of Florida (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009).

Due to their preference for shallow, nearshore waters (less than 20 ft. [6 m]) (Fox et al. 2000; Fox et al. 2002), it is unlikely that Gulf sturgeon would encounter any use of mid-frequency active sonar during training activities in the GOMEX Range Complex. It is possible that were Gulf sturgeon present, exposure to mid-frequency active sonar may occur during pierside surface ship maintenance activities occurring at naval ports within the Gulf of Mexico. As discussed previously (Section 3.9.2.1, Hearing and Vocalization), Gulf sturgeon are unlikely to be able to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources. Therefore, acoustic impacts from these sources are not expected.

Low-frequency active sonar and other active acoustic sources are typically used in deeper water beyond the shelf break, well away from potential Gulf sturgeon habitat. Nevertheless, Gulf sturgeon in the open ocean could be exposed to sound within their hearing range. If this did occur, they could experience behavioral reactions, physiological stress, and auditory masking, although these impacts would be expected to be short-term and infrequent based on the low probability of co-occurrence between the activity and species. Long-term consequences for the populations would not be expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose Gulf sturgeon to sound and general disturbance, potentially resulting in short-term behavioral responses as the sound source quickly passes. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

Proposed training activities overlap designated critical habitat for Gulf sturgeon within one mile of the coastline and at pierside locations in the eastern Gulf of Mexico as discussed in Section 3.9.2.7.1 (Status and Management). The primary constituent elements are generally not applicable to the Study Area since they occur within the riverine habitat of the species. The use of non-impulsive sources in Gulf sturgeon critical habitat are unlikely to interfere with the individuals' safe and unobstructed passage between riverine, estuarine and marine habitats. Therefore, non-impulsive sound sources used in proposed training activities are unlikely to affect Gulf sturgeon designated critical habitat.

Atlantic Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.8 (Atlantic Sturgeon [*Acipenser oxyrinchus oxyrinchus]*), Atlantic sturgeon, when not in the rivers during spawning season, inhabit estuarine and marine waters of the Atlantic coast out to a depth of 164 ft. (50 m) (Bain 1997). Atlantic sturgeon are found along nearly the entire east coast of the United States from the St. Croix River in Maine south to the St. Johns River in Florida.

While unlikely, due to their preference for shallow, nearshore habitats, Atlantic sturgeon may occur in areas that coincide with training activities involving active sonar, particularly in the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes. Atlantic sturgeon may also be exposed to sonar noise during pierside surface ship sonar maintenance activities occurring at Naval Submarine Base in Groton, Connecticut; Norfolk Naval Base in Virginia; Joint Expeditionary Base Little Creek in Norfolk, Virginia; Naval Submarine Base Kings Bay in Georgia; and Naval Base Mayport in Florida. As discussed previously (see Section 3.9.2.1, Hearing and Vocalization), Atlantic sturgeon are unlikely to be able to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources. Therefore, acoustic impacts from these sources are not expected.

Low-frequency active sonar and other active acoustic sources are typically used in deeper water beyond the shelf break, well away from potential Atlantic sturgeon habitat. Nevertheless, Atlantic sturgeon in the open ocean could be exposed to sound within their hearing range. If this did occur, they could experience behavioral reactions, physiological stress, and auditory masking, although these impacts would be expected to be short-term and infrequent based on the low probability of co-occurrence between the activity and species. Long-term consequences for the populations would not be expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose Atlantic sturgeon to sound and general disturbance, potentially resulting in short-term behavioral responses as the sound source quickly passes. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

Conclusion

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral reactions. Long-term consequences for populations would not be expected.

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources for training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.2.2 No Action Alternative – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1 (Acoustic Stressors), testing activities under the No Action Alternative include activities that use sonar and other active acoustic sources that produce underwater sound. These activities would be concentrated in the Northeast Range Complexes and the Rhode Island inland waters, with lesser amounts of activity in the GOMEX Range Complex and the Naval Surface Warfare Center, Panama City

Division Testing Range. VACAPES, JAX, and Key West Range Complexes also host a significant number testing activities. Within these range complexes, activities involving the use of sonar and other active acoustic sources are concentrated in the Northeast U.S. Continental Shelf, as well as the Gulf of Mexico Large Marine Ecosystems. Proposed testing activities under the No Action Alternative that involve sonar and other active acoustic sources differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

As discussed in Section 3.0.5.3.1.6 (Vessel Noise), testing activities under the No Action Alternative include vessel movement in many events. Navy vessel traffic associated with testing could take place anywhere within the Study Area primarily concentrated within the VACAPES, Navy Cherry Point, and JAX Range Complexes as well as the Northeast Range Complexes and adjacent inland waters; and in the Gulf of Mexico, especially in areas near Naval Surface Warfare Center, Panama City Division Testing Range. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Additionally, a variety of smaller craft will be operated within the Study Area. Small craft types, sizes, and speeds vary. During testing, speeds generally range from 10 to 14 knots; however, vessels can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. In all cases, the vessels would be operated in a safe manner consistent with the local conditions. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. Proposed testing activities under the No Action Alternative that involve vessel movement differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

As discussed in Section 3.0.5.3.1.7 (Aircraft Overflight Noise), testing activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These events would be spread across the large marine ecosystems and open ocean areas designated within the Study Area. Proposed testing activities under the No Action Alternative that involve aircraft overflights differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral reactions. Long-term consequences for populations would not be expected. Predicted impacts to Endangered Species Act-listed fish species and any designated critical habitat would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.2.3 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1 and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), the number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would increase; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.6 (Vessel Noise), training activities, under Alternative 1 include an increase in the numbers of activities that involve vessels compared to the No Action Alternative; however, the locations and predicted impacts would not differ. Proposed training activities under Alternative 1 that involve vessel movement differ in number from training activities proposed under the No Action Alternative; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.7 (Aircraft Overflight Noise), training activities under Alternative 1 include an increase in the number of activities that involve aircraft as compared to the No Action Alternative; however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral responses, physiological stress, and short periods of auditory masking; however, long-term consequences for populations would not be expected. Predicted impacts to ESA-listed fish species and designated critical habitat would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.2.4 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Acoustic Stressors), the number of annual testing activities that produce in-water sound from the use of sonar and other active acoustic sources analyzed under Alternative 1 would increase over what was analyzed for the No Action Alternative. These activities would happen in the same general locations under Alternative 1 as described under the No Action Alternative in Section 3.9.3.1.2.2 (No Action Alternative – Testing Activities).

In addition to unmanned underwater vehicle demonstrations described under the No Action Alternative conducted once per five-year period at both Naval Surface Warfare Center, Panama City Division Testing Range and Naval Undersea Warfare Center Division, Newport Testing Range, one unmanned underwater

vehicle demonstration per five-year period could be conducted at the South Florida Ocean Measurement Facility Testing Range near Fort Lauderdale, Florida under Alternative 1. These activities would mean in increase in high-frequency sonar use in these areas once during a five year period. As described in Section 3.9.3.1.2.2 (No Action Alternative – Testing Activities), these non-impulsive sources may impact a few species that inhabit nearshore waters with hearing above 1,000 Hz (e.g., clupeids, some species of reef-fish, and some species of sciaenid); however, due to the infrequent nature of this activity, long-term consequences for populations in these areas would not be expected.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 through 2.8-3, and Section 3.0.5.3.1.6 (Vessel Noise), testing activities proposed under Alternative 1, would increase Navy vessel traffic from the No Action Alternative, leading to an increase in vessel-related noise in some portions of the Study Area. Additional ship trials will be conducted in the Northeast, VACAPES, JAX and GOMEX Range Complexes, and activities that include the use of vessels would increase at the South Florida Ocean Measurement Facility Testing Range. New vessels proposed for testing under Alternative 1, such as the Littoral Combat Ship, the Joint High Speed Vessel, and the Expeditionary Fighting Vehicle, are all fast moving, designed to operate in nearshore waters, and may increase overall noise levels in these environments. Proposed testing activities under Alternative 1 that produce underwater noise from vessel movement differ in number and location from training activities proposed under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.2 (No Action Alternative – Testing Activities). Long-term consequences to populations due to the proposed activities are not expected.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 and 2.8-3, and Section 3.0.5.3.1.7 (Aircraft Overflight Noise), testing activities under Alternative 1 include an increase in the number of events that involve aircraft as compared to the No Action Alternative; however, the testing locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.2 (No Action Alternative – Testing Activities). Long-term consequences to populations due to the proposed activities are not expected.

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral responses, physiological stress, and short period of auditory masking; however, long-term consequences for populations would not be expected. Predicted impacts to Endangered Species Act-listed fish species and designated critical habitat would not be discernible from those described above in Section 3.9.3.1.2.2 (No Action Alternative – Testing Activities). Long-term consequences to populations due to the proposed activities are not expected.

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.2.5 Alternative 2 – Training Activities (Preferred Alternative)

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Training Activities under Section 3.9.3.1.2.3 (Alternative 1 – Training Activities).

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.2.6 Alternative 2 – Testing Activities (Preferred Alternative)

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Acoustic Stressors), the number of annual testing activities that use sonar and other active acoustic sources analyzed under Alternative 2 would increase over what was analyzed for the No Action Alternative. Proposed testing activities under Alternative 2 that produce underwater sound from sonar and other active acoustic sources differ in number from testing activities proposed under Alternative 1; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.4 (Alternative 1 – Testing Activities).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 through 2.8-3, and Section 3.0.5.3.1.6 (Vessel Noise), testing activities proposed under Alternative 2, would increase the number of testing activities that use Navy vessels, leading to an increase in vessel-related noise in some portions of the Study Area as described under testing activities for Alternative 1 (Section 3.9.3.1.2.4, Alternative 1 – Testing Activities). Proposed testing activities under Alternative 2 that produce underwater noise from vessel movement differ in number from testing activities proposed under Alternative 1; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.4 (Alternative 1 – Testing Activities).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 through 2.8-3, and Section 3.0.5.3.1.7 (Aircraft Overflight Noise), testing activities under Alternative 2 include an increase in the number of events that involve aircraft as compared to the No Action Alternative; however, the testing locations, types of aircraft, and types of activities would not differ. Proposed testing activities under Alternative 2 that involve aircraft participation differ in number from testing activities proposed under Alternative 1; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.2.4 (Alternative 1 – Testing Activities).

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral responses, physiological stress, and short period of auditory masking; however, long-term consequences for populations would not be expected. Predicted impacts to Endangered Species Act-listed fish species and designated critical habitat would not be discernible from those described above in Section 3.9.3.1.2.4 (Alternative 1 – Testing Activities).

Pursuant to the ESA, the use of sonar and other non-impulsive acoustic sources during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

3.9.3.1.3 Impacts from Explosives and Other Impulsive Acoustic Sources

Explosions and other impulsive sound sources include explosions from underwater detonations and explosive munitions, swimmer defense airguns, pile driving, and noise from weapons firing, launch, and impact with the water's surface. Potential acoustic effects to fish from impulsive sound sources may be considered in four categories, as detailed above in Section 3.9.3.1 (Acoustic Stressors) (1) direct injury; (2) hearing loss; (3) auditory masking; and (4) physiological stress and behavioral reactions.

Concern about potential fish mortality associated with the use of at-sea explosives led military researchers to develop mathematical and computer models that predict safe ranges for fish and other animals from explosions of various sizes (e.g., Goertner 1982; Goertner et al. 1994; Yelverton et al. 1975). Young (1991) provides equations that allow estimation of the potential effect of underwater explosions on fish possessing swim bladders using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (e.g., depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3.9-5, which lists estimated explosive-effects ranges using Young's (1991) method for fish possessing swim bladders exposed to explosions that would typically occur during training exercises. The 10 percent mortality range is the distance beyond which 90 percent of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (Continental Shelf Associates Inc. 2004).

Table 3.9-5: Estimated Explosive Effects Ranges for Fish with Swim Bladders

Training Operation and Type of Ordnance	NEW (lb.)	Depth of Explosion (ft.)	10% Mortality Range (ft.)		
			1-oz. Fish	1-lb. Fish	30-lb. Fish
Mine Neutralization					
MK-103 Charge	0.002	10	40	28	18
AMNS Charge	3.24	20	366	255	164
20-lb. NEW UNDET Charge	20	30	666	464	299
Missile Exercise					
Hellfire	8	3.3	317	221	142
Maverick	100	3.3	643	449	288
Firing Exercise with IMPASS					
HE Naval Gun Shell, 5-inch	8	1	244	170	109
Bombing Exercise					
MK-20	109.7	3.3	660	460	296
MK-82	192.2	3.3	772	539	346
MK-83	415.8	3.3	959	668	430
MK-84	945	3.3	1,206	841	541

AMNS: airborne mine neutralization system; ft.: foot/feet; HE: high-explosive; IMPASS: integrated marine portable acoustic scoring system; NEW: net explosive weight; lb.: pound; oz.: ounce, UNDET: underwater detonation; %: percent

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

The number of fish killed by an underwater explosion would depend on the population density in the vicinity of the blast, as well as factors discussed above such as net explosive weight, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of menhaden, herring, or other schooling fish, a large number of fish could be killed. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish.

A detailed description of weapons firing, launch, and impact noise is provided in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise under the muzzle blast of a 5-inch gun and directly under the flight path of the shell (assuming the shell is a few meters above the water's surface) would produce a peak sound pressure level of approximately 200 dB re 1 µPa near the surface of the water (1–2 m depth). Sound due to missile and target launches is typically at a maximum during initiation of the booster rocket and rapidly fades as the missile or target travels downrange. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Large-caliber non-explosive projectiles, non-explosive bombs, and intact missiles and targets could produce a large impulse upon impact with the water surface (McLennan 1997). These sounds from weapons firing launch, and impact noise would be transient and of short duration, lasting no more than a few seconds at any given location.

See the discussion in Section 3.0.5.3.1.4 (Swimmer Defense Airguns) for details on swimmer defense airguns. Source levels are estimated to be 185-195 dB re 1 μPa^2-s at 1 m. For 100 shots, the cumulative sound exposure level would be approximately 215-225 dB re 1 μPa^2-s at 1 m.

Details pertaining to the proposed pile driving activities, and potential resultant noise levels are discussed in Section 3.0.5.3.1.3 (Pile Driving). Impulses from the impact pile driving hammer are broadband and carry most of their energy in the lower frequencies. The impulses can produce a shock wave that is transmitted to the sediment and water column (Reinhall and Dahl 2011). Elevated causeway system pile installation and removal within the project area would result in a temporary increased in underwater noise levels.

3.9.3.1.3.1 No Action Alternative – Training Activities

Training activities under the No Action Alternative do not include the use of pile driving or swimmer defense airguns.

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosives), training activities under the No Action Alternative would use underwater detonations and explosive munitions. Training activities involving explosions would be conducted throughout the Study Area but would be concentrated in the VACAPES Range Complex, followed in descending order of numbers of activities by JAX, Navy Cherry Point, GOMEX, and the Northeast Range Complexes. These events would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf or the Gulf Stream Open Ocean Area, with lesser activities in the Gulf of Mexico Large Marine Ecosystem and the North Atlantic Gyre Open Ocean Areas. Training activities that involve underwater detonations and explosive munitions typically occur greater than 3 nm from shore.

Sounds from explosions could cause hearing loss in nearby fish (dependent upon charge size). Permanent hearing loss has not been demonstrated in fish, as lost sensory hair cells can be replaced unlike in mammals. Fish that experience hearing loss could miss opportunities to detect predators or prey, or reduce interspecific communication. If an individual fish were repeatedly exposed to sounds from underwater explosions that caused alterations in natural behavioral patterns or physiological stress, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Consequently, repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. Long-term consequences for populations would not be expected.

As described in Chapter 2 (Description of Proposed Action and Alternatives), and Table 2.8-1, training activities under the No Action Alternative include activities that produce in water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. Activities are spread throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, and JAX Range Complexes, with lesser numbers of events in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area, but would be concentrated within the Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other ordnance are conducted greater than 12 nm from shore.

Fish that are exposed to noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface may exhibit brief behavioral reactions; however, due to the short term, transient nature of weapons firing, launch, and non-explosive impact noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short-term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

Atlantic Salmon (Endangered Species Act-Listed)

Atlantic salmon, as summarized in Section 3.9.2.3 (Atlantic salmon [*Salmo salar*]), are anadromous and spend a portion of their lives in both the marine environment as well as in the riverine and estuarine systems of the northeast United States and Canada. While in the marine environment, Atlantic salmon have the potential to be exposed to explosive energy and sound as its being used in the Northeast Range Complexes. Since salmon spawn in rivers and the early life stages of the fish occur in riverine and estuarine environments, eggs and larvae would not be exposed to impulsive sounds produced from explosions, weapons firing, launch, and non-explosive practice munitions impact with the water's surface during training events.

Training activities involving explosives in the Northeast Range Complexes have the possibility to impact Atlantic salmon, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. Atlantic salmon typically travel in schools within the top 10 ft. (3 m) of the water column (Hedger et al. 2009) and would, therefore, be susceptible to explosions both at the surface and at depth. However, given the infrequent nature of training events involving explosives in the Northeast Range Complexes and the rarity of the species, the likelihood of a school of salmon encountering an explosive event taking place anywhere within the range complexes is remote.

There is also a potential for Atlantic salmon to encounter training activities that produce in water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface within the Northeast Range Complexes. However, the likelihood of encounter, based on the rarity of the species and the relative infrequency of events, is very unlikely. Salmon that are exposed to noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface may exhibit brief behavioral reactions. However, due to the short-term, transient nature of these activities, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

The designated primary constituent elements (sites for spawning and incubation, sites for juvenile rearing, and sites for migration) for Atlantic salmon critical habitat do not occur within the Study Area and therefore, the proposed training activities would not affect the critical habitat.

Largetooth Sawfish (Endangered Species Act-Listed)

The historical range of the largetooth sawfish in the waters of the U.S. originally included the shallow waters of the entire Gulf of Mexico, as reviewed in Section 3.9.2.4 (Largetooth Sawfish [*Pristis pristis*]). However, confirmed sightings of these fish have not occurred in U.S. waters since 1961 (FR 74 (144): 37671-37674, July 29, 2009).

Due to their preference for shallow, nearshore waters (less than 33 ft. [10 m]) (FR 74 (144): 37671-37674, July 29, 2009), it is unlikely that largetooth sawfish would encounter any training activities involving explosives in the GOMEX Range Complex. If an encounter were to occur, it may result in behavior responses, hearing loss, physical injury, or death to fish near the activity.

There is also a small potential for largetooth sawfish to encounter training activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface within the GOMEX Range Complex where these activities occur. However, due to the largetooth sawfish's preference for nearshore, shallow waters, it is unlikely these fish would occur in waters where training was occurring. Were they to co-occur, the noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface would be unlikely to disturb the fish due to the largetooth sawfish's preference for moving along the seafloor. Behavioral reactions would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

As noted, due to the overall lack of any confirmed largetooth sawfish sightings in U.S. waters over the last five decades, it is highly unlikely that largetooth sawfish will co-occur with any Navy training activities, particularly given the infrequent nature of these events.

Smalltooth Sawfish (Endangered Species Act-Listed)

The distribution of the smalltooth sawfish has contracted greatly over the past several decades and is believed to be restricted now primarily to Florida waters (Simpfendorfer 2006; Simpfendorfer and Wiley 2006), as described in Section 3.9.2.5 (Smalltooth Sawfish [*Pristis pectinata*]). However, verified encounters over the past 15 years have been noted within the Panama City OPAREA and the Key West Range Complex in the Gulf of Mexico and in the JAX Range Complex along the east coast of the United States (Simpfendorfer and Wiley 2006). Typically, smalltooth sawfish prefer nearshore, coastal habitats, but it is not uncommon for larger adults to occur in deeper waters ranging from 230 to 400 ft. (70 to 120 m) in depth (Poulakis and Seitz 2004; Simpfendorfer 2006).

While unlikely, due to their preference for shallow, nearshore habitats, smalltooth sawfish may occur in areas that coincide with training activities involving explosives, such as the JAX Range Complexes and the Panama City OPAREA. Encounters may result in behavior responses, hearing loss, physical injury, or death to fish near the activity.

Smalltooth sawfish could be exposed to training activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. These encounters were they to occur, have the potential to expose smalltooth sawfish to noise, potentially resulting in short-term behavioral responses. Behavioral reactions would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

As discussed in Section 3.9.2.5 (Smalltooth Sawfish [*Pristis pectinata*]), the Key West Range Complex does not overlap with critical habitat areas; the northeastern boundary (W-174G) of the Key West Range Complex is within approximately 9 nm [17 km] of critical habitat at its closest point. Therefore, proposed training activities are unlikely to take place within smalltooth sawfish critical habitat, although sound from activities involving impulsive sound sources that take place near the Key West Range Complex boundary may be present within the critical habitat. The primary constituent elements (i.e., red mangroves and shallow water less than 3 ft. [0.9 m] deep) would not be affected.

Shortnose Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.6 (Shortnose Sturgeon [*Acipenser brevirostrum*]), shortnose sturgeon, which primarily inhabit rivers and estuaries, are not expected to occur in portions of the Study Area located in the Atlantic Ocean (Dadswell 2006; National Marine Fisheries Service 1998). Individuals generally remain within their natal river or estuary, only occasionally moving to marine environments (Dadswell et al. 1984). In addition, shortnose sturgeon rarely occur in the lower Chesapeake Bay portion of the Study Area. The current Chesapeake Bay system population appears to be centered in the upper Chesapeake Bay (Welsh et al. 2002). However, the species is known to frequent other inshore portions of the Study Area, including the Kennebec River in Maine, Kings Bay in Georgia, and St. Johns River in Florida.

Underwater explosions, particularly those associated with mine warfare training that occur in shallow water areas of the JAX Range Complex or activities in the shallow waters of the Northeast Range Complexes, may impact shortnose sturgeon. Encounters may result in behavioral responses, hearing loss, physical injury, or death to fish if near the activity.

Since shortnose sturgeon rarely move far offshore, exposure to training activities that produce in water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface would be unlikely as well. These encounters were they to occur, have the potential to expose shortnose sturgeon to sound and general disturbance, potentially resulting in short-term behavioral responses. Behavioral reactions would likely be short-term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

Gulf Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.7 (Gulf Sturgeon [*Acipenser oxyrinchus desotoi*]), Gulf sturgeon, when not spawning in the rivers, are found in the Gulf of Mexico in nearshore and inshore waters. They typically range in distribution from Louisiana through the panhandle of Florida (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009).

Due to their preference for shallow, nearshore waters (less than 20 ft. [6 m]) (Fox et al. 2000; Fox et al. 2002), it is unlikely that Gulf sturgeon would occur in areas that coincide with training activities involving explosives in the GOMEX Range Complex. Encounters, if they were to occur, may result in behavioral responses, hearing loss, physical injury, or death to fish near the activity.

There is a potential for Gulf sturgeon to encounter training activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface within the GOMEX Range Complex where these activities occur. Due to the short-term, transient nature of these activities, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short-term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. In addition, due to the sturgeon's preference for nearshore, shallow waters, it is unlikely these fish would occur in waters in which the training was occurring.

Proposed training activities overlap designated critical habitat for Gulf sturgeon within one mile of the coastline in the eastern Gulf of Mexico as discussed in Section 3.9.2.7.1 (Status and Management). Most of the primary constituent elements are generally not applicable to the Study Area since they occur within the riverine habitat of the species. The use of explosive and other impulsive sources in Gulf sturgeon critical habitat are unlikely to interfere with the individuals' safe and unobstructed passage between riverine, estuarine, and marine habitats. However, part of the primary constituent elements for Gulf sturgeon critical habitat includes abundant prey items (e.g., amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs, and crustaceans) within estuarine and marine habitats and substrates. It is possible that the use of explosive sound sources within the critical habitat may impact the abundance of prey items within the vicinity of the sound source. Therefore, explosive sound sources used in proposed training activities may affect Gulf sturgeon designated critical habitat.

Atlantic Sturgeon (Endangered Species Act-Listed)

As discussed in Section 3.9.2.8 (Atlantic Sturgeon [*Acipenser oxyrinchus oxyrinchus*]), Atlantic sturgeon, when not in the rivers during spawning season, inhabit estuarine and marine waters of the Atlantic coast out to a depth of 164 ft. (50 m) (Bain 1997). Atlantic sturgeon are found along nearly the entire east coast of the United States from the St. Croix River in Maine south to the St. Johns River in Florida.

Atlantic sturgeon may occur in areas that coincide with training activities involving explosives, particularly in the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes. Atlantic sturgeon frequent the waters of the continental shelf and migrate up and down the coastline. Underwater explosions, particularly those associated with mine warfare training that occur in shallow water areas close to shore, may coincide with areas sturgeon frequent. Encounters may result in behavioral responses, hearing loss, physical injury, or death to fish near the activity.

There is also a potential for Atlantic sturgeon to encounter training activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface within any of the Atlantic range complexes where these activities occur. Sturgeon exposed to noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface may exhibit brief behavioral reactions. However, due to the short-term, transient nature of these activities, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short-term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

Conclusion

Impacts to fish due to explosives and other impulsive sound are expected to be limited to short-term, minor behavioral reactions. However, long-term consequences for populations would not be expected.

Pursuant to the ESA, the use of explosives during training activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect the ESA-listed Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, shortnose sturgeon, and largetooth sawfish;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, weapons firing, launch, and impact noise during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish, and Gulf sturgeon.*

3.9.3.1.3.2 No Action Alternative – Testing Activities

Testing Activities do not include pile driving.

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-2 and Table 2.8-3, and Section 3.0.5.3.1.2 (Explosives), testing activities under the No Action Alternative would involve underwater detonations and explosive practice munitions. Testing activities involving explosions could be conducted throughout the Study Area but would be concentrated in the VACAPES Range Complex, followed by the JAX Range Complex. These events would be concentrated in the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Testing activities using explosions do not normally occur within 3 nm of shore; the exception is the designated underwater detonation area near Naval Surface Warfare Center, Panama City Division Testing Range, which is located nearshore, partially within the surf zone. Proposed testing activities under the No Action Alternative that involve explosives and other impulsive sources differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.1 (No Action Alternative – Training Activities).

As described in Tables 2.8-2 to 2.8-3, testing activities under the No Action Alternative include activities that produce in water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. Activities are spread throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area, but would be concentrated within the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Proposed testing activities under the No Action Alternative that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface differ in number and location from training activities under the No Action Alternative; however, the types and severity of impacts would not

be discernible from those described above in Section 3.9.3.1.3.1 (No Action Alternative – Training Activities).

Testing activities under the No Action Alternative would include the use of swimmer defense airguns up to five times per year pierside at Joint Expeditionary Base Little Creek in Virginia Beach, Virginia and up to five times per year pierside at Newport, Rhode Island as described in Table 2.8-3. Both of these areas are located within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area.

Single, small airguns (60 cubic inches [983 cubic centimeters]) are unlikely to cause direct trauma to marine fish. Impulses from airguns lack the strong shock wave and rapid pressure increase, as would be expected from explosive sources that can cause primary blast injury or barotrauma. As discussed in Section 3.9.3.1.1.1 (Direct Injury), there is little evidence that airguns can cause direct injury to adult fish, with the possible exception of injuring small juvenile or larval fish nearby (approximately 5 m [16 ft.]). Therefore, larval and small juvenile fish within a few meters of the airgun may be injured or killed. Considering the small footprint of this hypothesized injury zone, and the isolated and infrequent use of the swimmer defense airgun, population consequences would not be expected.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), temporary hearing loss in fish could occur if fish were exposed to impulses from swimmer defense airguns, although some studies show no hearing loss from exposure to airguns within 5 m (16 ft.). Therefore, fish within a few meters of the airgun may receive temporary hearing loss. However, due to the relatively small size of the airgun, and their limited use in pierside areas, impacts would be minor, and may only impact a few individual fish. Population consequences would not be expected.

Airguns do produce broadband sounds; however, the duration of an individual impulse is about $1/10^{th}$ of a second. Airguns could be fired up to 100 times per event, but would generally be used less based on the actual testing requirements. The pierside areas where these activities are proposed are inshore, with high levels of use, and therefore have high levels of ambient noise, see Section 3.0.4.5 (Ambient Noise). Auditory masking is discussed in Section 3.9.3.1.1.3 (Auditory Masking), and only occurs when the interfering signal is present. Due to the limited duration of individual shots and the limited number of shots proposed for the swimmer defense airgun, only brief, isolated auditory masking to marine fish would be expected. Population consequences would not be expected.

In addition, fish that are able to detect the airgun impulses may exhibit alterations in natural behavior. As discussed in Section 3.9.3.1.1.4 (Physiological Stress and Behavioral Reactions), some fish species with site fidelity such as reef fish may show initial startle reactions, returning to normal behavioral patterns within a matter of a few minutes. Pelagic and schooling fish that typically show less site fidelity may avoid the immediate area for the duration of the events. Due to the limited use and relatively small footprint of swimmer defense airguns, impacts to fish are expected to be minor. Population consequences would not be expected.

Impacts to fish due to exposure to impulsive sound and especially explosive energy could be injured, killed, suffer hearing loss, or alter natural behavior patterns. However, long-term consequences for populations would not be expected.

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas of the Naval Surface Warfare Center, Panama City Division Testing Range, may coincide with areas Gulf sturgeon and smalltooth sawfish frequent. Exposures may result in behavioral responses,

hearing loss, physical injury, or death to fish near the activities. The remainder of predicted impacts to ESA-listed fish species and any designated critical habitat would not be discernible from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training Activities).

Pursuant to the ESA, the use of explosives during testing activities as described under the No Action Alternative:

- *may affect and is likely to adversely affect the ESA-listed Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, and shortnose sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, the use of airguns and weapons firing, launch, and impact noise during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; and*
- *will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish and Gulf sturgeon.*

3.9.3.1.3.3 Alternative 1- Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosives), the number of annual training activities that use explosives under Alternative 1 would increase. These activities would happen in the same general locations as described by the No Action Alternative including the following notable exceptions:

- Training activities using explosive source sonobuoys (Bin E4) would be relocated from the GOMEX Range Complex under Alternative 1 to the VACAPES and JAX Range Complexes and increase. This would lead to a decrease of potential impacts to fish in the GOMEX Range Complex, and an increase in potential impacts for the VACAPES and JAX Range Complexes.
- Alternative 1 would include the training activity civilian port defense, which is not included under the No Action Alternative. This event would take place once every two years in one of the following locations: Earle, New Jersey; Groton, Connecticut; Hampton Roads, Virginia; Morehead City, North Carolina; Wilmington, North Carolina; Kings Bay, Georgia; Mayport, Florida; Beaumont, Texas; or Corpus Christi, Texas. However, any phases of the event that involve underwater detonation training would occur in designated areas in the VACAPES, JAX, and GOMEX Range Complexes.
- Two additional join task force/sustainment exercises per year (four total) are proposed under Alternative 1.
- Mine neutralization events would increase in the VACAPES Range Complex under Alternative 1 to 524 events per year from 24 events per year as described under the No Action Alternative. These activities use up to a 60 lb. net explosive weight charge (but typically use a 20 lb. net explosive weight charge or less) to destroy an underwater mine (explosive mines are not used for this activity, only mine-like shapes).

Proposed training activities under Alternative 1 that involve underwater explosions differ in number from training activities proposed under the No Action Alternative; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.1 (No Action Alternative – Training Activities).

As described in 3.0.5.3.1.5. (Weapons Firing, Launch, and Impact Noise), training activities under Alternative 1 include activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. Activities are spread throughout the Study Area but would be concentrated in VACAPES, Navy Cherry Point, and JAX Range Complexes, with lesser numbers of events in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area, but would be concentrated within the Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area. Proposed training activities under Alternative 1 that produce in water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface differ in number from training activities proposed under the No Action Alternative. The associated impacts would differ in quantity; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.1 (No Action Alternative – Training Activities).

Training activities under Alternative 1 do not include the use of swimmer defense airguns.

As described in Table 2.8-1 and Section 3.0.5.3.1.3 (Pile Driving), training activities under Alternative 1 include pile driving associated with construction and removal the elevated causeway system. This activity would take place nearshore and within the surf zone, once per year at either Marine Corps Base Camp Lejeune, North Carolina; Joint Expeditionary Base Fort Story, Virginia; or Joint Expeditionary Base Little Creek, Virginia. The two areas in Virginia are located within the Northeast U.S. Continental Shelf Large Marine Ecosystem, and the area in North Carolina is located within the Southeast U.S. Continental Shelf Large Marine Ecosystem. The pile driving locations are adjacent to Navy pierside locations in industrialized waterways that carry a high volume of vessel traffic in addition to Navy vessels using the pier. These coastal areas tend to have high ambient noise levels due to natural and anthropogenic sources and have limited numbers of sensitive fish species present. Underwater sound pressure levels from impact pile driving would be approximately 194 dB re 1 µPa, and a peak sound pressure level of 207 dB re 1 µPa at 10 m (33 ft.). This corresponds to a single strike sound exposure level of approximately 180 dB re 1 μPa^2-s at 10 m (33 ft.), based on a comparison sound exposure level versus sound pressure level for other pile driving measurements (California Department of Transportation 2009). Conservatively assuming eight piles a day are driven at 10 minutes per pile and 50 strikes per minute, cumulative sound exposure levels would be approximately 216 dB re 1 μPa^2-s at 10 m (33 ft.). Underwater sound levels likely to result from vibratory pile driving would be a sound pressure level of 170 dB re 1 µPa at 10 m (33 ft.).

As discussed in Section 3.9.3.1.1.1 (Direct Injury), injuries and mortality to fish are possible near the pile driving location. Based on the above sound levels for pile driving, fish within about 10 m (33 ft.) of the active impact pile driving operation could suffer injuries with the probability and severity of injuries increasing closer to the pile.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), hearing loss in fish is possible within the vicinity of a pile driving event. Hearing loss due to pile driving in fish has not been studied; however, other impulsive sounds such as airgun shots have been studied and can be applied in this case. Based on the limited

research, fish within a few tens of meters of the active pile driving activity may suffer temporary hearing loss.

As discussed in Section 3.9.3.1.1.3 (Auditory Masking), auditory masking could occur due to anthropogenic noise interfering with biologically relevant sounds. Pile driving may cause auditory masking on the order of a kilometer or more; however, pile driving activities are intermittent, with actual pile driving occurring for only about 80 minutes per 24-hour period. Therefore, auditory masking would be localized and of limited duration during pile driving.

As discussed in Section 3.9.3.1.1.4 (Physiological Stress and Behavioral Responses), fish may have behavioral reactions to pile driving sound. Based on the predicted pile driving noise levels and the limited research on fish reaction to pile driving, fish within approximately one kilometer may react to pile driving noise by increasing their swimming speed, moving away from the source, or not responding at all. Fish may habituate, or choose to tolerate pile driving noise after multiple strikes, returning to normal behavior patterns during the pile driving activities.

Overall, impacts to fish from pile driving are expected to be intermittent and isolated with only a single two to three week period of active pile driving per year at one location in the nearshore waters near Virginia Beach, Virginia, or Camp Lejeune, North Carolina. Long term consequences for fish populations would not be expected.

Potential effects of training activities involving impulsive sounds under the Alternative 1 on ESA-listed fish species would be similar to those described above for training activities under the No Action Alternative. In addition, pile driving activities occurring at Marine Corps Base Camp Lejeune, Joint Expeditionary Base Fort Story, and Joint Expeditionary Base Little Creek (discussed above) may impact Atlantic sturgeon, which are found in all of these locations. While also found on the east coast of the United States, shortnose sturgeon are rarely observed in waters between the northern Chesapeake Bay and the Cape Fear River in North Carolina (National Marine Fisheries Service 1998) and would, therefore, not likely be exposed to pile driving activities. Shortnose sturgeon that happen to be in the vicinity of pile driving activities may suffer behavioral impacts or temporary hearing loss depending on their proximity to the activity.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed Gulf sturgeon, Atlantic sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, and shortnose sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, pile driving and weapons firing, launch, and impact noise during training activities as described under Alternative 1:

- *may affect but are not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; and*
- *will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish and Gulf sturgeon.*

3.9.3.1.3.4 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1.2 (Explosives), the number of annual testing activities that use explosives under Alternative 1 would increase compared to the No Action Alternative. These activities would happen in the same general locations under Alternative 1 as under the No Action Alternative. New testing activities proposed under Alternative 1 and notable increases in numbers of activities from the No Action Alternative are as follows:

- Alternative 1 would include one aircraft carrier sea trial that would take place once within a five-year period.
- Alternative 1 would include one aircraft carrier ship shock trial during the five-year period. This event could take place in one of two locations (VACAPES or JAX Range Complex) during fall, winter or summer. The aircraft carrier ship shock trial would use up to four 58,000 lb. net explosive weight charges, one at a time, over a several week period.
- Alternative 1 would include one guided missile destroyer ship shock trial and two Littoral Combat Ship shock trials during the five-year period. These ship shock trials would use up to four 14,500 lb. net explosive weight charges, one at a time, over a several week period. These events could take place in the JAX Range Complex during fall, spring, or summer, or year-round within the VACAPES Range Complex.

As described in Tables 2.8-2 and 2.8-3, testing activities under the Alternative 1 include activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. Activities are spread throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area, but would be concentrated within the Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems, and the Gulf Stream Open Ocean Area. Proposed testing activities under Alternative 1 that involve underwater explosions differ in number and location from testing activities proposed under the No Action Alternative; however, the types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.2 (No Action Alternative – Testing Activities).

As described in Table 2.8-3, testing activities under Alternative 1 would include the use of swimmer defense airguns at Joint Expeditionary Base Little Creek, Virginia up to two times per year, and pierside at Newport, Rhode Island up to five times per year. Both of these areas are located within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Stationary source testing at Naval Surface Warfare Center, Panama City Division Testing Range includes a limited amount of swimmer defense airgun use and could occur up to 10 times per year. This area is located in inland waters, within the Gulf of Mexico Large Marine Ecosystem. The proposed pierside swimmer defense activities under Alternative 1 represent a decrease of three events per year as compared to the No Action Alternative. Therefore, the associated impacts would differ in quantity, but the types and severity

of impacts would not be discernible from those discussed above in Section 3.9.3.1.3.2 (No Action Alternative – Testing Activities).

Potential effects of testing activities involving impulsive sounds under Alternative 1 on ESA-listed fish species would be similar to those described above for testing activities under the No Action Alternative in Section 3.9.3.1.3.2 0 (No Action Alternative – Testing Activities). In addition, the testing of swimmer defense airguns at pierside locations at Naval Surface Warfare Center, Panama City Division Testing Range may potentially impact the largetooth sawfish, smalltooth sawfish, and the Gulf sturgeon. As discussed above, fish exposed to airguns could receive temporary hearing loss or exhibit an alteration in natural behavior. Neither of these conditions should have a lasting effect nor be expected to compromise the general health or condition of individual fish. Population consequences would not be expected.

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 1:

- *may affect and is likely to adversely affect the ESA-listed Atlantic sturgeon. Gulf sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, and shortnose sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, the use of airguns and weapons firing, launch, and impact noise during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; and*
- *will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish and Gulf sturgeon.*

3.9.3.1.3.5 Alternative 2 – Training Activities (Preferred Alternative)

Proposed training activities under Alternative 2 are identical to training activities proposed under Alternative 1. Therefore, the predicted impacts for Alternative 2 are identical to those described above in Training Activities under Section 3.9.3.1.3.3 (Alternative 1- Training Activities).

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed Gulf sturgeon, Atlantic sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, and shortnose sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, pile driving and weapons firing, launch, and impact noise during training activities as described under Alternative 2:

- *May affect but are not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; and*
- *Will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish and Gulf sturgeon.*

3.9.3.1.3.6 Alternative 2 – Testing Activities (Preferred Alternative)

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1.2 (Explosives), the number of annual testing activities that use explosives under Alternative 2 would increase compared to the No Action Alternative. The associated impacts would differ in quantity; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.2 (No Action Alternative – Testing Activities). Also see Section 3.9.3.1.3.4 (Alternative 1 – Testing Activities) for a discussion of additional activities (one aircraft carrier sea trial and four ship shock trials) and the predicted impacts, which are identical under Alternatives 1 and 2.

As described in Tables 2.8-2 and 2.8-3, testing activities under the Alternative 2 include activities that produce in-water noise from weapons firing, launch, and non-explosive practice munitions impact with the water's surface. Activities are spread throughout the Study Area but would be concentrated in the GOMEX and Northeast Range Complexes. These activities could take place within any large marine ecosystem or open ocean area, but would be concentrated within the Northeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area. The associated impacts would differ in quantity; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.2 (No Action Alternative – Testing Activities).

As described in Table 2.8-3, testing activities under Alternative 2 would include the use of swimmer defense airguns at Joint Expeditionary Base Little Creek, Virginia up to three times per year, and pierside at Newport, Rhode Island up to six times per year. Both of these areas are located within the inland waters of the Northeast U.S. Continental Shelf Large Marine Ecosystem. Stationary source testing at Naval Surface Warfare Center, Panama City Division Testing Range includes a limited amount of swimmer defense airgun use and could occur up to 11 times per year. This area is located in inland waters, within the Gulf of Mexico Large Marine Ecosystem. The associated impacts would differ in quantity; however, the locations, types, and severity of impacts would not be discernible from those described above in Section 3.9.3.1.3.2 (No Action Alternative – Testing Activities).

Potential effects of testing activities involving impulsive sounds under Alternative 2 on ESA-listed fish species would be similar to those described above in Section 3.9.3.1.3.4 0 (Alternative 1 – Testing Activities).

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 2:

- *may affect and is likely to adversely affect the ESA-listed Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish;*
- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, and shortnose sturgeon;*
- *will have no effect on designated critical habitat for Atlantic salmon and smalltooth sawfish; and*
- *may affect but is not likely to adversely affect designated Gulf sturgeon critical habitat.*

Pursuant to the ESA, the use of airguns and weapons firing, launch, and impact noise during testing activities as described under Alternative 2 (Preferred Alternative):

- *may affect is but not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Gulf sturgeon, and Atlantic sturgeon; and*
- *will have no effect on designated critical habitat for Atlantic salmon, smalltooth sawfish and Gulf sturgeon.*

3.9.3.1.3.7 Substressor Impacts on Fishes That Occupy Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other active acoustic sources (Atlantic herring only), explosives, and pile driving during training and testing activities may have minimal and temporary adverse effects on fishes that occupy water column habitat by reducing the quality or quantity of water column (sound and electro-chemical environment) that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.9.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from (1) electromagnetic devices, and (2) high energy lasers.

3.9.3.2.1 Impacts from Electromagnetic Devices

Several different electromagnetic devices are used during training and testing activities. A discussion of the type, number, and location of activities using these devices under each alternative is presented in Section 3.0.5.3.2.1 (Electromagnetic Devices).

A comprehensive review of information regarding the sensitivity of marine organisms to electric and magnetic impulses, including fish comprising the subclass Elasmobranchii (sharks, skates, and rays; hereafter referred to as elasmobranchs), as well as other bony fishes, is presented in Normandeau (2011). The synthesis of available data and information contained in this report suggests that while many fish species (particularly elasmobranchs) are sensitive to electromagnetic fields (Hore 2012), further investigation is necessary to understand the physiological response and magnitude of the potential impacts. Most examinations of electromagnetic fields on marine fish have focused on buried undersea cables associated with offshore wind farms in European waters (Boehlert and Gill 2010; Gill 2005; Ohman et al. 2007).

Many fish groups including lamprey, elasmobranchs, sturgeon, eels, marine catfish, salmon, stargazers, and others, have an acute sensitivity to electrical fields, known as electroreception (Bullock et al. 1983; Helfman et al. 2009). Each ESA-listed fish has some level of electroreception, but elasmobranchs (including sawfish) are more sensitive than the others. In elasmobranchs, behavioral and physiological response to electromagnetic stimulus varies by species and age, and appears to be related to foraging behavior (Rigg et al. 2009). Many elasmobranchs respond physiologically to electric fields of 10 nanovolts (nV) per cm and behaviorally at 5 nV per cm (Collin and Whitehead 2004). Electroreceptive marine fish identified above with ampullary (pouch) organs can detect considerably higher frequencies of 50 hertz (Hz) to more than 2 kilohertz (kHz) (Helfman et al. 2009). The distribution of electroreceptors on the head of these fish, especially around the mouth (e.g., along the rostrum of sawfish), suggests that these sensory organs may be used in foraging. Additionally, some researchers hypothesize that the electroreceptors aid in social communication (Collin and Whitehead 2004).

Electromagnetic sensitivities of the Gulf, Atlantic, and shortnose sturgeon have not been studied; however, the presence of electroreceptive ampullae in all sturgeon strongly supports the assertion that they are sensitive to electromagnetic energy. The ampullae of most fish are sensitive to low frequencies (less than 0.1–25 Hz) of electrical energy (Helfman et al. 2009), which may be of physical or biological origin, such as muscle contractions. The ampullae in a closely related species, the shovelnose sturgeon (*Scaphirhynchus platorynchus*), were shown to respond to electromagnetic stimuli in a way comparable to the well-studied elasmobranchs, which are sensitive to electric fields as low as 1 microvolt (µV) per cm with a magnetic field of 100 gauss (G) (Bleckmann and Zelick 2009). Zhang et al. (2012) studied electroreception on Siberian sturgeon (*Acipenser baerii*) and suggested that electroreception plays a role in the feeding behavior of most sturgeon species.

While elasmobranchs and other fish can sense the level of the earth's electromagnetic field, the potential impacts on fish resulting from changes in the strength or orientation of the background field are not well understood. When the electromagnetic field is enhanced or altered, sensitive fish may experience an interruption or disturbance in normal sensory perception. Research on the electrosensitivity of sharks indicates that some species respond to electrical impulses with an apparent avoidance reaction (Helfman et al. 2009; Kalmijn 2000). This avoidance response has been exploited as a shark deterrent, to repel sharks from areas of overlap with human activity (Marcotte and Lowe 2008).

Electroreceptors are thought to aid in navigation, orientation, and migration of sharks and rays (Kalmijn 2000). The exact mechanism is unknown and no magnetic sensory organ has been discovered, but magnetite (a magnetic mineral) is incorporated into the tissues of these fish (Helfman et al. 2009). Magnetite of biogenic origins has been documented in the lateral line of the European eel (*Anguilla anguilla*), a close relative of the American eel (*Anguilla rostrata*); both species occur in the Study Area (Moore and Riley 2009). These species undergo long-distance migrations from natal waters of the Sargasso Sea (North Atlantic Subtropical Gyre) to freshwater habitats in Europe and North America (Helfman et al. 2009), where they mature and then return as adults to the Sargasso Sea to spawn. Some species of salmon, tuna, and stargazers have likewise, been shown to respond to magnetic fields and may also contain magnetite in their tissues (Helfman et al. 2009).

Experiments with electromagnetic pulses can provide indirect evidence of the range of sensitivity of fish to similar stimuli. Two studies reported that exposure to electromagnetic pulses do not have any effect on fish (Hartwell et al. 1991; Nemeth and Hocutt 1990). The observed 48-hour mortality of small estuarine fish (sheepshead minnow, mummichog, Atlantic menhaden, striped bass, Atlantic silverside, fourspine stickleback, and rainwater killifish) exposed to electromagnetic pulses of 100 to 200 kilovolts

(kV) per m (10 nanoseconds per pulse) from distances greater than 164 ft. (50 m) was not statistically different than the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990). During a study of Atlantic menhaden, there were no statistical differences in swimming speed and direction (toward or away from the electromagnetic pulse source); between a group of individuals exposed to electromagnetic pulses and the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990).

Both laboratory and field studies confirm that elasmobranchs (and some teleost [bony] fish) are sensitive to electromagnetic fields, but the long-term impacts are not well-known. Electromagnetic sensitivity in some marine fish (e.g., salmonids) is already well-developed at early life stages (Ohman et al. 2007), with sensitivities reported as low as 0.6 millivolt per centimeter (mV/cm) in Atlantic salmon (Formicki et al. 2004); however, most of the limited research that has occurred focuses on adults. Some species appear to be attracted to undersea cables, while others show avoidance (Ohman et al. 2007). Under controlled laboratory conditions, the scalloped hammerhead (*Sphyrna lewini*) and sandbar shark (*Carcharhinus plumbeus*) exhibited altered swimming and feeding behaviors in response to very weak electric fields (less than 1 nV per cm) (Kajiura and Holland 2002). In a test of sensitivity to fixed magnets, five Pacific sharks were shown to react to magnetic field strengths of 25 to 234 G at distances ranging between 0.85 and 1.90 ft. (0.26 and 0.58 m) and avoid the area (Rigg et al. 2009). A field trial in the Florida Keys demonstrated that southern stingray (*Dasyatis americana*) and nurse shark (*Ginglymostoma cirratum*) detected and avoided a fixed magnetic field producing a flux of 950 G (O'Connell et al. 2010). The maximum electromagnetic fields typically generated during Navy training and testing activities is approximately 23 G.

Potential impacts of electromagnetic activity on adult fish may not be relevant to early life stages (eggs, larvae, juveniles) due to ontogenic (life stage-based) shifts in habitat utilization (Botsford et al. 2009; Sabates et al. 2007). Some skates and rays produce egg cases that occur on the bottom, while many neonate and adult sharks occur in the water column or near the water surface. Electromagnetic exposure of eggs and larvae of sensitive bony fish would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998) and; therefore, potential impacts on recruitment would not be expected. Early life history stages of ESA-listed sturgeon and Atlantic salmon occur in freshwater or estuarine habitats outside of the Study Area. Similarly, sawfish neonates and juveniles typically inhabit nearshore mangrove habitats, beyond the areas where electromagnetic devices are used. For many sharks, skates, rays, and livebearers, the fecundity and natural mortality rates are much lower, and the exposure of the larger neonates and juveniles to electromagnetic energy would be similar across life stages for these species.

Based on current literature, only the fish groups identified above are capable of detecting electromagnetic fields (primarily elasmobranchs, sturgeon, salmon, tuna, eels, and stargazers) and thus will be carried forward in this section. The remaining taxonomic groups (from Table 3.9-3) will not be presented further. Aspects of electromagnetic stressors that are applicable to marine organisms in general are described in Section 3.0.5.7.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

3.9.3.2.1.1 No Action Alternative

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, training activities involving electromagnetic devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. Use of electromagnetic devices is concentrated within the

VACAPES Range Complex. Fish species that do not occur within these specified areas, including the ESA-listed Atlantic salmon (Gulf of Maine distinct population segment), largetooth sawfish, and Gulf sturgeon, would not be exposed to electromagnetic devices. Species that do occur within the areas listed above, including the ESA-listed smalltooth sawfish, Atlantic sturgeon, and shortnose sturgeon would have the potential to be exposed to electromagnetic devices.

Exposure of fish is to electromagnetic stressors is limited to those fish groups identified in Section 3.9.2 (Affected Environment), that are able to detect the electromagnetic properties in the water column, such as elasmobranchs, sturgeon, tuna, salmon, eels, and stargazers (Bullock et al. 1983; Helfman et al. 2009). Fish sensitive to electromagnetic fields may experience temporary disturbance of normal sensory perception during migratory or foraging movements, or they could experience avoidance reactions (Kalmijn 2000), resulting in alterations of behavior and avoidance of normal foraging areas or migration routes. Exposure of electromagnetically sensitive fish species to electromagnetic activities has the potential to result in stress to the animal and may also elicit alterations in normal behavior patterns (e.g., swimming, feeding, resting, and spawning). Such effects may have the potential to disrupt long-term growth and survival of an individual. However, due to the temporary (hours) and isolated locations where electromagnetic devices are used in the Study Area, the resulting stress on fish is not likely to impact the health of resident or migratory populations. Likewise, some fish in the vicinity of training activities may react to electromagnetic devices, but the signals are not widespread or frequent enough to alter behavior on a long-term basis. Any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

Smalltooth sawfish, Atlantic sturgeon, and shortnose sturgeon are the only ESA-listed fish species occurring in training areas that are known to be capable of detecting electromagnetic energy. Smalltooth sawfish could occur in the JAX Range Complex, but any occurrences would be extremely rare (Florida Museum of Natural History 2011). Atlantic sturgeon and shortnose sturgeon inhabit shallow nearshore and coastal waters, and therefore, may encounter electromagnetic devices used in training activities in the lower Chesapeake Bay. Other locations include portions of the range complexes that lie within the continental shelf, overlapping the normal distribution of Atlantic sturgeon, shortnose sturgeon, and smalltooth sawfish. Any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of fish at the population level.

All of the primary constituent elements required by Atlantic salmon are applicable to freshwater only and are outside the Study Area. Therefore, none of the electromagnetic stressors would affect Atlantic salmon critical habitat. The primary constituent elements for smalltooth sawfish are red mangrove habitats and shallow marine waters of less than 1 m (3.28 ft.) deep. Electromagnetic activities do not occur at these depths and thus would not overlap with smalltooth sawfish critical habitat.

The electromagnetic devices used in training activities would not cause any risk to fish because of the: (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 656 ft. [200 m] from the source), (2) highly localized potential impact area, and (3) limited and temporally distinct duration of the activities (hours). Fish may have a detectable response to electromagnetic exposure, but would likely recover completely. Potential impacts of exposure to electromagnetic stressors are not expected to result in substantial changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, or Gulf sturgeon;*
- *may affect but is not likely to adversely affect ESA-listed smalltooth sawfish, Atlantic sturgeon or shortnose sturgeon; and*
- *will have no effect on critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under the No Action Alternative, testing activities involving electromagnetic devices occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Activities using electromagnetic devices are concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. Fish species that do not occur within these specified areas—including the ESA-listed Atlantic salmon—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, and Gulf sturgeon—would have the potential to be exposed to electromagnetic devices.

Exposure of fish to electromagnetic stressors is limited to those fish groups identified in Section 3.9.2 (Affected Environment) that are able to detect the electromagnetic properties in the water column, such as elasmobranchs, sturgeon, tuna, salmon, stargazers, and eels (Bullock et al. 1983; Helfman et al. 2009). Two such species, the Atlantic torpedo ray (*Torpedo nobiliana*) and the lesser electric ray (*Narcine brasiliensis*) occur in the Naval Surface Warfare Center, Panama City Division Testing Range, where a portion of the electromagnetic activities will be concentrated. For reasons described in Section 3.9.3.2.1.1 (No Action Alternative) any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

With the exception of Atlantic salmon, which do not occur in testing areas under the No Action Alternative, all of the ESA-listed fish species occurring in testing areas are capable of detecting electromagnetic energy. The potential effects to largetooth sawfish are discountable because they are historically rare in the Study Area. The last confirmed records of the species in U.S. waters are from Port Aransas, Texas in 1961; Florida in 1941; and Louisiana in 1917 (FR 76 (133): 40822-40836, July 12, 2011). Smalltooth sawfish are rare in the Gulf of Mexico Large Marine Ecosystem, but since 1999 the species has been documented in the vicinity of the Naval Surface Warfare Center, Panama City Division Testing Range and as far west as Pensacola, Florida (Florida Museum of Natural History 2011). Gulf sturgeon typically inhabit nearshore coastal waters within 1,000 m (3,280 ft.) of the shoreline (Robydek and Nunley 2012), but may also occur as far as 60 nm from shore. Therefore, they may encounter electromagnetic devices during testing activities in the Naval Surface Warfare Center, Panama City Division Testing Range. This area includes nearshore areas and, along with the VACAPES Range Complex may overlap the distribution of Gulf sturgeon, Atlantic sturgeon, and shortnose sturgeon. Therefore, potential exposure to electromagnetic testing activities may also occur in the offshore portions of those areas.

Behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of fish species, see Section 3.9.3.2.1.1 (No Action Alternative). Similarly, electromagnetic devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic

salmon, or smalltooth sawfish (Section 3.9.3.2.1.1, No Action Alternative – Training). The only applicable primary constituent element of critical habitat for Gulf sturgeon is "abundant food items" (e.g., amphipods, polychaetes, gastropods, ghost shrimp, isopods, molluscs, and crustaceans). Electromagnetic devices are not expected to impact these invertebrate populations, as described in Section 3.8 (Marine Invertebrates); therefore, no effects are expected on the abundance of these food items for Gulf sturgeon that contribute to the conservation value of its critical habitat.

The electromagnetic devices used in testing activities would not cause any risk to fish because of the: (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 656 ft. [200 m] from the source), (2) highly localized potential impact area, and (3) limited and temporally distinct duration of the activities (hours). Fish may have a detectable response to electromagnetic exposure, but would likely recover completely. Potential impacts of exposure to electromagnetic stressors are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon;*
- *may affect but is not likely to adversely affect the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on critical habitat for Atlantic salmon, or smalltooth sawfish; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use in the Study Area would increase by less than 2 percent over the No Action Alternative. Training activities involving electromagnetic devices would continue to occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. In addition, activities would be introduced within the Gulf of Mexico Large Marine Ecosystem—specifically within the GOMEX Range Complex, as well as any of the following bays or inland waters: Sandy Hook Bay, Earle, New Jersey; lower Chesapeake Bay, Hampton Roads, Virginia; Beaufort Inlet Channel, Morehead City, North Carolina; Cape Fear River, Wilmington, North Carolina; St. Andrew Bay, Panama City, Florida; Sabine Lake, Beaumont, Texas; and Corpus Christi Bay, Corpus Christi, Texas. Electromagnetic device activities would remain concentrated within the VACAPES Range Complex. Fish species that do not occur within these specified areas—including the ESA-listed Atlantic salmon—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-listed largetooth sawfish, smalltooth sawfish, Atlantic sturgeon, shortnose sturgeon, and Gulf sturgeon—would have the potential to be exposed to electromagnetic devices.

Exposure is limited to those marine fish groups able to detect electromagnetic properties as described in Section 3.9.2 (Affected Environment) that are able to detect the electromagnetic properties in the water column, such as elasmobranchs, sturgeon, tuna, salmon, eels, and stargazers (Bullock et al. 1983; Helfman et al. 2009).

As stated in Section 3.9.3.2.1.1 (No Action Alternative), the use of electromagnetic devices is not expected to result in any lasting effects on the survival, growth, recruitment, or reproduction of ESA-listed species. Similarly, the use of electromagnetic devices will not result in impacts on the primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish, see Section 3.9.3.2.1.1 (No Action Alternative). The civilian port defense training activity could overlap with Gulf sturgeon critical habitat, if it were to occur in St. Andrew Bay in a given year. Any effects on the primary constituent elements of Gulf sturgeon critical habitat would be discountable because of the low probability of occurrence in any given year, and the food sources identified as primary constituent elements of the critical habitat that occur in St. Andrew Bay would not be impacted by this activity, see Section 3.8 (Marine Invertebrates).

In comparison to the No Action Alternative, the 2 percent increase in activities presented in Alternative 1 would not substantially increase the risk of fish being exposed to electromagnetic energy. The introduction of one civilian port defense training activity in one of the bays listed above could expose estuarine fish, including early life stages of ESA-listed sturgeon and sawfish species to an electromagnetic field and potentially elicit a reaction from sensitive fish, see Section 3.9.3.2.1 (Impacts from Electromagnetic Devices). However, the single occurrence would not likely be widespread or frequent enough to alter behavior on a long-term basis. As described in the No Action Alternative, electromagnetic activities are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of fish species at the population level.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1:

- *will have no effect on ESA-listed Atlantic salmon;*
- *may affect but is not likely to adversely affect the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on critical habitat for Atlantic salmon or smalltooth sawfish; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 1, electromagnetic device use would increase by approximately 14 percent in the Study Area as compared to the No Action Alternative. Testing activities involving electromagnetic devices would continue to occur in the Northeast U.S. Continental Shelf and Gulf of Mexico Large Marine Ecosystems—specifically within the VACAPES Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, activities will be introduced in the Southeast U.S. Continental Shelf Large Marine Ecosystem in the South Florida Ocean Measurement Facility Testing Range, and anywhere within the Gulf of Mexico. Activities involving electromagnetic device use would remain concentrated within the Naval Surface Warfare Center, Panama City Division Testing Range. Fish species that do not occur within these specified areas—including the ESA-listed Atlantic salmon—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-listed largetooth sawfish, smalltooth sawfish, Atlantic sturgeon, shortnose sturgeon, and Gulf sturgeon—would have the potential to be exposed to electromagnetic devices.

Exposure is limited to those marine fish groups able to detect electromagnetic properties as described in Section 3.9.2 (Affected Environment) that are able to detect the electromagnetic properties in the water

column, such as elasmobranchs, sturgeon, tuna, salmon, eels, and stargazers (Bullock et al. 1983; Helfman et al. 2009).

As stated in Section 3.9.3.2.1 (No Action Alternative), the use of electromagnetic devices is not expected to result in any lasting effects on the survival, growth, recruitment, or reproduction of ESA-listed species. Similarly, electromagnetic devices will not result in impacts on the primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish (see Section 3.9.3.2.1, No Action Alternative). The electromagnetic activities at Naval Surface Warfare Center, Panama City Division Testing Range could overlap with Gulf sturgeon critical habitat. Any effects on the primary constituent elements of Gulf sturgeon critical habitat would be discountable because the food sources identified as primary constituent elements of the critical habitat that occur in the Naval Surface Warfare Center, Panama City Division Testing Range would not be impacted by this activity (see Section 3.8, Marine Invertebrates).

Electromagnetic activities under Alternative 1 would not increase the likelihood of fish exposure to electromagnetic energy in comparison to the No Action Alternative. Fish may respond to exposure, but these responses are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed Atlantic salmon;*
- *may affect but is not likely to adversely affect the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on critical habitat for Atlantic salmon or smalltooth sawfish; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.2.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.2.1.2 (Alternative 1).

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 2:

- *will have no effect on ESA-listed Atlantic salmon;*
- *may affect but is not likely to adversely affect the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on critical habitat for Atlantic salmon or smalltooth sawfish; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

Testing Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), under Alternative 2, electromagnetic device use would increase by 35 percent in the Study Area as compared to the No Action Alternative, but only increases by 18 percent as compared to Alternative 1. The location of testing activities and species potentially impacted under Alternative 2 are identical to those specified under Alternative 1.

Fish species that do not occur within these specified areas—including the ESA-listed Atlantic salmon—would not be exposed to electromagnetic devices. Species that do occur within the areas listed above—including the ESA-listed largetooth sawfish, smalltooth sawfish, Atlantic sturgeon, shortnose sturgeon, and Gulf sturgeon—would have the potential to be exposed to electromagnetic devices.

Exposure is limited to those marine fish groups able to detect electromagnetic properties as described in Section 3.9.2 (Affected Environment) that are able to detect the electromagnetic properties in the water column, such as elasmobranchs, sturgeon, tuna, salmon, eels, and stargazers (Bullock et al. 1983; Helfman et al. 2009).

As stated in Section 3.9.3.2.1.1 (No Action Alternative), the use of electromagnetic devices is not expected to result in any lasting effects on the survival, growth, recruitment, or reproduction of ESA-listed species. Similarly, electromagnetic devices would not result in impacts on the primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish (see Section 3.9.3.2.1.1, No Action Alternative). The electromagnetic activities at Naval Surface Warfare Center, Panama City Division Testing Range could overlap with Gulf sturgeon critical habitat. Any effects on the primary constituent elements of Gulf sturgeon critical habitat would be discountable because the food sources identified as primary constituent elements of the critical habitat that occur in the Naval Surface Warfare Center, Panama City Division Testing Range would not be impacted by this activity (see Section 3.8, Marine Invertebrates).

Fish may respond to exposure of electromagnetic activities under Alternative 2, but these responses are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed Atlantic salmon;*
- *may affect but is not likely to adversely affect the ESA-listed largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on critical habitat for Atlantic salmon or smalltooth sawfish; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.2.1.4 Substressor Impacts on Fishes That Occupy Essential Fish Habitat (Preferred Alternative)

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of electromagnetic devices during training and testing activities may have minimal and temporary adverse effects on fishes that occupy water column habitat by reducing the quality or quantity of water column (electro-chemical environment) that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013).

3.9.3.2.2 Impacts from High Energy Lasers

This section analyzes the potential impacts of high energy lasers on fish. As discussed in Section 3.0.5.3.2.2 (Lasers), high energy laser weapons are designed to disable surface targets, rendering them immobile. The primary concern is the potential for a fish to be struck by a laser beam at or near the water's surface, which could result in injury or death.

Marine fish could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual fish at or near the surface could be exposed. The potential for exposure to a high energy laser beam decreases as the water depth increases. Most marine fish are not susceptible to laser exposure because they are benthic or primarily occur more than a few meters below the sea surface.

3.9.3.2.2.1 No Action Alternative

Under the No Action Alternative, no high energy lasers would be used during training or testing activities.

3.9.3.2.2.2 Alternatives 1 and Alternative 2 (Preferred Alternative)

Training Activities

Under Alternatives 1 and 2, no high energy lasers would be used during training activities.

Testing Activities

Under Alternatives 1 and 2, high energy laser weapons tests would be introduced in the Northeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex (see Section 3.0.5.3.2.2, Lasers).

Fish species that do not occur within the VACAPES Range Complex or that do not occur near the sea surface—including the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, and Gulf sturgeon—would not be exposed to high energy lasers. Species that do occur within this area, and occur near the sea surface, would have the potential to be exposed. Both Atlantic and shortnose sturgeon could occur occasionally in the VACAPES Range Complex. However, these species are mainly nearshore species and spend the majority of their time at or near the bottom. It is very unlikely that an individual would surface at the exact moment in the exact place that the laser hit the surface. Fish are unlikely to be exposed to high energy lasers based on: the (1) relatively low number of events, (2) very localized potential impact area of the laser beam, and (3) temporary duration of potential impact (seconds).

Pursuant to the ESA, the use of high energy lasers during testing activities as described under Alternatives 1 and 2:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon or smalltooth sawfish and*
- *will have no effect on ESA-listed Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.3 Physical Disturbance and Strike Stressors

This section evaluates the potential impacts of various types of physical disturbance and strike stressors associated with Navy training and testing activities within the Study Area. Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors) discusses the activities that may produce physical disturbance and strike stressors.

Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area (Table 3.9-3), although some fish groups are more susceptible to strike potential than others. The potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality. Despite their ability to detect approaching vessels using a combination of sensory cues (sight, hearing, and

lateral line), larger slow-moving fish (e.g., sturgeon, whale sharks, basking sharks, and manta rays) cannot avoid all collisions, with some collisions resulting in mortality (Speed et al. 2008).

How a physical strike impacts a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Before being struck by an object, Atlantic salmon for example, would sense a pressure wave through the water (Hawkins and Johnstone 1978) and have the ability to swim away from the oncoming object. The movement generated by a large object moving through the water would simply displace small fish in open water, such as Atlantic herring. Some fish might have time to detect the approaching object and swim away; others could be struck before they become aware of the object. An open-ocean fish that is displaced a small distance by movements from an object falling into the water nearby would likely continue on its original path as if nothing had happened. However, a bottom-dwelling fish near a sinking object would likely be disturbed, and may exhibit a general stress response, as described in Section 3.0.5.7 (Biological Resource Methods). As in all vertebrates, the function of the stress response in fish is to rapidly raise the blood sugar level to prepare the fish to flee or fight (Helfman et al. 2009). This generally adaptive physiological response can become a liability to the fish if the stressor persists and the fish is not able to return to its baseline physiological state. When stressors are chronic, the fish may experience reduced growth, health, or survival (Wedemeyer et al. 1990). If the object hits the fish, direct injury (in addition to stress) or death may result.

Many fish respond to a sudden physical approach or contact by darting quickly away from the stimulus. Some other species may respond by freezing in place and adopting cryptic coloration. Some other species may respond in an unpredictable manner. Regardless of the response, the individual must stop its current activity and divert its physiological and cognitive attention to responding to the stressor (Helfman et al. 2009). The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the fish for other functions, such as predator avoidance, reproduction, growth, and maintenance (Wedemeyer et al. 1990).

The ability of a fish to return to its previous activity following a physical strike (or near-miss resulting in a stress response) is a function of a variety of factors. Some fish species are more tolerant of stressors than others and become re-acclimated more easily. Experiments with species for use in aquaculture have revealed the immense variability among species in their tolerance to physical stressors. Within a species, the rate at which an individual recovers from a physical strike may be influenced by its age, sex, reproductive state, and general condition. A fish that has reacted to a sudden disturbance by swimming at burst speed would tire after only a few minutes; its blood hormone and sugar levels (cortisol and glucose) may not return to normal for up to, or longer than, 24 hours. During its recovery period, the fish would not be able to attain burst speeds and would be more vulnerable to predators (Wardle 1986). If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer reduced immune function and even death (Wedemeyer et al. 1990).

Potential impacts of physical disturbance and strike to adults may be different than for other life stages (e.g., eggs, larvae, juveniles) because these life stages do not necessarily occur together in the same location (Botsford et al. 2009; Sabates et al. 2007), and because they have different response capabilities. The numbers of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass (Able and Fahay 1998); therefore, measurable effects on fish recruitment would not be expected. Also, the early life stages of most marine fish (excluding sharks and other livebearers) already have extremely high natural mortality rates (10 to 85 percent per day) from

predation on these life stages (Helfman et al. 2009), and therefore, most eggs and larvae are not expected to survive to the next life stage, as demonstrated by equivalent adult modeling (Horst 1977).

3.9.3.3.1 Impacts from Vessels and In-Water Devices

The majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). See Table 3.0-25 for a representative list of Navy vessel types, lengths, and speeds and Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area. Figures 3.0-20 and 3.0-21 provide graphics that illustrate the location and relative use of vessels under the Preferred Alternative. Vessels and in-water devices are covered together in this section because they both present similar potential impacts on fish. Vessels and in-water devices do not normally collide with adult fish, most of which can detect and avoid them. One study on fish behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004), reducing the potential for vessel strikes. Misund (1997) found that fish ahead of a ship that showed avoidance reactions did so at ranges of 160–490 ft. (50–350 m). When the vessel passed over them, some fish responded with sudden escape responses that included lateral avoidance or downward compression of the school. Conversely, Rostad (2006) observed that some fish are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations. Fish behavior in the vicinity of a vessel is therefore quite variable, depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Early life stages of most fish could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early life stages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins 1973), but avoidance ended within 10 seconds after the vessel departed. Because a towed in-water device is continuously moving, most fish are expected to move away from it or to follow behind it, in a manner similar to their responses to a vessel. When the device is removed, most fish would simply move to another area.

There are a few notable exceptions to this assessment of potential vessel strike impacts on marine fish groups. Large slow-moving fish such as sturgeon, ocean sunfish, whale sharks, basking sharks, and manta rays occur near the surface in open-ocean and coastal areas, and are more susceptible to ship strikes, causing blunt trauma, lacerations, fin damage, or mortality. Speed et al. (2008) evaluated this specifically for whale sharks, but these other large slow-moving fish are also likely to be susceptible because of their similar behavior and location in the water column. Increases in the numbers and sizes of shipping vessels in the modern cargo fleets make it difficult to gather mortality data because personnel on large ships are often unaware of whale shark collisions (Stevens 2007), therefore, the occurrence of whale shark strikes is likely much higher than has been documented by the few studies that have been conducted. The results of a whale shark study outside of the Study Area in the Gulf of Tadjoura, Djibouti, revealed that of the 23 whale sharks observed during a five-day period, 65 percent had scarring from boat and propeller strikes (Rowat et al. 2007). Based on the typical physiological responses described in Section 3.9.3.3 (Physical Disturbance and Strike Stressors), vessel movements are not expected to compromise the general health or condition of individual fish, except for large slow-moving fish such as whale sharks, basking sharks, manta rays, sturgeon, and ocean sunfish.

3.9.3.3.1.1 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative)

Section 3.0.5.3.3.1 (Vessels) and Section 3.0.5.3.3.2 (In-Water Devices) provide estimates of relative vessel use and location for each of the alternatives. These estimates are based on the number of activities predicted for each alternative. While these estimates predict use, actual Navy vessel usage depends on military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Training and testing concentrations mostly depend on locations of Navy shore installations and established training and testing areas. Even with the introduction of the Undersea Warfare Training Range, these areas have not appreciably changed in the last decade and are not expected to change in the foreseeable future. Under Alternatives 1 and 2, the Study Area would be expanded from the No Action Alternative and the number of events may increase, but the concentration of vessel and in-water device use and the manner in which the Navy trains and tests would remain consistent with the range of variability observed over the last decade. This is partly because multiple activities occur from the same vessel platform. Therefore, the increased number of activities estimated for Alternatives 1 and 2 is not expected to result in an increase in vessel use or transit. Consequently, the Navy does not foresee any appreciable changes in the levels, frequency, or locations where vessels have been used over the last decade, and therefore the level at which strikes are expected to occur is likely to remain consistent with the previous decade or be reduced because of the implementation of mitigation measures as outlined in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The difference in activities from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-36, is not likely to change the probability of a vessel strike in any meaningful way.

Training Activities

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices occur in the Gulf of Mexico, Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Use of in-water devices is concentrated within the VACAPES Range Complex. The differences in the number of in-water device activities between alternatives increases by less than two times under Alternative 1 and Alternative 2 compared to the No Action Alternative. Species that do not occur near the surface within the Study Area—including the ESA-listed Atlantic salmon—would not be exposed to in-water device strike potential. Species that occur near the surface within the Study Area—including the ESA-listed largetooth sawfish, smalltooth sawfish, Atlantic sturgeon, shortnose sturgeon, and Gulf sturgeon—would have the potential to be exposed to in-water device strikes.

Operational features of in-water devices and their use substantially limit the exposure of fish to potential strikes. First, in-water devices would not pose any strike risk to benthic fish because the towed equipment is designed to stay off the bottom. Prior to deploying a towed in-water device, there is a standard operating procedure to search the intended path of the device for any floating debris (i.e., driftwood) or other potential obstructions (i.e., *Sargassum* rafts and animals), since they have the potential to cause damage to the device. Therefore, the device would not be used in areas where pelagic (open ocean) fish naturally aggregate.

As indicated in Sections 3.0.5.3.3.1 (Vessels), the majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. See Table 3.0-25 for a representative list of Navy vessel types, lengths, and speeds and Table 3.0-37 for the types, sizes, and speeds of Navy in-water devices used in the Study Area. Figure 3.0-20 provides graphics that illustrate the location and relative use of vessels under the Preferred Alternative. These activities do not differ seasonally and could be widely dispersed throughout the Study Area, but would be more concentrated

near naval ports, naval piers, and range areas. Navy training vessel traffic would especially be concentrated in the Northeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Norfolk in Norfolk, Virginia, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Mayport in Jacksonville, Florida.

Based on the primarily nearshore distribution of Atlantic, shortnose, and Gulf sturgeon and overlap of in-water device use, potential strike risk would be greatest in the lower Chesapeake Bay and nearshore waters of the GOMEX Range Complex, although a minor potential exists for strikes of Atlantic and Gulf sturgeon within waters less than 50 to 60 m in depth within any of the ranges.

The likelihood of strikes by towed mine warfare devices on adult or juvenile fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile. The use of in-water devices may result in short-term and local displacement of fish in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness, or species recruitment, and are not expected to result in population-level impacts. Ichthyoplankton (fish eggs and larvae) in the water column could be displaced, injured, or killed by towed mine warfare devices. The numbers of eggs and larvae exposed to vessels or in-water devices would be extremely low relative to total ichthyoplankton biomass (Able and Fahay 1998); therefore, measurable changes on fish recruitment would not occur.

Large vessel movement primarily occurs within the U.S. Exclusive Economic Zone, with the majority of the traffic flowing in a direct line between Naval Stations Norfolk and Mayport. There would be a higher likelihood of vessel strikes over the continental shelf portions than in the open ocean portions of the Study Area because of the concentration of vessel movements in those areas. Because vessel use is so widespread, all of the ESA-listed fish species would have the potential to be exposed to vessel strikes. Smaller vessels would be more concentrated in the coastal areas close to naval installations, ports, and ranges. Species that do occur near the surface in the Study Area, including all ESA-listed species would have the potential to be exposed to vessel strikes.

Exposure of fish to vessel strike stressors is limited to those fish groups identified in Section 3.9.2 (Affected Environment) that are large, slow-moving, and may occur near the surface, such as sturgeon, ocean sunfish, whale sharks, basking sharks, and manta rays. With the exception of sturgeon, these species are distributed widely in offshore portions of the Study Area. Any isolated cases of a Navy vessel striking an individual could injure that individual, impacting the fitness of an individual fish. Vessel strikes would not pose a risk to most of the other marine fish groups, because many fish can detect and avoid vessel movements, making strikes rare and allowing the fish to return to their normal behavior after the ship or device passes. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (e.g., swimming away and increased heart rate) as the passing vessel displaces them. However, such reactions are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

All of the ESA-listed fish species occurring in training areas would be potentially exposed to vessel strikes. Atlantic salmon are fast swimmers but typically occur in the top 10 ft. (3 m) of the water column while moving through coastal waters (Hedger et al. 2009). The salmon can sense pressure changes in the water column and swim quickly (Baum 1997; Popper and Hastings 2009a), and are likely to escape collision with vessels. Therefore, while vessels and in-water devices could overlap with Atlantic salmon, the likelihood of a strike would be extremely low, with discountable effects.

All sturgeon are restricted to the waters of the continental shelf; particularly the shallow, coastal, or nearshore waters of the Study Area (Dadswell 2006; Ross et al. 2009) and, therefore, could be exposed to vessel strikes only in these locations. Because of the concentration of Navy vessel movements near Norfolk (Lower Chesapeake Bay, VACAPES Range Complex) and Mayport (JAX Range Complex), vessel activity during training could overlap with sturgeon occupying these waters.

The behavior of sturgeons in rivers and estuaries includes occasional use of the surface waters, which could expose them to vessel strikes (Watanabe et al. 2012). In estuarine areas, Brown and Murphy (2010) found that 28 deaths of Atlantic sturgeon in the Delaware River estuary were reported over a four-year period, between 2005 and 2008. Of those, 50 percent were caused by vessel collisions, although the size or types of the vessels were unknown. An unknown number of additional sturgeon was likely struck by vessels that was not included in this total. Based on an egg-per-recruit analysis of the Delaware River population, an annual mortality rate of 2.5 percent of the females could have adverse impacts on the population (Brown and Murphy 2010). Data from 2009 were analyzed by Mintz and Filadelfo (2011) and indicated that along the Atlantic U.S. Exclusive Economic Zone, Navy vessels accounted for slightly less than 6 percent of the total large vessel traffic (from estimated hours) in that area. In the VACAPES and JAX Range Complexes where Navy vessel activity is concentrated, the Navy vessels accounted for 7 percent and 9 percent (respectively) of the total large vessel traffic. Barco et al. (2009) found that military vessels were 10.4 percent of the total vessels transiting (inbound and outbound) the Chesapeake Bay channel, an area of highly concentrated Navy activity because of the proximity of Naval Station Norfolk. When smaller vessels (less than 65 ft. [20 m] in length) are included in the total estimates of vessel traffic, the percentage of vessels attributable to Navy activities is reduced.

The Atlantic sturgeon populations of Chesapeake Bay (and VACAPES Range Complex) are extremely low (National Marine Fisheries Service 2007; Waldman and Wirgin 1998) and shortnose sturgeon populations are concentrated in the upper portion of the bay (Welsh et al. 2002), outside of the Study Area and away from Navy vessel traffic. In addition, within the Chesapeake Bay, most of the Navy vessel traffic is large vessels that travel in deeper channels and at slow safe speeds during navigation within the bay.

Navy vessel activity during training exercises is less concentrated in the GOMEX Range Complex, where training could overlap with Gulf sturgeon. Sawfish are restricted to shallow coastal waters of South Florida and the Gulf of Mexico, usually near the ocean bottom. They typically would only be found near the surface while in very shallow water (less than 1 m) deep associated with inshore (within estuaries or barrier islands) mangrove and seagrass habitats (Poulakis and Seitz 2004; Simpfendorfer 2006). These habitats do not overlap with Navy vessel movements during training activities in these areas.

There is no overlap of the stressor with designated critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon. All of the primary constituent elements required by Atlantic salmon are applicable to freshwater only and are outside the Study Area. Therefore, vessels and in-water devices would not affect Atlantic salmon critical habitat. The primary constituent elements for smalltooth sawfish are red mangrove habitats and shallow marine waters of less than 1 m deep. In-water devices are not used in these shallow areas. Amphibious landings would occur at these shallow depths, but not in mangrove areas (just at Onslow Beach and Seminole Beach) and thus would not overlap with smalltooth sawfish critical habitat. The only applicable primary constituent element of critical habitat for Gulf sturgeon is “abundant food items” (e.g., amphipods, polychaetes, gastropods, ghost shrimp, isopods, molluscs, and crustaceans). Vessels and in-water devices are not expected to impact these

invertebrate populations, as described in Section 3.8 (Marine Invertebrates), therefore, no effects are expected on the abundance of these food items for Gulf sturgeon that contribute to the conservation value of its critical habitat.

The risk of a strike from vessels and in-water devices used in training activities would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, or shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on ESA-listed Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

Testing Activities

As indicated in Section 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices occur in the Gulf of Mexico and Northeast U.S. Continental Shelf Large Marine Ecosystems, as well as Gulf Stream Open Ocean Area—specifically within the Northeast Range Complexes; the South Florida Ocean Measurement Facility Testing Range; and Naval Surface Warfare Center, Panama City Division Testing Range. The differences in the number of in-water device activities between alternatives increases by more than two times under Alternative 1 and Alternative 2 compared to the No Action Alternative. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to in-water devices.

As described for training in Section 3.9.3.3.1.1 (No Action Alternative, Alternative 1, and Alternative 2 [Preferred Alternative]), the use of in-water devices may result in short-term and local displacement of fish in the water column. Atlantic salmon would not be exposed to in-water devices during testing activities in the Naval Undersea Warfare Center Division, Newport Testing Range, because the Atlantic salmon distinct population segment does not occur at that location; they could be exposed to in-water devices during testing activities in the Northeast Range Complexes. Atlantic salmon are a fast-moving fish would likely be able to avoid a collision with an in-water device. These behavioral reactions are not expected to result in substantial changes to an individual's fitness, or species recruitment, and are not expected to result in population-level impacts.

As indicated in Sections 3.0.5.3.3.1 (Vessels), Navy testing vessel traffic would especially be concentrated in the Northeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Norfolk in Norfolk, Virginia, and in the Southeast U.S. Continental Shelf Large Marine Ecosystem near Naval Station Mayport in Jacksonville, Florida. Because vessel use is so widespread, all of the ESA-listed fish species would have the potential to be exposed to vessel strikes.

Exposure of fish to vessel and in-water device strikes is limited to those marine fish groups identified in Section 3.9.2 (Affected Environment) that are susceptible to vessel strikes, including large and slow-moving species, such as sturgeon, ocean sunfish, whale sharks, basking sharks, and manta rays that

typically occur near the surface in open-ocean and coastal areas. Any isolated cases of a Navy vessel potentially striking an individual fish could injure the animal and impact its fitness, but is not expected to result in any lasting effects on the survival, growth, recruitment, or reproduction of marine fish species.

All of the ESA-listed fish species occurring in testing areas would be potentially exposed to vessel strikes. During some testing activities, vessels require operation at high speeds in the VACAPES Range Complex, which could potentially strike an Atlantic or shortnose sturgeon. The limited number of activities that occur at high speeds could increase the risk of strike to a sturgeon. Also for reasons stated in Section 3.9.3.3.1.1 (No Action Alternative, Alternative 1 and Alternative 2 [Preferred Alternative]), the likelihood of a vessel strike during other testing activities would be very low, and vessel movement is not expected to result in any lasting effects on the survival, growth, recruitment, or reproduction of ESA-listed species In addition, there is no overlap of the stressor with designated critical habitat or the primary constituent elements that contribute to the conservation value of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon.

The risk of a strike from vessels and in-water devices used in testing activities would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, or shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on ESA-listed Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.3.2 Impacts from Military Expended Materials

This section analyzes the strike potential to marine fish of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, vessel hulks, parachutes, fiber optic cables and guidance wires, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Material Strikes). Analysis of all potential impacts (disturbance, strike, ingestion, entanglement) of military expended materials on critical habitat is included in this section.

While disturbance or strike from any of these objects as they sink through the water column is possible, it is not very likely for most expended materials because the objects generally sink through the water slowly and can be avoided by most fish. Therefore, with the exception of sinking exercises, the discussion of military expended materials strikes focuses on strikes at the surface or in the upper water column from fragments (of high-explosives) and projectiles because those items have a greater potential for a fish strike as they hit the water, before slowing down as they move through the water column.

Vessel Hulk. During a sinking exercise, aircraft, ship, and submarine crews fire or drop munitions on a seaborne target, usually a clean deactivated ship, Section 3.1 (Sediments and Water Quality), which is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes, in waters exceeding 3,000 m in depth, as shown in Figures 3.0-2 and 3.0-3. Direct ordnance strikes from the various weapons used in these exercises are a source of potential impact. However, these impacts are discussed for each of those weapons categories in this section and are not repeated in the respective sections. Therefore, the analysis of sinking exercises as a strike potential for benthic fish is discussed in terms of the ship hulk landing on the seafloor.

Small-, Medium-, and Large-Caliber Projectiles. Various types of projectiles could cause a temporary (seconds), localized impact when they strike the surface of the water. Current Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including 5-in. naval gun shells, and small-, medium-, and large-caliber projectiles. See Table 3.0-70 for information regarding the number and location of activities involving non-explosive practice munitions. The larger-caliber projectiles are primarily used in the open ocean beyond 20 nm. Direct ordnance strikes from firing weapons are potential stressors to fish. There is a remote possibility that an individual fish at or near the surface may be struck directly if it is at the point of impact at the time of non-explosive practice munitions delivery. Expended rounds may strike the water surface with sufficient force to cause injury or mortality. However, limited fish species swim right at, or near, the surface of the water (e.g., with the exception of pelagic sharks, herring, salmonids, flying fish, jacks, tuna, mackerels, billfish, ocean sunfish, and other similar species).

Various projectiles will fall on soft or hard bottom habitats, where they could either become buried immediately in the sediments, or sit on the bottom for an extended time period. Except for the 5-in. and the 30 mm rounds, which are fired from a helicopter, all projectiles would be aimed at surface targets. These targets will absorb most of the projectiles' energy before they strike the surface of the water and sink. This factor would limit the possibility of high-velocity impacts with fish from the rounds entering the water. Furthermore, fish can quickly and easily leave an area temporarily when vessels or helicopters approach. It is reasonable to assume, therefore, that fish will leave an area prior to, or just after the onset of, projectile firing and will return once activities are completed.

Most munitions would sink through the water column and come to rest on the seafloor, stirring up sediment and possibly inducing a startle response, displacing, or injuring nearby fish in extremely rare cases. Particular impacts on a given fish species would depend on the size and speed of the munitions, the water depth, the number of rounds delivered, the frequency of training and testing, and the sensitivity of the fish.

Bombs, Missiles, and Rockets. Direct munitions strikes from bombs, missiles, and rockets are potential stressors to fish. Some individual fish at or near the surface may be struck directly if they are at the point of impact at the time of non-explosive practice munitions delivery. However, most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles and aerial targets hit the water as fragments, which quickly dissipates their kinetic energy within a short distance of the surface. A limited number of fish swim right at, or near, the surface of the water, as described for small, medium, and large-caliber projectiles.

As discussed in Appendix G (Statistical Probability Model for Estimating Direct Strike Impact and Number of Potential Exposures), statistical modeling conducted for the Study Area indicates that the probability of military expended materials striking marine mammals or sea turtles is extremely low. Statistical

modeling could not be conducted to estimate the probability of military expended material strikes on fish, because fish density data are not available at the scale of an OPAREA or testing range.

In lieu of strike probability modeling, the number, size, and area of potential impact (or "footprints") of each type of military expended material is presented in Tables 3.3-9 through 3.3-13. The application of this type of footprint analysis to fish follows the notion that a fish occupying the impact area could be susceptible to potential impacts, either at the water surface (e.g., pelagic sharks, herring, salmonids, flying fish, jacks, tuna, mackerels, billfish, and ocean sunfish [see Table 3.9-3]) or as military expended material falls through the water column and settles to the bottom (e.g., flounders, skates, and other benthic fish listed in Table 3.9-3). Furthermore, most of the projectiles fired during training and testing activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force. Of that small portion, a small number of fish at or near the surface (pelagic fish) or near the bottom (benthic fish) may be directly impacted if they are in the target area and near the expended item that hits the water surface (or bottom), but population-level impacts would not occur.

Propelled fragments are produced by an exploding bomb. Close to the explosion, fish could potentially sustain injury or death from propelled fragments (Stuhmiller et al. 1990). However, studies of underwater bomb blasts show that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keeffe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms.

Fish disturbance or strike could result from bomb fragments (after explosion) falling through the water column in very small areas compared to the vast expanse of the testing ranges, OPAREAs, range complexes, or the Study Area. The expected reaction of fish exposed to this stressor would be to immediately leave the area where bombing is occurring, thereby reducing the probability of a fish strike after the initial expended materials hit the water surface. When a disturbance of this type concludes, the area would be repopulated and the fish stock would rebound with inconsequential impacts on the resource (Lundquist et al. 2010).

3.9.3.3.2.1 No Action Alternative

Training Activities

Tables 3.0-70 to 3.0-73 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes, and in the Other AFTT Areas while vessels are in transit. Activities using military expended materials are concentrated within VACAPES and JAX Range Complexes. Species that occur in these areas, including all ESA-listed species, would have the potential to be exposed to military expended material strikes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) that are particularly susceptible to military expended material strikes are those occurring at the surface, within the offshore and continental shelf portions of the range complexes (where the strike would occur). Those groups include pelagic sharks, herring, salmonids, flying fish, jacks, tuna, mackerels, billfish, ocean sunfish, and other similar species (Table 3.9-3). Additionally, certain deep-sea fish would be exposed to strike risk as a ship

hulk, expended during a sinking exercise, settles to the seafloor. These groups include hagfish, dragonfish, lanternfish, Aulopiformes, anglerfish, and oarfish.

Sinking exercises occur in open ocean areas, outside of the coastal range complexes, shown in Figures 3.0-2 and 3.0-3. While serious injury or mortality to individual fish would be expected if they were present within range of high-explosive activities (analyzed in Section 3.9.3.1, Acoustic Stressors), sinking exercises under the No Action Alternative would not result in impacts on pelagic fish populations at the surface based on the placement of these activities in deep ocean areas where fish abundance is low or widely dispersed. Also, these activities are very few in number each year. Disturbances to benthic fish from sinking exercises would be highly localized to the sinking exercise box. Any deep-sea fish on the bottom where a ship hulk would settle could experience displacement, injury, or death. However, population level impacts on the deep-sea fish community would not occur because of the limited spatial extent of the impact and the wide dispersal of fish in deep ocean areas.

Projectiles, bombs, missiles, rockets, and associated fragments have the potential to directly strike fish as they hit the water surface and below the surface to the point where the projectile loses its forward momentum. Fish at the surface, and just below, would be most susceptible to injury or death from strikes, because velocity of these materials would rapidly decrease upon contact with the water and as they travel through the water column. Consequently, most water column fish would have ample time to detect and avoid approaching munitions or fragments that fall through the water column. The probability of strike based on the "footprint" analysis included in Table 3.3-9 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. Therefore, since most fish are smaller than bluefin tuna or whale sharks, and most military expended materials are less abundant than small-caliber projectiles, the risk of strike by these items is exceedingly low for fish overall. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of military expended material strike, but population-level impacts would not occur.

Training activities involving military expended materials could impact marine fish within the areas where the training is occurring. Each range complex within the Study Area is evaluated in Table 3.3-9 (see Section 3.3, Marine Habitats) to determine what the footprint and resulting level of impact could be under the No Action Alternative. Based on that analysis, the total footprint area of expended materials is less than 1/10,000 of 1 percent (less than 0.0001 percent) of each range complex. Therefore, the probability of any of these expended items striking a fish is exceedingly low, and population-level impacts would not be expected.

All of the ESA-listed fish species occurring in training areas would be potentially exposed to military expended materials. The Atlantic salmon occurs only in the Northeast Range Complexes and in the three northernmost large marine ecosystems, where the density of military expended materials is very low. Therefore, while military expended materials could overlap with Atlantic salmon, the likelihood of a strike would be extremely low, with discountable effects. All sturgeon are restricted to the continental shelf, particularly the shallow, coastal, or nearshore waters of the Study Area (Dadswell 2006; Ross et al. 2009), and, therefore, could be exposed to military expended materials only in these locations. Sawfish are restricted to shallow coastal waters of South Florida and the Gulf of Mexico, usually near the ocean bottom. They typically would only be found near the surface while in very shallow water (less than 1 m deep) associated with inshore (within estuaries or barrier islands), mangrove, and seagrass habitats

(Poulakis and Seitz 2004; Simpfendorfer 2006). These habitats do not overlap with military expended material use during training activities in these areas.

There is no overlap of the stressor with designated critical habitat for Atlantic salmon or smalltooth sawfish. All of the primary constituent elements required by Atlantic salmon are applicable to freshwater only and are outside the Study Area. Therefore, none of the military expended materials would affect Atlantic salmon critical habitat. The primary constituent elements for smalltooth sawfish are red mangrove habitats and shallow marine waters of less than 1 m deep. No activities involving military expended materials would occur at these depths and thus would not overlap with smalltooth sawfish critical habitat. Military expended materials (e.g., parachutes, guidance wires, and fiber optic cables) could be expended within Gulf sturgeon critical habitat. However, the only applicable primary constituent element of critical habitat for Gulf sturgeon is "abundant food items" (e.g., amphipods, polychaetes, gastropods, ghost shrimp, isopods, molluscs, and crustaceans). Military expended materials are not expected to impact these invertebrate populations, as described in Section 3.8 (Marine Invertebrates); therefore, while the stressor overlaps Gulf sturgeon critical habitat, no impacts are expected on the abundance of these food items for Gulf sturgeon that contribute to the conservation value of its critical habitat.

The impact of military expended material strikes would be inconsequential due to: (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, (3) the ability of most fish to detect and avoid an object falling through the water below the surface, and (4) the low probability of strike based on impact footprint area. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within sinking exercise boxes) and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of military expended materials during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on Atlantic salmon, or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

Testing Activities

Table 3.0-70 to Table 3.0-73 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under the No Action Alternative, the areas with the greatest amount of expended materials are expected to be the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Naval Surface Warfare Center, Panama City Division Testing Range; the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; and in the Other AFTT Areas. Activities using military expended materials are concentrated within VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to military expended material strikes.

The differences in species overlap and potential impacts of military expended material strikes on marine fish groups and ESA-listed species during testing activities would not be discernible from those described for training activities in Section 3.9.3.3.2.1 (No Action Alternative). Adult Gulf sturgeon may occur in St. Andrew Bay (Florida) during fall and winter (U.S. Fish and Wildlife Service 2004, 2006). Also, St. Andrew Bay is not part of any of the major freshwater river systems that Gulf sturgeon use during freshwater migration. The smalltooth sawfish may also occur in St. Andrew Bay; however, only three smalltooth sawfish encounters have been reported and verified since 1998 west of the mouth of St. Andrew Bay (Simpfendorfer and Wiley 2006).

Based on the analysis in Table 3.3-10, the total footprint area of expended materials is less than 1/10,000 of 1 percent (less than 0.0001 percent) of each testing range. Therefore, as described in the No Action Alternative, the probability of any of these expended items striking a fish is exceedingly low, and population-level effects would not be expected. Furthermore, the anticipated behavioral reactions are not expected to result in substantial changes to an individual's fitness, or species recruitment, and are not expected to result in population-level impacts. Similarly, military expended materials are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon. Specifically, parachutes, fiber optic cables, and guidance wires would overlap critical habitat for Gulf sturgeon only, but none of the primary constituent elements of Gulf sturgeon critical habitat would be affected (see discussion in Section 3.9.3.3.2.1, No Action Alternative).

The impact of military expended material strikes would be inconsequential due to: (1) the limited number of species found directly at or just below the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at or just below the surface by military expended materials, (3) the ability of most fish to detect and avoid an object falling through the water below the surface, and (4) the low probability of strike based on impact footprint area. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within the sinking exercise box) and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of military expended materials during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on ESA-listed Atlantic salmon or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.3.2.2 Alternative 1

Training Activities

Table 3.0-70 to Table 3.0-73 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-11. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is more than twice the amount expended in the No Action Alternative. The activities under Alternative 1 would occur in the same geographic locations as the No Action Alternative. Activities using military expended materials are concentrated within VACAPES, Navy Cherry Point, and JAX Range Complexes. Military expended materials would typically be of the same type listed under the No Action Alternative. Species that occur in these areas,

including all ESA-listed species would have the potential to be exposed to military expended material strikes.

The differences in species overlap and potential impacts from military expended material strikes on marine fish groups and ESA-listed species during training activities would not be discernible from those described for training activities in Section 3.9.3.3.2.1 (No Action Alternative). Military expended materials hitting the water could result in an extremely unlikely strike of an individual fish, or more likely in a short-term and local displacement of fish in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness or species recruitment, and are not expected to result in population-level impacts (see Section 3.9.3.3.2.1, No Action Alternative). Similarly, military expended materials are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish (see Section 3.9.3.3.2.1, No Action Alternative). Parachutes, fiber optic cables, and guidance wires would overlap critical habitat for Gulf sturgeon, but none of the primary constituent elements of Gulf sturgeon critical habitat would be affected (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1, No Action Alternative).

Alternative 1 would include a two-fold increase in small-caliber projectiles. For reasons stated in the No Action Alternative, the overall increase of military expended material under Alternative 1 would result in an increase in the strike risk; however, it would not rise to the level of being a concern. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within the sinking exercise box) and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of military expended materials during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on ESA-listed Atlantic salmon or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

Testing Activities

Table 3.0-70 to Table 3.0-73 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-12. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 1, the total amount of military expended materials is nearly four times the amount expended in the No Action Alternative. The activities under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of the introduction of activities in the South Florida Ocean Measurement Facility Testing Range and Key West Range Complex. Activities using military expended materials are concentrated within VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Military expended materials would typically be of the same type listed under the No Action Alternative. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to military expended material strikes.

The differences in species overlap and potential impacts of military expended material strikes on marine fish groups and ESA-listed species during testing activities would not be discernible from those described for training activities in Section 3.9.3.3.2.1 (No Action Alternative). Military expended materials hitting

the water could result in an extremely unlikely strike of an individual fish, or more likely in a short-term and local displacement of fish in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness or species recruitment, and are not expected to result in population-level impacts (see Section 3.9.3.3.2.1, No Action Alternative). Similarly, military expended materials are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish (see Section 3.9.3.3.2.1, No Action Alternative). Parachutes, fiber optic cables, and guidance wires would overlap critical habitat for Gulf sturgeon, but none of the primary constituent elements of Gulf sturgeon critical habitat would be affected (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1, No Action Alternative).

Alternative 1 would include a substantial increase in small-caliber projectiles. The overall increase of military expended material under Alternative 1 would result in an increase in the strike risk; however, it would not rise to the level of being a concern. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within the sinking exercise box) and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on ESA-listed Atlantic salmon or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.3.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.3.2.2 (Alternative 1).

Pursuant to the ESA, the use of military expended materials during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on ESA-listed Atlantic salmon or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

Testing Activities

Table 3.0-70 to Table 3.0-73 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. The number and footprint of military expended materials are detailed in Table 3.3-13. As indicated in Section 3.0.5.3.3.3 (Military Expended Material Strikes), under Alternative 2, the total amount of military expended materials is more than four times the amount expended in the No Action Alternative, but only increases by 11 percent overall as compared to Alternative 1. Activities under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of the introduction of activities in the Key West Range Complex. Activities using military expended materials are concentrated within VACAPES Range Complex and Naval

Surface Warfare Center, Panama City Division Testing Range. Military expended materials would typically be of the same type listed under the No Action Alternative. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to military expended material strikes.

The differences in species overlap and potential impacts of military expended material strikes on marine fish groups and ESA-listed species during testing activities would not be discernible from those described for training activities in Section 3.9.3.3.2.1 (No Action Alternative). Military expended materials hitting the water could result in an extremely unlikely strike of an individual fish, or more likely in a short-term and local displacement of fish in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness or species recruitment, and are not expected to result in population-level impacts (see Section 3.9.3.3.2.1, No Action Alternative). Similarly, military expended materials are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon or smalltooth sawfish (see Section 3.9.3.3.2.1, No Action Alternative). Parachutes, fiber optic cables, and guidance wires would overlap critical habitat for Gulf sturgeon, but none of the primary constituent elements of Gulf sturgeon critical habitat would be affected (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1, No Action Alternative).

Alternative 2 would include a substantial increase in small-caliber projectiles. The overall increase of military expended material under Alternative 2 would result in an increase in the strike risk; however, it would not rise to the level of being a concern. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within the sinking exercise box) and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

Pursuant to the ESA, the use of military expended materials during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon;*
- *will have no effect on ESA-listed Atlantic salmon or smalltooth sawfish critical habitat; and*
- *may affect but is not likely to adversely affect critical habitat for Gulf sturgeon.*

3.9.3.3.3 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.4 (Seafloor Devices). Seafloor devices include items placed on, dropped on, or moved along the seafloor, such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom-placed targets that are not expended. As discussed in the military expended materials strike section, objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most fish.

Seafloor devices with a strike potential for fish include those items temporarily deployed on the seafloor. The potential strike impacts of bottom crawling types of unmanned underwater vehicles are also included here. Some fish are attracted to virtually any tethered object in the water column (Dempster and Taquet 2004) and could be attracted to a non-explosive mine assembly. However, while a fish might be attracted to the object, their sensory abilities allow them to avoid colliding with fixed tethered objects in the water column (Bleckmann and Zelick 2009), so the likelihood of a fish striking

one of these objects is implausible. Therefore, strike hazards associated with collision into other seafloor devices such as deployed mine shapes or anchored devices are not discussed further.

3.9.3.3.3.1 No Action Alternative

Training Activities

Table 3.0-76 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, training activities that deploy seafloor devices occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes.

Seafloor devices are not expected to cause disturbance to any species other than bottom-dwelling fish; therefore, under the No Action Alternative, seafloor devices are not likely to impact any ESA-listed species. In addition, seafloor devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon. Activities that employ these devices do not overlap the critical habitat of the Atlantic salmon, smalltooth sawfish, and Gulf sturgeon.

Pursuant to the ESA, the use of seafloor devices during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

Testing Activities

Table 3.0-76 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, testing activities that use seafloor devices occur in the Gulf of Mexico, Northeast, and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex; Naval Undersea Warfare Center Division, Newport Testing Range; and Naval Surface Warfare Center, Panama City Division Testing Range.

As discussed in Section 3.9.3.3.2 (Impacts from Military Expended Material), objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most fish. The only seafloor device used during testing activities that has the potential to strike a fish within the water column are aircraft deployed mine shapes, which are deployed at the surface during aerial mine laying in the VACAPES Range Complex. Atlantic salmon, largetooth sawfish, and Gulf sturgeon do not occur where aerial mine laying activities take place. The impacts of these devices on Atlantic sturgeon, shortnose sturgeon, and smalltooth sawfish are identical to non-explosive practice bombs discussed in the analysis of potential impacts in the military expended material strike section. These devices would not be used where ESA-listed Atlantic salmon, largetooth sawfish, or Gulf sturgeon occur. Similarly, these devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1, No Action Alternative).

Pursuant to the ESA, the use of seafloor devices during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, or Gulf sturgeon;*
- *may affect but is not likely to adversely affect the ESA-listed smalltooth sawfish, Atlantic sturgeon, or shortnose sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.3.3.2 Alternative 1

Training Activities

Training activities that deploy seafloor devices under Alternative 1 would occur in the same geographic areas as under the No Action Alternative and are expected to increase by 44 percent. Seafloor devices are not expected to cause disturbance to any species other than bottom-dwelling fish; therefore, under the No Action Alternative, seafloor devices are not likely to impact any ESA-listed species. In addition, seafloor devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon.

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 1:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

Testing Activities

Table 3.0-76 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices is approximately twice that of the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic locations as the No Action Alternative. In addition, seafloor devices would be used in the South Florida Ocean Measurement Facility Testing Range; Northeast, Navy Cherry Point, and JAX Range Complexes; and throughout the Gulf of Mexico.

As discussed in Section 3.9.3.3.2 (Impacts from Military Expended Material), objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most fish. The only seafloor device used during testing activities that has the potential to strike a fish within the water column is an aircraft deployed mine shape, which is deployed at the surface during aerial mine laying in the VACAPES and JAX Range Complexes. Atlantic salmon, largetooth sawfish, and Gulf sturgeon do not occur where aerial mine laying activities take place. These devices are identical to non-explosive practice bombs and the potential impacts are included in the analysis of potential impacts on Atlantic sturgeon, shortnose sturgeon, and smalltooth sawfish within the military expended material strike section. Seafloor devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon for the same reasons identified for military expended materials strike (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1 [No Action Alternative]).

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 1:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, or Gulf sturgeon;*
- *may affect but is not likely to adversely affect the ESA-listed smalltooth sawfish, Atlantic sturgeon, or shortnose sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.3.3.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.3.3.2 (Alternative 1).

Pursuant to the ESA, the use of seafloor devices during training activities as described under Alternative 2:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

Testing Activities

Table 3.0-76 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2, the number of activities using seafloor devices is approximately twice that of the No Action Alternative. The activities using seafloor devices under Alternative 2 would occur in the same geographic locations as the No Action Alternative. In addition, seafloor devices would be used in the Northeast, Navy Cherry Point, and JAX Range Complexes as well as throughout the Gulf of Mexico.

As discussed in Section 3.9.3.3.2 (Impacts from Military Expended Material), objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most fish. The only seafloor device used during testing activities that has the potential to strike a fish within the water column is an aircraft deployed mine shape, which is deployed at the surface during aerial mine laying (in the VACAPES and JAX Range Complexes). Atlantic salmon, largetooth sawfish, and Gulf sturgeon do not occur where aerial mine laying activities take place. These devices are identical to non-explosive practice bombs and the potential impacts are included in the analysis of potential impacts on Atlantic sturgeon, shortnose sturgeon, and smalltooth sawfish within the military expended material strike section. Seafloor devices are not anticipated to affect any primary constituent elements of critical habitat for Atlantic salmon, smalltooth sawfish, or Gulf sturgeon for the same reasons identified for military expended materials strike (see discussion of the impacts from military expended materials in Section 3.9.3.3.2.1 [No Action Alternative]).

Pursuant to the ESA, the use of seafloor devices during testing activities as described under Alternative 2:

- *will have no effect on ESA-listed Atlantic salmon, largetooth sawfish, or Gulf sturgeon;*
- *may affect but is not likely to adversely affect the ESA-listed smalltooth sawfish, Atlantic sturgeon, or shortnose sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.4 Entanglement Stressors

This section evaluates potential entanglement impacts of various types of expended materials used by the Navy during training and testing activities within the Study Area. The likelihood of fish being affected by an entanglement stressor is a function of the physical properties, location, and buoyancy of the object and the behavior of the fish as described in Section 3.0.5.7.4 (Conceptual Framework for Assessing Effects from Entanglement). Two types of military expended materials are considered here: (1) cables and wires, and (2) parachutes.

Most entanglement observations involve abandoned or discarded nets, lines, and other materials that form loops or incorporate rings (Derraik 2002; Keller et al. 2010; Laist 1987; Macfadyen et al. 2009). A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for 68 percent of fish entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010b). No occurrences involving military expended materials were documented.

Fish entanglement occurs most frequently at or just below the surface or in the water column where objects are suspended. A smaller number involve objects on the seafloor, particularly abandoned fishing gear designed to catch bottom fish or invertebrates (Ocean Conservancy 2010b). More fish species are entangled in coastal waters and the continental shelf than elsewhere in the marine environment because of higher concentrations of human activity (e.g., fishing, sources of entangling debris), higher fish abundances, and greater species diversity (Helfman et al. 2009; Macfadyen et al. 2009). The consequences of entanglement range from temporary and inconsequential to major physiological stress or mortality.

Some fish are more susceptible to entanglement in derelict fishing gear and other marine debris, compared to other fish groups. Physical features, such as rigid or protruding snouts of sawfish and sturgeon and some elasmobranchs (e.g., the wide heads of hammerhead sharks), increase the risk of entanglement compared to fish with smoother, more streamlined bodies (e.g., lamprey and eels). Sawfish occur only in nearshore, and coastal waters of the Gulf of Mexico Large Marine Ecosystem and very limited portions of the Southeast U.S. Continental Shelf Large Marine Ecosystem (FR 74 (169): 45353-45359, September 2, 2009; FR 74 (144): 37671-37674, July 29, 2009), where they are concentrated in south Florida and the Florida Keys. Scalloped hammerhead sharks and each ESA-listed sturgeon species occurs in each of the large marine ecosystems that overlap Navy training and testing areas in the Study Area, within nearshore and offshore waters. Most other fish, except for jawless fish and eels that are too smooth and slippery to become entangled, are susceptible to entanglement gear specifically designed for that purpose (e.g., gillnets); however, the Navy does not expend any items that are designed to function as entanglement objects.

The overall impacts of entanglement are highly variable, ranging from temporary disorientation to mortality due to predation or physical injury. The evaluation of a species' entanglement potential should consider the size, location, and buoyancy of an object as well as the behavior of the fish species.

The following sections seek to identify entanglement potential due to military expended material. Where appropriate, specific geographic areas (large marine ecosystems, open ocean areas, range complexes, testing ranges, and bays and inland waters) of potential impact are identified.

3.9.3.4.1 Impacts from Fiber Optic Cables and Guidance Wires

Fiber optic cables and guidance wires are used during training and testing activities. A discussion of the types of activities, physical characteristics, location of use, and the number of items expended under each alternative is presented in Sections 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires).

Once a guidance wire is released, it is likely to sink immediately and remain on the seafloor. In some cases, the wire may snag on a hard structure near the bottom and remain partially or completely suspended. The types of fish that encounter any given wire would depend, in part, on its geographic location and vertical location in the water column. In any situation, the most likely mechanism for entanglement would involve fish swimming through loops in the wire that tighten around it; however, loops are unlikely to form in guidance wire (Environmental Sciences Group 2005).

Because of their physical characteristics, guidance wires and fiber optic cables pose a potential, though unlikely, entanglement risk to susceptible fish. Potential entanglement scenarios are based on fish behavior in abandoned monofilament, nylon, and polypropylene lines used in commercial nets. Such derelict fishing gear is abundant in the ocean (Macfadyen et al. 2009) and pose a greater hazard to fish than the very thin wire expended by the Navy. Fishing gear materials often have breaking strengths that can be up to orders of magnitude greater than that of guidance wire and fiber optic cables (Environmental Sciences Group 2005), and are far more prone to tangling, as discussed in 3.0.5.3.4.1, Fiber Optic Cables and Guidance Wires. Fiber optic cables do not easily form loops, are brittle, and break easily if bent, so they pose a negligible entanglement risk. Additionally, the encounter rate and probability of impact from guidance wires and fiber optic cables are low, as few are expended and therefore, have limited overlap with sawfish or sturgeon.

Tube-launched optically tracked wire-guided missiles would expend wires in the nearshore or offshore waters of the Navy Cherry Point Range Complex, during training only and are discussed together with torpedo guidance wires because their potential impacts would be similar to those described here for torpedo guidance wires, which are also expended in the Navy Cherry Point Range Complex.

3.9.3.4.1.1 No Action Alternative

Training Activities

Tables 3.0-86 and 3.0-89 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, activities that expend fiber optic cables occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas— specifically within the VACAPES, Navy Cherry Point, and JAX Range Complexes. The area that will have the greatest concentration of expended cables or wires is within the VACAPES Range Complex (specifically W-50). W-50 includes 123 square nautical miles (nm^2) of sea space. Under the No Action Alternative, there would be approximately six cables per nm^2 if they were expended evenly throughout the area.

Torpedoes expending guidance wire would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, and JAX Range Complexes. The greatest concentration would occur in the JAX Range Complex, but guidance wires could also be expended outside the range complexes—specifically the sinking exercise box and anywhere in the Gulf of Mexico portion of the Study Area.

Marine fish groups identified in Sections 3.9.2 (Affected Environment), that could be susceptible to entanglement in expended cables and wires are those with elongated snouts lined with tooth-like structures that easily snag on other similar marine debris, such as derelict fishing gear (Macfadyen et al. 2009). Some elasmobranchs (sawfish and hammerhead sharks), sturgeon, and billfish occurring within the offshore and continental shelf portions of the range complexes (where the potential for entanglement would occur) could be susceptible to entanglement in cables and wires. Atlantic salmon would not be as prone to entanglement because they do not possess the morphological features (rigid or protruding snouts) associated with high entanglement rates. Species occurring outside the specified areas within these range complexes would not be exposed to fiber optic cables or guidance wires.

The locations of expended cables and wires overlap the range for all of the ESA-listed fish, with the exception of Atlantic salmon. Smalltooth sawfish and largetooth sawfish are vulnerable to entanglement in the JAX and GOMEX Range Complexes due to elongated snouts lined with tooth-like structures that easily snag on fishing gear and other marine debris (Macfadyen et al. 2009; Seitz and Poulakis 2006; Simpfendorfer and Wiley 2006). However, the likelihood of a sawfish encountering expended wires and cables in these locations is low because of the low density in which they are expended.

The entanglement potential of discarded sections of fiber optic cable is low due to the brittle nature of the cable, which is easily broken when kinked, twisted, or bent sharply. The physical properties of the fiber optic cable prevent it from forming loops, greatly reducing or even eliminating the risk to fish (U.S. Department of the Navy 2001a). Additionally, encounter rates with fiber optic cables is limited by the small number that are expended.

Atlantic and shortnose sturgeon could encounter fiber optic cables in the VACAPES, Navy Cherry Point, or JAX Range Complexes; smalltooth sawfish could occur in the JAX Range Complex as well. For sawfish, early life stages have the same body-type as adults. However, the likelihood of entanglement of early life stages would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m) (National Marine Fisheries Service 2009c), where no cables or wires would be expended. Early life stages of sturgeon and Atlantic salmon are typically (or exclusively, for salmon) found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to entanglement stressors. Gulf sturgeon would not encounter fiber-optic cables because none are expended during training activities in the Gulf of Mexico. In the rare instance where a fish did encounter a fiber optic cable, entanglement is unlikely because the cable is not strong enough to bind most fish (U.S. Department of the Navy 2001a).

Guidance wire would not be expended within the inshore or nearshore habitats of either smalltooth or largetooth sawfish in the Other AFTT Areas. Any of the ESA-listed sturgeon species could encounter guidance wire because they can occur in nearshore waters out to the shelf break, where they feed on the bottom and could become entangled in a guidance wire while feeding. However, sturgeon are more commonly found closer to shore, where they would be less likely to encounter any guidance wire.

Guidance wires sink too quickly to be transported very far before reaching the seafloor (Environmental Sciences Group 2005). Fish would rarely encounter guidance wires expended during training activities. If a guidance wire were encountered, the most likely result would be that the fish ignores it, which is an inconsequential and immeasurable effect. In the rare instance where an individual fish became entangled in guidance wire and could not break free, the individual could be impacted as a result of impaired feeding, bodily injury, or increased susceptibility to predators. However, this is an extremely

unlikely scenario because the density of guidance wires would be very low, as discussed in Section 3.0.5.3.4.1 (Fiber Optic Cable and Guidance Wires).

While individual fish susceptible to entanglement could encounter guidance wires and cables, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate is low given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-86 and 3.0-89 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, activities that expend fiber optic cables would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Torpedoes expending guidance wire would occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream Open Ocean Area—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Under the No Action Alternative, there would be approximately one cable per 17 nm^2 if they were expended evenly throughout these areas. Guidance wire could also be expended outside the range complexes—specifically the sinking exercise box.

The differences in species overlap and potential impacts of military expended material strikes on marine fish groups and ESA-listed species during testing activities would not be discernible from those described in Section 3.9.3.4.1.1 (No Action Alternative). Atlantic salmon would not be as prone to entanglement because they do not possess the morphological features (rigid or protruding snouts) associated with high entanglement rates. ESA-listed species susceptible to entanglement (sawfish and sturgeon species) and those not susceptible to entanglement (Atlantic salmon) occur in testing locations, but are unlikely to encounter the guidance wires because of their low densities in the areas where they are expended. Early life stages of sturgeon and Atlantic salmon are typically (or exclusively, for salmon) found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to entanglement stressors. For sawfish, the early life stages have the same body-type as adults; however, the likelihood of entanglement of early life stages would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m), where no cables or wires would be expended.

The risk of entanglement resulting from proposed testing activities that expend cables and wires would be low as described in training activities for the No Action Alternative. While individual fish susceptible to entanglement could encounter guidance wires and cables, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate is low

given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.4.1.2 Alternative 1

Training Activities

Tables 3.0-86 and 3.0-89 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 1, activities that expend fiber optic cables is more than three times that of the No Action Alternative. These activities would occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas— specifically within the VACAPES, Cherry Point, and JAX Range Complexes. This would result in a maximum concentration of approximately one cable per 16 nm^2 if they were expended evenly throughout the area.

The number of torpedo activities that expend guidance wire would increase by 21 percent under Alternative 1 and would occur in the same geographic locations as the No Action Alternative, with the exception of introducing guidance wires in the Other AFTT Areas while vessels are in transit.

The differences in species overlap and potential impacts of fiber optic cables and guidance wires on marine fish groups and ESA-listed species during training activities would not be discernible from those described in Section 3.9.3.4.1.1 (No Action Alternative). ESA-listed species susceptible to entanglement (sawfish and sturgeon species) and those not as susceptible to entanglement (Atlantic salmon) occur in the general vicinity of the training, but are unlikely to encounter guidance wires because of the low density in areas where they are expended. For reasons stated in the No Action Alternative, the risk of entanglement resulting from proposed training activities that expend cables and wires would be low and are not expected to result in long-term impacts beyond behavioral disturbance.

While individual fish susceptible to entanglement could encounter guidance wires and fiber optic cables, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate is low given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-86 and 3.0-89 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 1, activities that expend fiber optic cables is more than two times that of the No Action Alternative. These activities would occur in the same geographic locations as the No Action Alternative with the exception of adding activities within the Gulf of Mexico. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended evenly throughout the area.

The number of torpedo activities that expend guidance wire is more than six times that of the No Action Alternative and occur in the same geographic locations as the No Action Alternative, with the exception of introducing guidance wires in the Gulf of Mexico portion of the Study Area.

The differences in species overlap and potential impacts of fiber optic cables and guidance wire on marine fish groups and ESA-listed species during testing activities would not be discernible from those described in Section 3.9.3.4.1.1 (No Action Alternative). ESA-listed species susceptible to entanglement (sawfish and sturgeon species) and those not as susceptible to entanglement (Atlantic salmon) occur in testing locations, but are unlikely to encounter the guidance wires because their densities are low in the areas where they are expended. The risk of entanglement resulting from proposed testing activities that expend cables and wires would be low and are not expected to result in long-term impacts beyond behavioral disturbance, as described in testing activities for the No Action Alternative (Section 3.9.3.4.1.1, No Action Alternative).

The risk of entanglement resulting from proposed testing activities that expend cables and wires would be low as described in training activities for the No Action Alternative. While individual fish susceptible to entanglement could encounter guidance wires and cables, consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate is low given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.4.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.4.1.2 (Alternative 1).

Pursuant to the ESA, the impacts from the use of fiber optic cables and guidance wires during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-86 and 3.0-89 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 2, the number of activities that expend fiber optic cables is 2.5 times higher than that of the No Action Alternative, but only increases by 17 percent as compared to Alternative 1. The activities using fiber optic cables under Alternative 2 would occur in the same geographic locations as the No Action Alternative. This would result in a maximum concentration of approximately one cable per 7 nm^2 if they were expended randomly in this area.

The number of torpedo activities that expend guidance wire is approximately seven times that of the No Action Alternative and results in an increase of 13 percent when compared to Alternative 1. These activities under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing guidance wires in the Gulf of Mexico portion of the Study Area.

The differences in species overlap and potential impacts of fiber optic cables and guidance wires on marine fish groups and ESA-listed species during testing activities would not be discernible from those described in Section 3.9.3.4.1.1 (No Action Alternative). ESA-listed species susceptible to entanglement (sawfish and sturgeon species) and those not as susceptible to entanglement (Atlantic salmon) occur in testing locations, but are unlikely to encounter guidance wires because their densities are low in the areas where they are expended. The risk of entanglement resulting from proposed testing activities would be low and are not expected to result in long-term impacts beyond behavioral disturbance, as described in Section 3.9.3.4.1.1 (No Action Alternative).

The risk of entanglement resulting from proposed testing activities that expend cables and wires would be low as described in training activities for the No Action Alternative. While individual fish susceptible to entanglement could encounter guidance wires and fiber optic cables, the long-term consequences of entanglement are unlikely for either individuals or populations. because (1) the encounter rate is low given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.4.2 Impacts from Parachutes

Parachutes of varying sizes are used during training and testing activities. The physical characteristics and size of parachutes are presented in Section 3.0.5.3.4.2 (Parachutes). The types of activities that use parachutes are listed in Tables 3.0-58 and 3.0-59. The estimated number of parachutes and locations where they would be expended are detailed in Table 3.0-73.

Fish face many potential entanglement scenarios in abandoned monofilament, nylon, polypropylene line, and other derelict fishing gear in the nearshore and offshore marine habitats of the Study Area (Macfadyen et al. 2009; Ocean Conservancy 2010b). Abandoned fishing gear is dangerous to fish because it is abundant, essentially invisible, strong, and easily tangled. In contrast, parachutes are rare, highly visible, and not designed to capture fish. The combination of low encounter rates and weak entangling features reduce the risk that sawfish and other ESA-protected fish would be adversely impacted by parachutes.

Once a parachute has been released to the water, it poses a potential entanglement risk to fish. The Naval Ocean Systems Center identified the potential impacts of torpedo air launch accessories, including parachutes, on fish (U.S. Department of the Navy 1996). Unlike other materials in which fish become entangled (such as gill nets and nylon fishing line), the parachute is relatively large and visible, reducing the chance that visually oriented fish would accidentally become entangled in it. No cases of fish entanglement have been reported for parachutes (Ocean Conservancy 2010b; U.S. Department of the Navy 2001a). Entanglement in a newly expended parachute while it is in the water column is unlikely because fish generally react to sound and motion at the surface with a behavioral reaction by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Material) and would detect the oncoming parachute in time to avoid contact. While the parachute is sinking, fish would have ample opportunity to swim away from the large moving object. Even if the parachute landed directly on a fish, it would likely be able to swim away faster than the parachute would sink because the resistance of the water would slow the parachute's downward motion.

Once the parachute is on the bottom, however, it is feasible that a fish could become entangled in the parachute or its suspension lines while diving and feeding, especially in deeper waters where it is dark. If the parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat to large fish feeding on the bottom. Benthic fish with elongated spines could become caught on the parachute or lines. Most sharks and other smooth-bodied fish are not expected to become entangled because their soft, streamlined bodies can more easily slip through potential snares. A fish with spines or protrusions (e.g., some sharks, billfish, sturgeon, or sawfish) on its body that swam into the parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape. Although this scenario is possible based on the structure of the materials and the shape and behavior of fish, it is not considered a likely event.

Aerial-launched sonobuoys are deployed with a parachute. The sonobuoy itself is not considered an entanglement hazard for upon deployment (Environmental Sciences Group 2005), but their components may pose an entanglement hazard once released into the ocean. Sonobuoys contain cords, electronic

components, and plastic mesh that may entangle fish (Environmental Sciences Group 2005). Open-ocean filter feeding species, such as basking sharks, whale sharks, and manta rays could become entangled in these items, whereas smaller species such as Atlantic herring could become entangled in the plastic mesh in the same manner as a small gillnet. The sonobuoy canister is similar in diameter to a coffee can, which is a known entanglement risk to the smalltooth sawfish; these fish have been found with a plastic pipe or coffee can encircling their snouts, which can interfere with their feeding (Seitz and Poulakis 2006). A smalltooth sawfish could get its snout lodged inside a sonobuoy canister in this same manner. Since most sonobuoys are expended in offshore areas, many coastal fish would not encounter or have any opportunity to become entangled in materials associated with sonobuoys, apart from the risk of entanglement in parachutes described above.

3.9.3.4.2.1 No Action Alternative

Training Activities

Table 3.0-73 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-9. As indicated in Table 3.0-73 under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For training events, the greatest concentration would occur in the Southeast U.S. Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area (specifically, the JAX Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 2 nm^2 if they were evenly expended throughout the area. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to parachutes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) that could be susceptible to entanglement in parachutes are the same as discussed for cables and wires in Section 3.9.3.4.1.1 (No Action Alternative). Some elasmobranchs (sawfish, hammerhead sharks), sturgeon, and billfish occurring within the offshore and continental shelf portions of the range complexes (where the potential for entanglement would occur) could be susceptible to entanglement in parachutes. As described above, the highly maneuverable swimming capabilities of these fish make it unlikely that any entanglement would occur while the parachutes are at the surface or sinking through the water column. Sawfish are not expected to co-occur with newly expended parachutes, as these ESA-protected fish remain primarily nearshore and close to the bottom, particularly in shallow areas where parachutes are not expended. It is conceivable that a sawfish or sturgeon could encounter an expended parachute that has settled to the bottom. Any of the sturgeon species could encounter parachutes because sturgeon can occur at the surface or on the bottom in nearshore waters out to the shelf break. However, the ESA-listed sturgeon are more commonly found closer to shore, where they would be less likely to encounter any parachutes.

The Atlantic salmon occurs in offshore areas where parachutes would be expended in the Northeast Range Complexes and may encounter parachutes in the water column. However, the Atlantic salmon, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended in this location and the body shape of Atlantic salmon, which makes it unlikely to become entangled. Potential impacts on smalltooth sawfish and largetooth sawfish would be discountable because of the low density of parachutes that would co-occur with sawfish habitat. The largetooth sawfish is particularly rare in the Study Area, even for an endangered species (the last

confirmed records of largetooth sawfish in U.S. waters were from Port Aransas, Texas in 1961, Florida in 1941, and Louisiana in 1917 (FR 76 (133): 40822-40836, July 12, 2011).

In addition to the low concentration of parachutes expended in areas where sawfish might occur, sawfish are highly mobile, visual predators that could easily avoid a floating or suspended parachute. If a rare parachute encounter by a sawfish led to entanglement, the fish would likely thrash its rostral saw in an effort to break free. If such an effort were unsuccessful, the individual could remain entangled, possibly resulting in injury or death. However, this scenario is considered so unlikely that it would be discountable.

For sawfish, the early life stages have the same body-type as adults; however, the likelihood of entanglement of early life stages would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m) (National Marine Fisheries Service 2009c), where no parachutes would be expended. Early life stages of sturgeon and Atlantic salmon are typically (or exclusively, for salmon) found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to entanglement stressors.

Fish are unlikely to encounter or become entangled in parachutes because of the large size of the range complexes and the resulting widely scattered expended parachutes. Individual fish are not prone to be repeatedly exposed to parachutes, thus the long-term consequences of entanglement risks from parachutes are unlikely for either individuals or populations.

Pursuant to the ESA, the use of parachutes during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Table 3.0-73 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-10. As indicated in Table 3.0-73 under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and in the SINKEX Box outside the range complexes. To estimate a worst-case scenario, calculations were made for the area where parachutes would be expended with greatest concentration. For testing events, the greatest concentration would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem and the Gulf Stream Open Ocean Area (specifically, in the VACAPES Range Complex). Under the No Action Alternative, there would be a concentration of approximately one parachute per 22 nm^2 if the parachutes were expended evenly throughout the area. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to parachutes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) that could be susceptible to entanglement in parachutes are the same as discussed for cables and wires in Section 3.9.3.4.1.1 (No Action Alternative). It is conceivable that a sawfish or sturgeon could encounter an expended parachute that has settled to the bottom. Any of the sturgeon species could encounter parachutes because sturgeon can occur at the surface or on the bottom in nearshore waters out to the shelf break. However,

the ESA-listed sturgeon are more commonly found closer to shore, where they would be less likely to encounter any parachutes. For sawfish, the early life stages have the same body-type as adults; however, the likelihood of entanglement of early life stages would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m), where no parachutes would be expended. Early life stages of sturgeon and Atlantic salmon are typically (or exclusively, for salmon) found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to entanglement stressors. For the reasons stated in Section 3.9.3.4.2.1 (No Action Alternative), impacts on Atlantic salmon, smalltooth sawfish, and largetooth sawfish would be discountable.

Fish are unlikely to encounter or become entangled in parachutes because of the large size of the range complexes and testing ranges and the resulting widely scattered expended parachutes. Individual fish are not prone to be repeatedly exposed to parachutes, thus the long-term consequences of entanglement risks from parachutes are unlikely for either individuals or populations.

Pursuant to the ESA, the use of parachutes during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.4.2.2 Alternative 1

Training Activities

Table 3.0-73 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-11. As indicated in Table 3.0-73 under Alternative 1 the number of activities involving the use of parachutes are 5 percent higher than that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, parachutes would also be expended in the Key West and GOMEX Range Complexes. Under Alternative 1, there would be a concentration of approximately one parachute per 2 nm^2 if the parachutes were expended evenly throughout the area. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to parachutes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) and ESA-listed species that could be susceptible to entanglement in parachutes are the same as discussed for cables and wires in Section 3.9.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.9.3.4.2.1 (No Action Alternative), impacts on Atlantic salmon, smalltooth sawfish, and largetooth sawfish would be discountable.

Under Alternative 1 only one sonobuoy would be deployed per 32 nm^2 in the area of highest concentration. The parachute encounter rate for the smalltooth sawfish would be extremely low. In addition, sawfish are highly mobile, visual predators that could easily avoid a floating or suspended parachute. If a rare parachute encounter by a sawfish led to entanglement, the fish would likely thrash its rostral saw in an effort to break free. If such an effort were unsuccessful, the individual could remain entangled, possibly leading to injury or death. However, this scenario is so unlikely that it would be discountable because of the low density of parachutes expended in the Study Area. The risk of entanglement of sawfish from proposed training activities under Alternative 1 is low.

Fish are unlikely to encounter or become entangled in parachutes because of the large size of the range complexes and the resulting widely scattered expended parachutes. Individual fish are not prone to be repeatedly exposed to parachutes, thus the long-term consequences of entanglement risks from parachutes are unlikely for either individuals or populations.

Pursuant to the ESA, the use of parachutes during training activities as proposed under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Table 3.0-73 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-12. As indicated in Table 3.0-73 under Alternative 1 the number of activities involving the use of parachutes is four times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Key West Range Complex. In addition, there are testing activities expending parachutes that could occur throughout the Study Area. Under Alternative 1, there would be a concentration of approximately one parachute per 5 nm^2 if the parachutes were expended evenly throughout the area. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to parachutes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) and ESA-listed species that could be susceptible to entanglement in parachutes are the same as discussed for cables and wires in Section 3.9.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.9.3.4.2.1 (No Action Alternative), impacts on Atlantic salmon, smalltooth sawfish, and largetooth sawfish would be discountable.

Sawfish could encounter parachutes expended in the Key West Range Complex that were transported to the nearshore habitats where sawfish occur. However, only one sonobuoy per 7 nm^2 is proposed in this area under Alternative 1, making encounter rates very low. Moreover, sawfish are highly mobile visual predators that could easily avoid a floating or suspended parachute. Under Alternative 1, the risk of entanglement of sawfish resulting from proposed testing activities that expend parachutes would be low.

Fish are unlikely to encounter or become entangled in parachutes because of the large size of the range complexes and testing ranges and the resulting widely scattered expended parachutes. Individual fish are not prone to be repeatedly exposed to parachutes, thus the long-term consequences of entanglement risks from parachutes are unlikely for either individuals or populations.

Pursuant to the ESA, the use of parachutes during testing as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.4.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are nearly identical to training activities under Alternative 1 (three additional parachutes). Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.4.2.2 (Alternative 1).

Pursuant to the ESA, the use of parachutes during training as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Table 3.0-73 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-13. As indicated in Table 3.0-73 under Alternative 2, the number of activities involving the use of parachutes is more than five times that of the No Action Alternative, but only increases by 19 percent as compared to Alternative 1. The activities using parachutes under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Key West Range Complex. In addition, there are testing activities expending parachutes that could occur throughout the Study Area. Under Alternative 2, there would be a concentration of approximately one parachute per 4 nm^2 if the parachutes were expended evenly throughout the area. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to parachutes.

Marine fish groups identified in Section 3.9.2 (Affected Environment) and ESA-listed species that could be susceptible to entanglement in parachutes are the same as discussed for cables and wires in Section 3.9.3.4.2.1 (No Action Alternative). For the reasons stated in Section 3.9.3.4.2.1 (No Action Alternative), impacts on Atlantic salmon, smalltooth sawfish, and largetooth sawfish would be discountable.

Sawfish could encounter parachutes expended in the Key West Range Complex that are transported to the nearshore habitats where sawfish occur. However, only one sonobuoy per 7 nm^2 is proposed in this area under Alternative 2, making encounter rates very low. Moreover, sawfish are highly mobile visual predators that could easily avoid a floating or suspended parachute. Under Alternative 2, the risk of entanglement of sawfish resulting from proposed testing activities that expend parachutes would be low.

Fish are unlikely to encounter or become entangled in parachutes because of the large size of the range complexes and testing ranges and the resulting widely scattered expended parachutes. Individual fish are not prone to be repeatedly exposed to parachutes, thus the long-term consequences of entanglement risks from parachutes are unlikely for either individuals or populations.

Pursuant to the ESA, the use of parachutes during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5 Ingestion Stressors

This section evaluates the potential ingestion impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5 (Conceptual Framework for Assessing Effects from Ingestion). Ingestion of expended materials by fish could occur in all large marine ecosystems and open ocean areas and can occur at or just below the surface, in the water column, or at the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the fish. Floating material is more likely to be eaten by fish of all sizes that feed at or near the water surface (e.g., ocean sunfish, basking sharks, whale sharks, manta rays, herring, or flying fish), while materials that sink to the seafloor present a higher risk to bottom-feeding fish (e.g., sturgeon, hammerhead sharks, skates, rays, and flounders).

It is reasonable to assume that any item of a size that can be swallowed by a fish could be eaten at some time; this analysis focuses on ingestion of materials in two locations: (1) at the surface or water column, and (2) at the seafloor. Open-ocean predators and open-ocean planktivores are most likely to ingest materials in the water column. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators could ingest materials from the seafloor. The potential for fish, including the ESA-listed fish species, to encounter and ingest expended materials is evaluated with respect to their feeding group, size, and geographic range, which influence the probability that they would eat military expended materials.

The Navy expends the following types of materials during training and testing in the Study Area that could become ingestion stressors: non-explosive practice munitions (small- and medium-caliber), fragments from high-explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small parachutes. The activities that expend these items and their general distribution are detailed in Section 3.0.5.3.5 (Ingestion Stressors). Metal items eaten by marine fish are generally small (such as fish hooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological impacts could occur as a result of consuming metal or plastic materials (Davison and Asch 2011); (Dantas et al. 2012; Possatto et al. 2011). Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential impact on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small parachutes, and end caps and pistons from flares and chaff cartridges are considered to be of ingestible size for a fish. For many small fish species (e.g., herring, anchovy, etc.), even these items (with the exception of chaff) are too large to be ingested. Therefore, the discussion in this section focuses on those fish species large enough to potentially ingest these materials.

The analysis of ingestion impacts on fish is structured around the following feeding strategies:

Feeding at or Just Below the Surface or Within the Water Column

- **Open-Ocean Predators.** Large, migratory, open-ocean fish, such as salmon, tuna, dolphin fish, sharks, and billfish, feed on fast-swimming prey in the water column of the Study Area. These fish range widely in search of unevenly distributed food patches. Atlantic salmon generally travel alone (Fay et al. 2006) but gather in common feeding areas near Greenland and Labrador, where they prey on schooling fish associated with the surface and water column of shallow open-water

areas (Hansen and Windsor 2006). Smaller military expended materials could be mistaken for prey items and ingested purposefully or incidentally as the fish is swimming (Table 3.9-6). Prey fish sometimes dive deeper to avoid an approaching predator (Pitcher 1986). A few of these predatory fish (e.g., bull sharks, tiger sharks) are known to ingest any type of marine debris that they can swallow, even automobile tires. Some marine fish, such as the dolphinfish (*Coryphaena hippurus*) (South Atlantic Fishery Management Council 2011) and tuna (Hoss and Settle 1990), eat plastic fragments, strings, nylon lines, ropes, or even small light bulbs.

- **Open-Ocean Planktivores.** Plankton-eating fish in the open-ocean portion of the Study Area include herring, flyingfish, whale sharks, manta rays, and basking sharks. These fish feed by either filtering plankton from the water column or by selectively ingesting larger zooplankton. These planktivores could encounter and incidentally feed on smaller types of military expended materials (e.g., chaff, end caps, and pistons) at or just below the surface or in the water column (Table 3.9-6). None of the species listed under the ESA in the Study Area are open-ocean planktivores, but some species in this group of fish (e.g., herring) constitute a major prey base for many important predators, including salmon, tuna, sharks, marine mammals, and seabirds. While not a plankton eater, the ocean sunfish may also be capable of ingesting items at or just below the surface in the open ocean.

Military expended materials that could potentially impact these types of fish at or just below the surface or in the water column include those items that float or are suspended in the water column for some period of time (e.g., parachutes and end caps and pistons from chaff cartridges or flares).

Table 3.9-6: Summary of Ingestion Stressors on Fish Based on Location

Feeding Guild	Representative Species	Endangered Species Act-Protected Species	Overall Potential for Impact
Open-Ocean Predators	Dolphinfish, Most Shark Species	Atlantic Salmon	These fish may eat floating or sinking expended materials, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Open-Ocean Plankton Eaters (Planktivores)	Atlantic Herrings, Menhaden, Basking Shark, Whale Shark	None	These fish may ingest floating expended materials incidentally as they feed in the water column, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal Bottom-Dwelling Predators	Atlantic Cod, Skates, Cusk, and Rays	Atlantic Salmon	These fish may eat expended materials on the seafloor, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal Bottom-Dwelling Scavengers	Skates and Rays, Flounders	Sturgeon Species, Sawfish Species; Atlantic Salmon (Especially Smolts)	These fish could incidentally eat some expended materials while foraging, especially in muddy waters with limited visibility. However, encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.

Notes: the scientific names of the listed species are as follows: Atlantic cod (*Hippoglossus hippoglossus*), Atlantic salmon (*Salmo salar*), basking shark (*Cetorhinus maximus*), cusk (*Brosme brosme*), dolphinfish (*Coryphaena hippurus*), and whale shark (*Rhincodon typus*).

Fish Feeding at the Seafloor

- **Coastal Bottom-Dwelling Predators.** Large predatory fish near the seafloor are represented by species such as Atlantic cod and cusk, which are typical predators in coastal and deeper nearshore waters of the northern portion of the Study Area (Table 3.9-6). The cod and cusk feed opportunistically on or near the bottom, taking fish and invertebrates from the water column (e.g., shrimp) and from the sediment (e.g., crabs) (Collette and Klein-MacPhee 2002). The cod also ingests marine debris while feeding on or near the bottom. In the United Kingdom, plastic cups thrown from ferries have been discovered in cod stomachs (Hoss and Settle 1990). The varied diet of the cod and the low visibility in its deep shelf habitat may promote the ingestion of foreign objects. The Atlantic salmon also feeds on fish on or near the seafloor such as sand lances and capelin (Mills 1991). The cusk normally eats hard-shelled and spiny organisms, increasing the likelihood that it would swallow a sharp plastic or metal item rather than reject it.
- **Coastal Bottom-Dwelling Scavengers.** Bottom-dwelling fish in the nearshore coasts and estuaries (Table 3.9-6) may feed by seeking prey and by scavenging on dead fish and invertebrates. All sturgeon in the Study Area suction-feed along the bottom in coastal waters on small fish and invertebrate prey, which increases the likelihood of incidental ingestion of marine debris (Ross et al. 2009). The smalltooth and largetooth sawfish primarily inhabit nearshore habitats in southern Florida and other gulf coast locations, such as seagrass beds and mangroves.

Military expended materials that could be ingested by fish at the seafloor include items that sink (e.g., small-caliber projectiles and casings, fragments from high-explosive munitions).

Potential impacts of ingestion on adults are different than for other life stages (larvae and juveniles) because early life stages are too small to ingest any military expended materials except for chaff, which has been shown to have no impact on fish (Arfsten et al. 2002; Spargo 1999; U.S. Air Force 1997). Therefore, no ingestion potential impacts on early life stages would occur, with the exception of later stage juveniles that are large enough to ingest military expended materials.

Within the context of fish location in the water column and feeding strategies, the analysis is divided into (1) munitions (small- and medium-caliber projectiles, and small fragments from larger munitions); and (2) military expended material other than munitions (chaff, chaff end caps, pistons, parachutes, flares, and target fragments).

3.9.3.5.1 Impacts from Munitions or Fragments from High-Explosive Munitions

The potential impacts of ingesting foreign objects on a given fish depend on the species and size of the fish. Fish that normally eat spiny, hard-bodied invertebrates could be expected to have tougher mouths and digestive systems than fish that normally feed on softer prey. Materials that are similar to the normal diet of a fish would be more likely to be ingested and more easily handled once ingested—for example, by fish that feed on invertebrates with sharp appendages. These items could include fragments from high-explosives that a fish could encounter on the seafloor. Relatively small or smooth objects, such as small-caliber projectiles or their casings, might pass through the digestive tract without causing harm. A small sharp-edged item could cause a fish immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the fish's mouth and throat), it may block the throat or obstruct the flow of waste through the digestive system. An object may be enclosed by a cyst in the gut lining (Danner et al. 2009; Hoss and Settle 1990). Ingestion of large

foreign objects could lead to disruption of a fish's normal feeding behavior, which could be sublethal or lethal.

Munitions are heavy and would sink immediately to the seafloor, so exposure would be limited to those fish identified as bottom-dwelling predators and scavengers. It is possible that expended small-caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small-caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal may corrode or become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small-caliber, non-explosive practice munitions.

Fish feeding on the seafloor in the offshore locations where these items are expended (e.g., gunnery boxes) would be more likely to encounter and ingest them than fish in other locations. A particularly large item (relative to the fish ingesting it) could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases, a fish would pass a round, smooth item through its digestive tract and expel it, with no long-term measurable reduction in the individual's fitness.

If high-explosive munitions do not explode, they would sink to the bottom. In the unlikely event that explosive material, high-melting-point explosive (known as HMX) or royal demolition explosive (known as RDX), is exposed on the ocean floor it would break down in a few hours (U.S. Department of the Navy 2001d). HMX or RDX would not accumulate in the tissues of fish (Lotufo et al. 2010; Price et al. 1998). Fish may take up trinitrotoluene (TNT) from the water when it is present at high concentrations but not from sediments (Lotufo et al. 2010). The rapid dispersal and dilution of TNT expected in the marine water column reduces the likelihood of a fish encountering high concentrations of TNT to near zero.

3.9.3.5.1.1 No Action Alternative

Training Activities

Table 3.0-90 lists the number and location of small- and medium-caliber projectiles. As indicated in Table 3.0-90 under the No Action Alternative, the areas with the greatest amount of small- and medium-caliber projectiles would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Use of small- and medium-caliber projectiles is concentrated within the VACAPES and JAX Range Complexes. Species that occur in these areas—including all ESA-listed species, except for Atlantic salmon—would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-71 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-9; however, the fragment size cannot be quantified. As indicated Table 3.0-71, under the No Action Alternative, the areas with the greatest amount of high-explosive ordnance and munitions would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Use of high-explosive ordnance and munitions is concentrated within the VACAPES Range Complex. Species that occur in these areas—including all ESA-listed species, except for Atlantic salmon—would have the potential to be exposed to fragments from high-explosive ordnance and munitions.

Small-caliber projectiles would be concentrated in the VACAPES Range Complex (one small-caliber projectile per 0.021 nm^2 each year). In contrast, approximately one small-caliber projectile per 0.100 nm^2 would be expended each year in the Navy Cherry Point Range Complex. Encounter rates in locations with concentrated small-caliber projectiles would be assumed greater than encounter rates in less concentrated areas. Atlantic and shortnose sturgeon may occur at the offshore and deeper nearshore locations where small-caliber projectile use is concentrated in the VACAPES Range Complex.

When these items explode, they may break apart or remain largely intact in irregularly shaped pieces—some of which may be small enough for a fish to ingest. Some fish species feed on crustaceans that have hard, sharp, or irregular parts, without any impacts. Most fragments from high-explosives would be too large for a fish to ingest. Also, it is assumed that fragments from larger munitions are similar in size to fragments from smaller munitions. Although fragment size cannot be quantified, more individual fragments would result from larger munitions than from smaller munitions. The number of fragments that would result from the proposed explosions in the No Action Alternative cannot be quantified. However, it is believed to be smaller than the number of small-caliber projectiles to be expended in the Study Area. Small-caliber projectiles would likely be more prevalent throughout the Study Area and more likely to be encountered and potentially ingested by bottom-dwelling fish than fragments from any type of high-explosive munitions.

The Atlantic and Gulf sturgeon may occur in portions of the Study Area out to the continental shelf break where projectiles and munitions are used. Shortnose sturgeon generally remain within their natal river or estuary, only occasionally moving to nearshore marine environments (Dadswell 2006). The current Chesapeake Bay system population of shortnose sturgeon appears to be centered in the upper Chesapeake Bay (Welsh et al. 2002), outside of the Study Area. Training activities expending projectiles or munitions could expose sturgeon to ingestion risk. However, if a sturgeon ingested a small-caliber projectile or fragment, no change to its growth, survival, annual reproductive success, or lifetime reproductive success would be likely to occur. Smalltooth and largetooth sawfish could encounter some ordnance-related material; although the likelihood is remote because there are no small-caliber projectiles expended in the Key West Range Complex portion of the Study Area where sawfish would most likely occur. Most ordnance used during training is expended in deep waters beyond the continental shelf break, where sawfish are not expected to occur.

The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where munitions are expended. The last confirmed records of the largetooth sawfish in U.S. waters are from Port Aransas, Texas in 1961; Florida in 1941; and Louisiana in 1917 (FR 76 (133): 40822-40836, July 12, 2011). The likelihood of ingestion of munitions (or fragments) by early life stages of sawfish would be slightly less than that of adults because nursery habitats are found in very shallow water (less than 1 m), where no munitions would be expended. Early life stages of sturgeon are typically found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to ingestion stressors.

Overall, the potential impacts of ingesting munitions or fragments from munitions would be limited to individual fish that might suffer a negative response from a given ingestion event. While ingestion of munitions or fragments from munitions identified here could result in sublethal or lethal effects to a small number of individuals, the likelihood of a fish encountering an expended item is low based on the dispersed nature of the materials. Furthermore, an encounter may not lead to ingestion, and ingestion may not lead to swallowing. A fish might “taste” an item, then expel it (Felix et al. 1995) in the same manner that a fish would take a lure into its mouth then spit it out. Based on these factors, the number

of fish potentially impacted by ingestion of munitions or fragments from munitions would be low, and population-level effects would not be expected.

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during training activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon; and*
- *may affect but is not likely to adversely affect the ESA-listed smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Table 3.0-90 lists the number and location of small- and medium-caliber projectiles. As indicated in Table 3.0-90, under the No Action Alternative, the areas with the greatest amount of small- and medium-caliber projectiles would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the VACAPES, JAX, and GOMEX Range Complexes and the Naval Surface Warfare Center, Panama City Division Testing Range. In addition, less than 10 percent of the total small- and medium-caliber projectiles could be expended anywhere in the Study Area, outside the range complexes while vessels are in transit. Species that occur in these areas—including all ESA-listed species, except for Atlantic salmon—would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-71 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-10; however, the fragment size cannot be quantified. As indicated in Table 3.0-71, under the No Action Alternative, the areas with the greatest amount of high-explosive ordnance and munitions would occur in the Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystems and the Gulf Stream Open Ocean Area—specifically within the VACAPES Range Complex and Naval Surface Warfare Center, Panama City Division Testing Range. Species that occur in these areas—including all ESA-listed species, except for Atlantic salmon—would have the potential to be exposed to fragments from high-explosive ordnance and munitions.

Small-caliber projectiles would be expended in low densities overall, and concentrated in the GOMEX Range Complex (a maximum density of one small-caliber projectile per 3.46 nm^2 each year). In contrast, approximately one small-caliber projectile per 34.48 nm^2 each year would be expended in the VACAPES Range Complex. The rates at which fish encounter small-caliber projectiles is assumed proportional to the number of small-caliber projectiles expended, with a greater encounter rate in the GOMEX Range Complex. Gulf sturgeon and smalltooth sawfish could occur at the deeper portions of nearshore locations where small-caliber projectile use is concentrated in the GOMEX Range Complex. However, neither of these species is common within the GOMEX Range Complex; the likelihood of these species encountering small-caliber munitions is extremely low in this area. Risk of potential impacts of these species ingesting munitions or fragments from munitions resulting from proposed testing activities would be low, as described in Section 3.9.3.5.1.1 (No Action Alternative).

Adult Gulf sturgeon may occur in St. Andrew Bay (Florida) during fall and winter (U.S. Fish and Wildlife Service 2004, 2006). Also, St. Andrew Bay is not part of any of the major freshwater river systems that Gulf sturgeon use during freshwater migration. The largetooth and smalltooth sawfish may also occur in St. Andrew Bay. The potential impacts on smalltooth and largetooth sawfish are discountable because

they are historically rare in the locations where munitions are expended. The last confirmed records of the largetooth sawfish in U.S. waters are from Port Aransas, Texas in 1961; Florida in 1941; and Louisiana in 1917 (FR 76 (133): 40822-40836, July 12, 2011). Smalltooth sawfish are rare in the Gulf of Mexico Large Marine Ecosystem, but since 1999 the species has been documented in the vicinity of the Naval Surface Warfare Center, Panama City Division Testing Range; however, only three smalltooth sawfish encounters have been reported and verified since 1998 west of the mouth of St. Andrew Bay (Simpfendorfer and Wiley 2006).

The likelihood of ingestion of munitions (or fragments) by early life stages of sawfish would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m), where no munitions would be expended. Early life stages of sturgeon are typically found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to ingestion stressors.

Overall, the impacts of fish ingesting munitions or fragments from munitions resulting from proposed testing activities would be low. The number of fish potentially impacted by ingestion of munitions or fragments from munitions would be low, and population-level effects would not be expected.

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during testing activities as described under the No Action Alternative:

- *will have no effect on ESA-listed Atlantic salmon; and*
- *may affect but is not likely to adversely affect the ESA-listed smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5.1.2 Alternative 1

Training Activities

Table 3.0-90 lists the number and location of small- and medium-caliber projectiles. As indicated in Table 3.0-90, under Alternative 1, the amount of small- and medium-caliber projectiles is more than three times that of the No Action Alternative. The activities using small- and medium-caliber projectiles under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing small- and medium-caliber projectiles in the Northeast Range Complexes and less than 10 percent of the total small- and medium-caliber projectiles could be expended anywhere in the Study Area, outside the range complexes while vessels are in transit. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-71 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-11; however, the fragment size cannot be quantified. As indicated in Table 3.0-71, under Alternative 1, the number of activities that use high-explosive ordnance and munitions is more than 13 times that of the No Action Alternative. The activities using high-explosive ordnance and munitions under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing high-explosive ordnance and munitions in the Northeast Range Complexes, Key West Range Complex, and in the Other AFTT Areas outside of the range complexes while vessels are in transit. Species that occur in these areas, including all ESA-listed species would have the potential to be exposed to fragments from high-explosive ordnance and munitions.

Small-caliber projectiles would be concentrated in the VACAPES Range Complex (one small-caliber projectile per 0.007 nm^2 each year). In contrast, approximately one small-caliber projectile per 0.476 nm^2 would be expended each year in the Navy Cherry Point Range Complex. The rates at which fish encounter small-caliber projectiles is assumed proportional to the number of small-caliber projectiles expended, with a greater encounter rate in the VACAPES Range Complex. Atlantic and shortnose sturgeon may occur at the deeper portions of nearshore locations where small-caliber projectile use is concentrated in the VACAPES Range Complex.

Atlantic salmon and shortnose, Atlantic, and Gulf sturgeon may occur in portions of the Study Area where projectiles and munitions are used. Risk of potential impacts on these species ingesting munitions or fragments from munitions resulting from proposed training activities would be low, as described in Section 3.9.3.5.1.1 (No Action Alternative). The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where munitions are expended, as described for the No Action Alternative.

The increase of munitions or fragments from munitions under Alternative 1 would not result in an increased ingestion risk for fish because the densities of these items would continue to be low and are not expected to result in long-term impacts, as described in training activities for the No Action Alternative. The number of fish potentially impacted by ingestion of munitions or fragments from munitions would be low, and population-level effects would not be expected.

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Table 3.0-90 lists the number and location of small- and medium-caliber projectiles. As indicated in Table 3.0-90, under Alternative 1, the amount of small- and medium-caliber projectiles is approximately 4.3 times that of the No Action Alternative. The activities using small- and medium-caliber projectiles under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing small- and medium-caliber projectiles in the Key West Range Complex, and testing activities could occur throughout the Study Area. Species that occur in these areas—including all ESA-listed species—would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-71 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-12; however, the fragment size cannot be quantified. As indicated in Table 3.0-71, under Alternative 1, the number of activities that use high-explosive ordnance and munitions is more than 13 times that of the No Action Alternative. The activities using high-explosive ordnance and munitions under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing high-explosive ordnance and munitions in the Key West and JAX Range Complexes and throughout the Gulf of Mexico. Species that occur in these areas—including all ESA-listed species—would have the potential to be exposed to fragments from high-explosive ordnance and munitions.

Small-caliber projectiles would be concentrated in the VACAPES Range Complex (one small-caliber projectile per 0.752 nm^2 each year). In contrast, approximately one small-caliber projectile per 2.778 nm^2 would be expended each year in the Navy Cherry Point Range Complex. Encounter rates in locations with concentrated small-caliber projectiles would be assumed to be greater than in less concentrated areas. Atlantic and shortnose sturgeon may occur at the deeper portions of nearshore locations where small-caliber projectile use is concentrated in the VACAPES Range Complex.

The shortnose, Atlantic, and Gulf sturgeon may occur in portions of the Study Area where projectiles and munitions are used. Risk of potential impacts on these species from ingesting munitions or fragments from munitions resulting from proposed testing activities would be low as in Section 3.9.3.5.1.1 (No Action Alternative). The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where munitions are expended, as described for the No Action Alternative.

The increase of munitions or fragments from munitions under Alternative 1 would not result in an increased ingestion risk for fish because the densities of these items in the No Action Alternative would remain low and are not expected to result in long-term impacts. The number of fish potentially impacted by ingestion of munitions or fragments from munitions would be low, and population-level effects would not be expected.

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5.1.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described in Section 3.9.3.5.1.2 (Alternative 1).

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, smalltooth sawfish, largetooth sawfish, shortnose sturgeon or Gulf sturgeon.*

Testing Activities

Table 3.0-90 lists the number and location of small- and medium-caliber projectiles. As indicated in Table 3.0-90, under Alternative 2, the amount of small- and medium-caliber projectiles is 4.6 times that of the No Action Alternative, but only increases by 6 percent as compared to Alternative 1. The activities using small- and medium-caliber projectiles under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing small- and medium-caliber projectiles in the Key West Range Complex, and testing activities could occur throughout the Study Area. Species that occur in these areas—including all ESA-listed species—would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-71 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-13; however, the fragment size cannot be quantified. As indicated in Table 3.0-71, under Alternative 2, the number of activities that use high-explosive ordnance and munitions is more than 14 times that of the No Action Alternative, but only increases by 7 percent as compared to Alternative 1. The activities using high-explosive ordnance and munitions under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing high-explosive ordnance and munitions in the Key West and JAX Range Complexes as well as throughout the Gulf of Mexico. Species that occur in these areas—including all ESA-listed species—would have the potential to be exposed to fragments from high-explosive ordnance and munitions.

Small-caliber projectiles would be concentrated in the VACAPES Range Complex (one small-caliber projectile per 0.752 nm^2 each year). In contrast, approximately one small-caliber projectile per 2.778 nm^2 would be expended each year in the Navy Cherry Point Range Complex. Encounter rates in locations with concentrated small-caliber projectiles would be assumed to be greater than in less-concentrated areas. Atlantic and shortnose sturgeon may occur at the deeper portions of nearshore locations where small-caliber projectile use is concentrated in the VACAPES Range Complex. The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where munitions are expended, as described for the No Action Alternative.

The increase of munitions or fragments from munitions under Alternative 2 would not result in an increased ingestion risk for fish because the densities of these items in the Alternative 2 would remain low and are not expected to result in long-term impacts. The number of fish potentially impacted by ingestion of munitions or fragments from munitions would be low, and population-level effects would not be expected.

Pursuant to the ESA, the potential for ingestion of munitions or fragments from munitions during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5.2 Impacts from Military Expended Materials Other than Munitions

Fish feed throughout the water column and could mistake many types of marine debris for prey items. Ingesting nonfood items is common among a variety of marine fish, particularly those that feed on the seafloor (Boerger et al. 2010; Hoss and Settle 1990; Jackson et al. 2000). Many fish are also known to intentionally ingest plastic materials (e.g., plastic fishing lures), although the extent to which a fish might discriminate between a plastic item shaped like a prey item and an indistinct or less appealing shape is not clear. Once eaten, any type of plastic could cause digestive problems for the fish (Danner et al. 2009). Fish have been reported to ingest a variety of materials or debris, such as plastic pellets, bags, rope, and line (Hoss and Settle 1990; Jackson et al. 2000).

Chaff is used throughout the Study Area. As described in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), fish that ingested high concentrations of chaff under experimental laboratory conditions showed no negative impacts. Based on the small size of chaff fibers, fish would likely not confuse the fibers with prey items or purposefully feed on them. However, fish could occasionally ingest low concentrations of chaff incidentally while feeding on prey items on the surface,

in the water column, or the seafloor. Chaff fiber ingestion is not expected to impact fish based on the low concentration that could reasonably be ingested, the small size of the chaff fibers, and the low toxicity of chaff to fish (see Section 3.0.5.3.5.3, Military Expended Materials Other Than Munitions). Therefore, exposure to chaff would cause no injury, mortality, or tissue damage to fish. Potential impacts of chaff ingestion by fish are not discussed further. Impacts of ingestion of the end caps or pistons associated with chaff cartridges are analyzed together with impacts of flares below.

Chaff end caps and pistons sink in saltwater (Spargo 1999). Fish feeding on the seafloor in the deeper portions of nearshore locations where chaff canisters and flares are expended (e.g., range complexes, OPAREAs, and testing ranges) would be more likely to encounter and ingest these items than in other locations. Ingested end caps or pistons could disrupt a fish's feeding behavior or digestive processes. If the item is particularly large relative to the fish ingesting it, the item could become permanently encapsulated by the stomach lining, and potentially lead to starvation and death; however, in most cases, an ingested end cap or piston would pass unhindered through the fish's digestive tract and be expelled. The fish would recover fully, and experience no reduction in reproductive fitness.

As described above, surface-feeding fish have little opportunity to ingest end caps or pistons before they sink. However, some of these items could become entangled in dense *Sargassum* mats near the surface. Predatory open-ocean fish, such as tuna, dolphinfish, and billfish, are attracted to the many small prey species associated with *Sargassum* mats. While foraging near the floating mats, predatory fish may incidentally ingest end caps and pistons. The density of these items in any given location would vary based on release points and dispersion by wind and water currents. The number of end-caps and pistons that would remain at or just below the surface in *Sargassum* mats and potentially available to fish is unknown. Unlike other plastic types of marine debris, end caps and pistons are heavier than water and not expected to float unless they are enmeshed in *Sargassum* or other floating debris.

Most materials associated with airborne mine neutralization system activities are recovered, but pieces of fiber optic cable may be expended (U.S. Department of the Navy 2001a). For a discussion of the physical characteristics of these expended materials, where they are used, and the number of activities in each alternative, please see Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires).

Only small amounts of fiber optic cable would be deposited onto the seafloor each year and the small amount of fiber optic cable expended during training and testing would sink to the seafloor. Highly migratory pelagic predators such as dolphinfish and tuna would be unlikely to encounter the small, dispersed lengths of fiber optic cable unless they were in the immediate area when the cable was expended. The low number of fiber optic cables expended in the Study Area during this activity makes it unlikely that fish would encounter any fiber optic cables. Potential impacts of fiber optic cable ingestion by fish are not discussed further.

3.9.3.5.2.1 No Action Alternative

Training Activities

Tables 3.0-73, 3.0-91, and 3.0-93 list the number and locations of activities that expend parachutes, target materials, chaff, and flares. The number and footprint of target materials are detailed in Table 3.3-9.

As indicated in Table 3.0-73, under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within

the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Under the No Action Alternative, small parachutes associated with sonobuoys could be potentially ingested by open-ocean plankton eaters (e.g., whale sharks, basking sharks, and ocean sunfish). The only fish species large enough to eat a parachute that feeds on items that size is the ocean sunfish, which could mistake a small parachute for a jellyfish and ingest it. Only 4 percent of the sonobuoys expended in the Study Area would be expended in open ocean areas (Other AFTT Areas—outside of range complexes) where ocean sunfish primarily occur. This results in a density of approximately one sonobuoy per 1,675 nm^2 in these locations. With this low density of parachutes, it is not likely that an ocean sunfish would encounter any sonobuoy parachutes; therefore, the risk of ingestion is extremely low for these fish. Fish that do not occur in the areas where these types of military expended materials are used, would not be exposed to this stressor. For the ESA-listed Atlantic salmon, they would only be exposed to parachutes expended in the Northeast Range Complexes, but these items are too large for them to ingest. Therefore, potential impacts on Atlantic salmon at the individual or population level would not be expected.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. All of the ESA-listed species occur where target materials could potentially be expended. The potential impacts of these fragments are identical to those of fragments from high-explosive munitions, as described in Section 3.9.3.5.1.1 (No Action Alternative).

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Areas—specifically within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. No potential impacts would occur from the chaff itself, as previously discussed, but there is some potential for fish to ingest the end caps or pistons associated with the chaff cartridges. Under the No Action Alternative, the smalltooth and largetooth sawfish and sturgeon may occur at the locations where chaff and flares are concentrated in the VACAPES, Key West, and GOMEX Range Complexes. Species occurring outside the specified areas within these range complexes, such as the ESA-listed Atlantic salmon would not be exposed to chaff or flares.

The highest density of chaff and flare end caps and pistons would be expended in the Key West Range Complex. Assuming that all end caps and pistons would be evenly dispersed in the Key West Range Complex, the relative end cap and piston concentration would be very low (2.8 pieces/nm^2/year, based on an area of 25,500 nm^2 and 71,885 end-caps and pistons per year). Environmental concentrations would vary based on release points and dispersion by wind and water currents. The number of end caps and pistons that would remain at or just below the surface in *Sargassum* mats and potentially available to fish is unknown but is expected to be an extremely small percentage of the total. The smalltooth and largetooth sawfish may occur at the locations where chaff and flare use is concentrated in the Key West Range Complex.

The ESA-listed species in the Key West Range Complex are bottom feeders, and would not encounter end caps or flares at the surface. The smalltooth sawfish could ingest an item after it settled to the bottom, but the item would most likely pass through the digestive tract of larger fish without causing harm (see Section 3.9.3.5.1.1, No Action Alternative). Based on the low density of expended endcaps and pistons, the encounter rate would be extremely low, and the ingestion rate even lower. No chaff or

flares are planned for use in the Northeast Range Complexes where the Atlantic salmon occurs. The number of fish potentially impacted by ingestion of end caps or pistons would be low based on the low environmental concentration. Population-level effects would not be expected.

Overall, the potential impacts of ingesting parachutes, target fragments, or end caps and pistons would be limited to individual fish that ingest an item too large to pass through its gut. Fish encounter many items (natural and manmade) in their environment that are unsuitable for ingestion and most species have behavioral mechanisms for spitting out the item. If the item were swallowed, it could either pass through the digestive system without doing any harm, or become lodged inside the fish and cause injury or mortality.

For sawfish, the likelihood of ingestion of military expended materials other than munitions by early life stages would be slightly less than that of adults, because nursery habitats are found in very shallow water (less than 1 m), where no military expended materials would occur. The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where military expended materials are expended. Early life stages of sturgeon are typically found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to ingestion stressors.

Although ingestion of military expended materials identified here could result in sublethal or lethal effects, the likelihood of ingestion is low based on the dispersed nature of the materials, the limited encounter rate of fish to the expended items, behavioral mechanisms for expelling the item, and the capacity of the fish's digestive system to simply pass the item through as waste. Based on these factors, the number of fish potentially impacted by ingestion of military expended materials (such as chaff and flare end caps and pistons) would be low, and no population-level effects would be expected.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during training activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, smalltooth sawfish, largetooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-73, 3.0-91, and 3.0-93 list the number and locations of activities that expend parachutes, target materials, chaff, and flares. The number and footprint of target materials are detailed in Table 3.3-10.

As indicated in Table 3.0-73, under the No Action Alternative, activities involving parachute use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and in the sinking exercise box outside the range complexes. In addition, there are testing activities that could expend parachutes outside of the range complexes in Other AFTT Areas. As described in Section 3.9.3.5.2.1 (No Action Alternative), small parachutes associated with sonobuoys could be ingested by large ocean sunfish mistaking them for jellyfish. Only 4 percent of the sonobuoys used in the Study Area would be expended in open ocean areas (Other AFTT Areas—outside of range complexes), which results in about one sonobuoy per 12,192 nm^2 in these locations. An ocean sunfish would be extremely unlikely to encounter a parachute or to ingest one that was encountered; therefore, the risk of ingestion is

extremely low for these fish. Fish that do not occur in the areas where these types of military expended materials are used, would not be exposed to this stressor. For the ESA-listed Atlantic salmon, they would only be exposed to parachutes expended in the Northeast Range Complexes, but these items are too large for them to ingest. Therefore potential impacts on Atlantic salmon at the individual or population level would not be expected.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under the No Action Alternative, activities involving target materials use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream and North Atlantic Gyre Open Ocean Areas—specifically within the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. In addition, activities that expend target materials would occur at Naval Undersea Warfare Center Division, Newport Testing Range. All of the ESA-listed species occur where target materials could potentially be expended. The potential impacts of these fragments are identical to those of fragments from high-explosive munitions, as described in Section 3.9.3.5.1.1 (No Action Alternative).

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under the No Action Alternative, activities involving chaff and flare use would occur in the Northeast and Southeast U.S. Continental Shelf, and Gulf of Mexico Large Marine Ecosystems as well as the Gulf Stream Open Ocean Areas—specifically within the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. No potential impacts would occur from the chaff itself, as previously discussed, but there is some potential for the end caps or pistons associated with the chaff cartridges to be ingested. The ESA-listed sawfish and sturgeon may occur at the locations where the greatest chaff and flares are expended in the VACAPES Range and Key West Range Complexes. Species occurring outside the specified areas within these range complexes, such as the ESA-listed Atlantic salmon would not be exposed to chaff and flare end caps.

The ESA-listed species in the VACAPES Range Complex are bottom feeders, and would not encounter parachutes, end caps, target materials, or flares at the surface while feeding. The smalltooth sawfish or sturgeon could ingest one of these items after it settled to the bottom, but the item would most likely pass through the digestive tract of a larger fish without causing harm, as the items measure only 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.3 cm) in thickness. Based on the low density of expended end caps and pistons, the encounter rate would be extremely low, and the ingestion rate even lower. No chaff or flares are planned for use in the Northeast Range Complexes where the Atlantic salmon occurs. The number of fish potentially impacted by ingestion of end caps or pistons would be low based on the low environmental concentration. Population-level effects would not be expected.

The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where parachutes, chaff, targets, and end-caps are expended. The last confirmed records of the largetooth sawfish in U.S. waters are from Port Aransas, Texas in 1961; Florida in 1941; and Louisiana in 1917 (FR 76 (133): 40822-40836, July 12, 2011). Smalltooth sawfish are rare in the Gulf of Mexico Large Marine Ecosystem, but since 1999 the species has been documented in the vicinity of the Naval Surface Warfare Center, Panama City Division Testing Range; however, only three smalltooth sawfish encounters have been reported and verified since 1998 west of the mouth of St. Andrew Bay (Simpfendorfer and Wiley 2006).

For sawfish, the early life stages have the same body-type as adults; however, the likelihood of ingestion of military expended materials other than munitions by early life stages would be slightly less than that

of adults, because nursery habitats are found in very shallow water (less than 1 m [3 ft.]), where no military expended materials would be expended. Early life stages of sturgeon are typically found in freshwater rivers and not in marine environments, so only juveniles and adults would be potentially exposed to ingestion stressors.

Overall, the risk of potential impacts of fish ingesting military expended materials resulting from proposed testing activities would be low.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under the No Action Alternative:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5.2.2 Alternative 1

Training Activities

Tables 3.0-73, 3.0-91, and 3.0-93 list the number and locations of activities that expend parachutes, target materials, chaff, and flares. The number and footprint of target materials are detailed in Table 3.3-11.

As indicated in Table 3.0-73, under Alternative 1 the number of activities involving the use of parachutes are 5 percent higher than that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, parachutes would also be expended in the Key West Range Complex, as well as anywhere in the Study Area, outside the range complexes while vessels are in transit. For reasons described in the No Action Alternative, ocean sunfish could mistake small parachutes for jellyfish while foraging in open ocean areas. However, the density of expended sonobuoys in the open ocean areas would amount to approximately one sonobuoy per 1,562 nm^2, making it extremely unlikely that an ocean sunfish would encounter any parachutes; therefore, the risk of ingestion is extremely low for these fish. Species occurring outside the specified areas within these range complexes, such as the ESA-listed Atlantic salmon would not be exposed to parachutes.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 1, the number of activities that expend target-related materials is about four times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Key West Range Complex, as well as anywhere in the Study Area outside the range complexes while vessels are in transit. All of the ESA-listed species occur where target materials could potentially be expended. The potential impacts of these fragments are identical to those of fragments from high-explosive munitions, as described in Section 3.9.3.5.1.1 (No Action Alternative).

As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend chaff decreases by 30 percent from the No Action Alternative, while flares increase by 30 percent. The activities using chaff and flares under Alternative 1 would occur in the same geographic locations as the No Action Alternative. The ESA-listed species in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes are bottom feeders, and would not encounter end caps or pistons at the surface, as described for the No Action Alternative above. No chaff or flares are planned for use in the Northeast Range Complexes where the Atlantic salmon occurs. The number of fish potentially impacted by ingestion of end caps or pistons would be low based on the low

environmental concentration. Population-level effects would not be expected. The differences in species overlap and potential impacts from ingestion of military expended material on marine fish groups and ESA-listed species during training activities would not be discernible from those described for training activities in Section 3.9.3.5.2.1 (No Action Alternative).

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during training activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-73, 3.0-91, and 3.0-93 list the number and locations of activities that expend parachutes, target materials, chaff, and flares. The number and footprint of target materials are detailed in Table 3.3-12.

As indicated in Table 3.0-73, under Alternative 1 the number of activities involving the use of parachutes is approximately four times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Key West and Gulf of Mexico Range Complexes. In addition, there are testing activities that could expend parachutes throughout the Study Area. For reasons described in the No Action Alternative, ocean sunfish could mistake parachutes for jellyfish while foraging in open ocean areas. Those locations would have about one sonobuoy per 12,192 nm^2. With this sparse distribution of parachutes, it is not likely that an ocean sunfish would encounter any sonobuoy parachutes; therefore, the risk of ingestion is extremely low for these fish. Species occurring outside the specified areas within these range complexes, such as the ESA-listed Atlantic salmon would not be exposed to parachutes.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend target-related materials of ingestible size is approximately two times that of the No Action Alternative. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Key West and GOMEX Range Complexes. In addition, there are testing activities that could expend target-related materials throughout the Study Area. All of the ESA-listed species occur where target materials could potentially be expended. The potential impacts of these fragments are identical to those of fragments from high-explosive munitions, as described in Section 3.9.3.5.1.1 (No Action Alternative).

As indicated in 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 1, the number of activities that expend chaff and flares is approximately four times and three times, respectively, compared to the No Action Alternative. The activities using chaff and flares under Alternative 1 would occur in the same geographic locations as the No Action Alternative. ESA-listed sawfish and sturgeon at these locations are bottom feeders that are not expected to encounter expended items in any great numbers. No chaff or flare use is planned in the Northeast Range Complexes where the Atlantic salmon occurs. Only a small number of individuals could be impacted by ingestion of end caps based on the low environmental concentration of these items; no population-level effects would be expected. Atlantic and shortnose sturgeon may occur at the locations where chaff use is concentrated, such as in the VACAPES Range Complex. The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where parachutes,

chaff, targets, and end-caps are expended, as described for the No Action Alternative. The differences in species overlap and potential impacts from ingestion of military expended material on marine fish groups and ESA-listed species during training activities would not be discernible from those described for testing activities in Section 3.9.3.5.2.1 (No Action Alternative).

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under Alternative 1:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.5.2.3 Alternative 2 (Preferred Alternative)

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.5.2.2 (Alternative 1).

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during training activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

Testing Activities

Tables 3.0-73, 3.0-91, and 3.0-93 list the number and locations of activities that expend parachutes, target materials, chaff, and flares. The number and footprint of target materials are detailed in Table 3.3-13.

As indicated in Table 3.0-73, under Alternative 2 the number of activities involving the use of parachutes is more than five times that of the No Action Alternative, but increases by approximately 20 percent as compared to Alternative 1. The activities using parachutes under Alternative 2 would occur in the same geographic locations as the No Action Alternative, with the exception of introducing parachutes in the Key West Range Complex. In addition, there are testing activities that could expend parachutes throughout the Study Area. For reasons described in the No Action Alternative, ocean sunfish could mistake parachutes for jellyfish while foraging in open ocean areas where one sonobuoy would be expended for every 11,098 nm^2. With this extremely low concentration, it is not likely that an ocean sunfish would encounter any sonobuoy parachutes; therefore, the risk of ingestion is extremely low for these fish. Species occurring outside the specified areas within these range complexes, such as the ESA-listed Atlantic salmon would not be exposed to parachutes.

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 2, the number of activities that expend target-related materials is more than 2.5 times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. In addition to the geographic locations identified in the No Action Alternative, target-related materials would also be expended in the Key West and GOMEX Range Complexes. In addition, there are testing activities that could expend target-related materials throughout the Study Area. All of the ESA-listed species occur where target materials could potentially be expended. The potential impacts of these

fragments are identical to those of fragments from high-explosive munitions, as described in Section 3.9.3.5.1.1 (No Action Alternative).

As indicated in 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), under Alternative 2, the number of activities that expend chaff is nearly four times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. Under Alternative 2, the number of activities that expend flares is nearly three times that of the No Action Alternative, but only increases by approximately 10 percent from Alternative 1. The activities using chaff and flares under Alternative 2 would occur in the same geographic locations as the No Action Alternative.

The ESA-listed sturgeons and sawfish in these locations are closely associated with the bottom. The potential impacts on smalltooth and largetooth sawfish are discountable because they are historically rare in the locations where parachutes, chaff, targets, and end-caps are expended, as described for the No Action Alternative. No chaff or flare use is planned in the Northeast Range Complexes where the Atlantic salmon occurs. Few individual fish would encounter or ingest end caps; no population-level effects would be expected. The increase of military expended materials under Alternative 2 would not result in an increased ingestion risk for fish because the densities of these items in the Alternative 2 would remain low.

Pursuant to the ESA, the potential for ingestion of military expended materials other than munitions during testing activities as described under Alternative 2:

- *may affect but is not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon.*

3.9.3.6 Secondary Stressors

This section analyzes potential effects on fish exposed to stressors indirectly through impacts on their habitat (i.e., sediment or water quality, and physical disturbance). These are also primary elements of marine fish habitat, and firm distinctions between indirect effects and habitat effects are difficult to maintain. For this analysis, indirect effects on fish via sediment or water that do not require trophic transfer (e.g., bioaccumulation) to be observed are considered. It is important to note that the term "indirect" does not imply reduced severity of environmental consequences but instead describes *how* the effect may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose indirect impacts on fish via changes in habitat, sediment, and water quality. These include (1) explosives; (2) explosion byproducts and unexploded ordnance; (3) metals; (4) chemicals; (5) other materials such as targets, chaff, and plastics; and (6) physical disturbance. Activities associated with these stressors are detailed in Tables 2.8-1 to 2.8-3 and Table 3.0-8, and their potential effects are analyzed in Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats).

3.9.3.6.1 Explosives

In addition to directly impacting fish and fish habitat, underwater explosions could impact other species in the food web, including plankton and other prey species that fish feed upon. The effects of underwater explosions would differ depending upon the type of prey species in the area of the blast. As discussed in Section 3.9.3.1 (Acoustic Stressors), fish with swim bladders are more susceptible to blast injuries than fish without swim bladders.

In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals. The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fish if they are nearby (Kastelein et al. 2008). The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms and in turn could be susceptible to directly injury or death by subsequent explosions. Any of these scenarios would be temporary, occurring only during activities involving explosives; no lasting effect on prey availability or the pelagic food web would be expected. Indirect effects of underwater detonations and high-explosive ordnance use under the Proposed Action would not decrease the quantity or quality of fish populations or fish habitats in the Study Area.

3.9.3.6.2 Explosion Byproducts and Unexploded Ordnance

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high-explosives (Table 3.1-10). Undetonated explosives associated with ordnance disposal and mine clearance are collected after training is complete; therefore, potential impacts are assumed to be inconsequential for these training and testing activities, but other activities could leave these items on the seafloor. Fish may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of royal demolition explosive, 98 percent of the products are common seawater constituents, and the remainder is rapidly diluted below threshold effect level (see Section 3.1.3.1.2 [Background] and Table 3.1-13 and 3.1-14). Explosion byproducts associated with high-order detonations present no secondary stressors to fish through sediment or water. However, low-order detonations and unexploded ordnance present elevated likelihood of effects on fish.

Indirect effects on fish of explosives and unexploded ordnance via sediment are possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways discussed Section 3.1.3.1 (Explosives and Explosion Byproducts). Degradation products of royal demolition explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). TNT and its degradation products impact developmental processes in fish and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al. 2008a; Rosen and Lotufo 2010). The solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment 6 to 12 in. (0.15 to 0.3 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (1 to 2 m) from the degrading ordnance (Section 3.1.3.1, Explosives and Explosion Byproducts). Taken together, it is likely that various life stages of fish could be impacted by the indirect effects of degrading explosives within a radius of 1 to 6 ft. (0.3 to 2 m) around the explosive.

3.9.3.6.3 Metals

Certain metals and metal-containing compounds are harmful to fish at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang and Rainbow 2008). Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, ordnance, munitions, batteries, and other military expended materials (extensively discussed in Section 3.1.3.2, Metals). Some metals bioaccumulate, and physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals (U.S. Department of the Navy 2012). Indirect effects of metals on fish via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Fish may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fish would be indirectly impacted by toxic metals via the water.

3.9.3.6.4 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, principally flares and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls (PCBs) are discussed in Section 3.1.3.3 (Chemicals Other Than Explosives), but there is no additional risk to fish because the Proposed Action does not introduce this chemical into the Study Area and the use of polychlorinated biphenyls has been nearly zero since 1979. Properly functioning flares missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment. The greatest risk to fish from flares, missile, and rocket propellants is perchlorate. Fish may be exposed by contact with contaminated water or ingestion of contaminated sediments. However, perchlorate, is highly soluble in water and does not readily adsorb to sediments. Therefore, missile and rocket fuel poses no risk of indirect impact on fish via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate, and nitrodiphenylamine, adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Section 3.1.3.3, Chemicals Other Than Explosives). It is conceivable that various life stages of fish could be indirectly impacted by propellants via sediment within a few inches of the object, but these potential effects would diminish rapidly as the propellant degrades.

3.9.3.6.5 Other Materials

Some military expended materials (e.g., parachutes) could become remobilized after their initial contact with the seafloor (e.g., by waves or currents) and could be reintroduced as an entanglement or ingestion hazard for fish. In some bottom types (without strong currents, hard-packed sediments, and low biological productivity), items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. Such items were observed in the JAX CC range bottom mapping and habitat characterization survey (U.S. Department of the Navy 2011). While these items remain intact sitting on the bottom, they could potentially remain ingestion hazards. These potential impacts may cease only (1) when the military expended materials is too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials becomes encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials becomes permanently buried. In this scenario, a parachute could initially sink to the seafloor but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result.

The entanglement stressor will eventually cease to pose an entanglement risk as it becomes encrusted or buried.

3.9.3.6.6 Physical Disturbance

The Proposed Action could result in localized and temporary changes to the benthic community during activities that impact fish habitat. Fish habitat could become degraded during activities that would strike the seafloor or introduce military expended materials, bombs, projectiles, missiles, rockets or fragments to the seafloor. During or following activities that impact benthic habitats, fish species may experience loss of available benthic prey at locations in the Study Area where these items might be expended on Essential Fish Habitat or Habitat Areas of Particular Concern. Additionally, plankton and zooplankton that fish eat may also be negatively impacted by these expended materials. The spatial area of Essential Fish Habitat and Habitat Areas of Particular Concern impacted by the Proposed Action would be relatively small compared to the available habitat in the Study Area. However, there would still be vast expanses of Essential Fish Habitat and Habitat Areas of Particular Concern adjacent to the areas of habitat impact that would remain undisturbed by the Proposed Action.

Impacts of vessel disturbance and strike during amphibious assaults could temporarily reduce the quality and quantity of benthic substrate (sand) Essential Fish Habitat over an extremely localized and limited area within Onslow Beach and Seminole Beach. Fish in the taxonomic group that includes the snapper-grouper complex (as managed by the South Atlantic Fishery Management Council), use these designated amphibious assault areas with sandy benthic substrate as Essential Fish Habitat and could be impacted by this activity. However, the secondary habitat impacts on these fish would be extremely localized compared to the total available area of sandy substrate available in the JAX and VACAPES Range Complexes and the overall Study Area.

Impacts of physical disturbance and strikes by small-, medium-, and large-caliber projectiles would be concentrated within designated gunnery box areas, resulting in localized disturbances of hard bottom areas, but could occur anywhere in the range complexes or the Study Area. Hard bottom is important habitat for many different species of fish, including those fish in the snapper-grouper complex (as managed by the South Atlantic Fishery Management Council). It is estimated that hard bottom or biogenic Essential Fish Habitat covers 45 percent of the area of Charleston and JAX OPAREAs combined, 30 percent of the Cherry Point OPAREA, 12 percent of the VACAPES Range Complex area, and 7 percent of the Key West Range Complex area (Florida Fish and Wildlife Conservation Commission 2005). The likelihood these habitats would be impacted is greater in the Charleston, JAX, and Cherry Point OPAREAs compared to the VACAPES and Key West Range Complexes, based solely on these percentages. However, the location with the smallest proportion of hard bottom habitat (the VACAPES Range Complex) has the greatest concentration of small-caliber projectiles expended in the Study Area, with nearly 63 percent of the total 6,150,505 small-caliber projectiles expended. Because the VACAPES Range Complex includes only 12 percent hard bottom, the indirect impacts on the fish using hard bottom habitat in the Study Area would be minimal.

When a projectile hits a biogenic habitat, the substrate immediately below the projectile is not available as that habitat type until the material corrodes (over the long term). The substrate surrounding the projectile would be disturbed, possibly resulting in short-term, localized, and increased turbidity. Because of the large spatial area of the range complexes compared to the small percentage covered by biogenic habitat, it is unlikely that most of the small-, medium-, and large-caliber projectiles expended in the Study Area would fall onto this habitat type. Furthermore, these activities are distributed within

discrete locations within the Study Area, and the overall footprint of these areas is quite small with respect to the spatial extent of this biogenic habitat within the Study Area.

Sinking exercises could also result in indirect impacts on deep-sea populations. These activities occur in open ocean areas, outside of the coastal range complexes, shown in Figure 3.0-2 and 3.0-3, with potential direct disturbance or strike impacts on deep-sea fish, covered in Section 3.9.3.5.1 (Impacts from Munitions or Fragments from High-Explosive Munitions). Indirect impacts on these fish could occur after the ship hulks sink to the seafloor. Over time, the ship hulk would be colonized by marine organisms that attach to hard surfaces. For fish that feed on these types of organisms, or whose abundances are limited by available hard structural habitat, the ships that are sunk during sinking exercises could provide an incidental beneficial impact on the deep-sea fish community (Love and York 2005; Macreadie et al. 2011).

3.9.3.6.7 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Training

Pursuant to the ESA, secondary stressors resulting from training activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.3.6.8 No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) – Testing

Pursuant to the ESA, secondary stressors resulting from testing activities as described under the No Action Alternative, Alternative 1, and Alternative 2:

- *may affect but are not likely to adversely affect the ESA-listed Atlantic salmon, largetooth sawfish, smalltooth sawfish, shortnose sturgeon, Atlantic sturgeon, or Gulf sturgeon; and*
- *will have no effect on Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.*

3.9.4 SUMMARY OF POTENTIAL IMPACTS ON FISH

3.9.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each individual stressor are discussed in the analyses of each stressor in the sections above and summarized in Sections 3.9.4.2 (Endangered Species Act Determinations).

There are generally two ways that a fish could be exposed to multiple stressors. The first would be if a fish were exposed to multiple sources of stress from a single activity (e.g., a mine warfare activity may include the use of a sound source and a vessel). The potential for a combination of these impacts from a single activity would depend on the range of effects of each stressor and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a fish were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be even more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercises or composite training unit exercise).

Secondly, a fish could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., near naval ports, testing ranges, and routine activity locations outlined in Table 3.0-2) and in areas that individual fish frequent because it is within the animal's home range, migratory corridor, spawning or feeding area. Except for in the few concentration areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual fish would be exposed to stressors from multiple activities. However, animals with a home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory corridor. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (on the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, fish that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Fish that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors are difficult to predict in any meaningful way. Navy research and monitoring efforts include data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to contribute to the overall understanding of what impacts may be occurring overall to animals in these areas.

Although potential impacts on certain fish species from the Proposed Action may include injury or mortality, impacts are not expected to decrease the overall fitness of any given population. Mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Sections 3.9.4.2 (Endangered Species Act Determinations), with respect to each regulation applicable to fish.

3.9.4.2 Endangered Species Act Determinations

Table 3.9-7 summarizes the ESA determinations for each substressor analyzed. Pursuant to the ESA, the Navy has undertaken Section 7 consultation with NMFS for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative). For all substressors, training and testing activities are not likely to destroy or modify Atlantic salmon, smalltooth sawfish, or Gulf sturgeon critical habitat.

3.9.4.3 Essential Fish Habitat Determinations

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other active acoustic sources (Atlantic herring only), explosives, and pile driving during training and testing activities may have minimal and temporary adverse effects on fish that occupy water column habitat by reducing the quality or quantity of water column (sound and electro-chemical environment) that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013). The use of electromagnetic devices during training and testing activities may have minimal and temporary adverse

effects on fishes that occupy water column habitat by reducing the quality or quantity of water column electro-chemical environment) that constitutes Essential Fish Habitat or Habitat Areas of Particular Concern (U.S. Department of the Navy 2013). The AFTT Essential Fish Habitat Assessment states that individual stressor impacts were all either no-effect or minimal, and temporary in duration, depending on the stressor (U.S. Department of the Navy 2013).

Pursuant to the Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the Navy has undertaken consultation with NMFS for the proposed and ongoing activities in the AFTT Study Area under Alternative 2 (Preferred Alternative). The consultation is complete and NMFS concurred with the Navy's Essential Fish Habitat Assessment.

Table 3.9-7: Summary of Endangered Species Act Determinations for Training and Testing Activities for Alternative 2 (Preferred Alternative)

Navy Activities and Stressors		Atlantic Salmon	Largetooth Sawfish	Smalltooth Sawfish	Shortnose Sturgeon	Gulf Sturgeon	Atlantic Sturgeon
Acoustic Stressors							
Sonar and Other Active Acoustic Sources	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Explosives	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect not likely to adversely affect	May affect likely to adversely affect	May affect likely to adversely affect
Pile Driving	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Swimmer Defense Airguns	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Weapons Firing, Launch, and Impact Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

Table 3.9-7: Summary of Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Atlantic Salmon	Largetooth Sawfish	Smalltooth Sawfish	Shortnose Sturgeon	Gulf Sturgeon	Atlantic Sturgeon
Acoustic Stressors (Continued)							
Vessel Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Aircraft Noise	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Energy Stressors							
Electromagnetic Devices	Training Activities	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
High Energy Lasers	Training Activities	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Testing Activities	No effect	No effect	No effect	No effect	No effect	No effect
Physical Disturbance and Strike Stressors							
Vessels and In-Water Devices	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

Table 3.9-7: Summary of Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Atlantic Salmon	Largetooth Sawfish	Smalltooth Sawfish	Shortnose Sturgeon	Gulf Sturgeon	Atlantic Sturgeon
Physical Disturbance and Strike Stressors (Continued)							
Military Expended Materials	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Seafloor Devices	Training Activities	No effect	No effect	No effect	No effect	No effect	No effect
	Testing Activities	No effect	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect	No effect	May affect not likely to adversely affect
Entanglement Stressors							
Fiber Optic Cables and Guidance Wires	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Parachutes	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Ingestion Stressors							
Munitions	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

Table 3.9-7: Summary of Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative (Continued)

Navy Activities and Stressors		Atlantic Salmon	Largetooth Sawfish	Smalltooth Sawfish	Shortnose Sturgeon	Gulf Sturgeon	Atlantic Sturgeon
Ingestion Stressors (Continued)							
Military Expended Materials Other Than Munitions	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
Secondary Stressors							
Secondary Stressors	Training Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect
	Testing Activities	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect	May affect not likely to adversely affect

Note: The scientific names of the listed species are as follows: Atlantic salmon (*Salmo salar*), largetooth sawfish (*Pristis pristis*), smalltooth sawfish (*Pristis pectinata*), shortnose sturgeon (*Acipenser brevirostrum*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*).

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3.10 CULTURAL RESOURCES

CULTURAL RESOURCES SYNOPSIS

The Navy considered all potential stressors and the following have been analyzed for submerged cultural resources:

- Acoustic (underwater explosions, sonic booms, and cratering from underwater detonations)
- Physical disturbance and strike (use of seafloor devices and deposition of military expended materials)

Preferred Alternative (Alternative 2)

Acoustic and physical stressors, as indicated above, would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these resources.

3.10.1 INTRODUCTION AND METHODS

3.10.1.1 Introduction

Cultural resources are found throughout the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area). The approach for the assessment of cultural resources includes defining the resource; presenting the regulatory requirements for the identification, evaluation, and treatment within established jurisdictional parameters; establishing the specific resources subtypes in the Study Area; identifying the data used to define the current conditions; and providing the method for impact analysis.

Cultural resources are defined as districts, landscapes, sites, structures, objects, and ethnographic resources, as well as other physical evidence of human activities that are considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historical architectural resources, and traditional cultural properties related to precontact (prior to European contact) and post-contact periods.

Archaeological resources include prehistoric and historic sites and artifacts. Archaeological resources can have a surface component, a subsurface component, or both. Prehistoric resources are physical properties resulting from human activities that predate written records and can include village sites, temporary camps, lithic scatters, roasting pits, hearths, milling features, petroglyphs, rock features, shell mounds, and burials. Historic resources postdate the advent of written records in a region and include building foundations, refuse scatters, wells, cisterns, and privies. Submerged cultural resources include historical shipwrecks and other submerged historical materials, such as sunken airplanes and prehistoric cultural remains. Architectural resources are elements of the built environment consisting of standing buildings or structures from the historic period. These resources include existing buildings, dams, bridges, lighthouses, and forts. Traditional cultural resources are resources associated with beliefs and cultural practices of a living culture, subculture, or community. These beliefs and practices must be rooted in the group's history and must be important in maintaining the cultural identity of the group. Prehistoric archaeological sites and artifacts, historic and contemporary locations of traditional events, sacred places, landscapes, and resource collection areas, including fishing, hunting or gathering areas, may be traditional cultural resources.

3.10.1.1.1 Identification, Evaluation, and Treatment of Cultural Resources

Procedures for the identification, evaluation, and treatment of cultural resources within state territorial waters (varies from 3 nautical miles [nm] in most states to 9 nm in Florida [Gulf coast only], Puerto Rico, and Texas) and United States (U.S.) territorial waters (within 12 nm) are contained in a series of federal and state laws and regulations, and agency guidelines. Archaeological, architectural, and Native American resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act of 1966 as amended in 2006, the Archeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1979, the American Indian Religious Freedom Act of 1978, the Native American Graves Protection and Repatriation Act of 1990, the Submerged Lands Act of 1953, the Abandoned Shipwreck Act of 1987, and the Sunken Military Craft Act of 2004. The Advisory Council on Historic Preservation further guides treatment of archaeological and architectural resources through the regulations, Protection of Historic Properties (36 Code of Federal Regulations [C.F.R.] Part 800). Historic properties, as defined by the National Historic Preservation Act, represent the subset of cultural resources listed in, or eligible for, inclusion in the National Register of Historic Places.

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their actions on cultural resources listed in or eligible for inclusion in the National Register of Historic Places. The regulations implementing Section 106 (36 C.F.R. Part 800) specify a consultation process to assist in satisfying this requirement. Consultation with the appropriate State Historic Preservation Offices, the Advisory Council on Historic Preservation, Native American tribes, and the public and state and federal agencies as required by Section 106 of the National Historic Preservation Act and by government-to-government consultation required by Executive Order (EO) 13007 will be accomplished concurrently with the preparation of this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the portion of the Proposed Action within state territorial waters (within 3 or 9 nm). Scoping letters for this EIS/OEIS were sent to appropriate State Historic Preservation Offices and 28 federally recognized Native American tribes on July 16, 2010. The draft EIS/OEIS was submitted to the appropriate State Historic Preservation Offices for review on April 12, 2013. This correspondence also requested concurrence with "No Historic Properties Affected" in accordance with Section 106 of the National Historic Preservation Act.

Additional regulations and guidelines for submerged historical resources include 10 United States Code (U.S.C.) § 113, Title XIV for the Sunken Military Craft Act; the Abandoned Shipwreck Guidelines prepared by the National Park Service (National Park Service 2007); and the Guidelines for Archeological Research Permit Applications on Ship and Aircraft Wrecks under the Jurisdiction of the Department of the Navy (32 C.F.R. Part 767) overseen by the Naval History and Heritage Command. The Sunken Military Craft Act does not apply to actions taken by, or at the direction of, the United States. In accordance with the Abandoned Shipwreck Act, abandoned shipwrecks in state waters are considered the property of the U.S. Government; however, the federal government may transfer titles to abandoned shipwrecks to a state where shipwrecks fall within the jurisdiction of the state (Barnette 2010). Warships or other vessels used for military purposes at the time of their sinking retain sovereign immunity (e.g., German U-boats). According to the principle of sovereign immunity, foreign warships sunk in U.S. territorial waters are protected by the U.S. Government, which acts as custodian of the sites in the best interest of the sovereign nation (Neyland 2001). In addition, the federal archeological program, developed by the National Park Service as a result of presidential order, includes a collection of historical and archaeological resource protection laws to which federal managers adhere.

The addendum to the National Historic Preservation Act (16 U.S.C. § 470a-2: International Federal activities affecting historic properties) requires an assessment by federal agencies of project effects to

resources located outside U.S. territorial waters that are identified on the World Heritage List or on the applicable country's equivalent of the National Register of Historic Places. Eight resources listed on the World Heritage List and four resources listed on Canada's Historic Places Register are located adjacent to but not within the AFTT Study Area. No resources listed on the World Heritage List or on Canada's Historic Places Register occur in the AFTT Study Area.

No specific procedures for the identification and protection of cultural resources within the open ocean have been defined by the international community (Zander and Varmer 1996). No treaty offering comprehensive protection of submerged cultural resources has been developed and implemented; however, a few international conventions prepared by the United Nations Educational, Scientific, and Cultural Organisation are applicable to submerged cultural resources, including the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage, the 1982 Convention on the Law of the Sea, and the 2001 Convention on the Protection of the Underwater Cultural Heritage. Only the 1970 and 1972 conventions have been fully ratified by the United States. Individual submerged resources may be protected by international agreements, such as the RMS Titanic Maritime Memorial Act of 1986. The RMS Titanic Maritime Memorial Act of 1986 established the RMS Titanic as an international maritime memorial and gravesite.

3.10.1.2 Methods

The approach for establishing current conditions is based on different regulatory parameters defined by geographical location. Within state territorial waters, the National Historic Preservation Act is the guiding mandate; within U.S. territorial waters, the National Environmental Policy Act is the primary mandate.

Under NEPA, an EIS/OEIS must address the adverse and beneficial effects of a proposed federal action on important historical and cultural aspects of our national heritage (40 C.F.R. § 1508.8) (here defined as resources eligible for or listed in the National Register of Historic Places). Under the implementing regulations of Section 106 of the National Historic Preservation Act, federal agencies must take into account the effects that an action would have on cultural resources listed in or eligible for inclusion in the National Register of Historic Places. The term "historic properties" is synonymous with National Register of Historic Places-eligible or listed archaeological, architectural, or traditional resources. Cultural resources not formally evaluated may also be considered potentially eligible (i.e., a consensus determination in consultation with the State Historic Preservation Office) and, as such, are afforded the same regulatory consideration as those resources listed in the National Register of Historic Places.

Historic properties are defined in the National Historic Preservation Act (16 U.S.C. § 470w(5)) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register, including artifacts, records, and material remains related to such a property or resource. Properties are evaluated for nomination to the National Register and for evaluating eligibility of properties using the following criteria (36 C.F.R. § 60.4(a)-(d)):

- Criterion A: Be associated with events that have made a significant contribution to the broad patterns of American history.
- Criterion B: Be associated with the lives of persons significant in the American past.

- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: Yield, or may be likely to yield, information important in prehistory or history.

A historic property also must possess several of the seven aspects of integrity (location, design, setting, materials, workmanship, feeling, and association) to convey its significance and qualify it for the National Register of Historic Places.

The following are defined as cultural resources within U.S. territorial waters:

- Resources listed in or eligible for listing in the National Register of Historic Places (Section 106 of the National Historic Preservation Act)
- Resources entitled to sovereign immunity (e.g., German U-boats)

3.10.1.2.1 Data Used

Cultural resources information relevant to this EIS/OEIS was derived from a variety of sources, including previous environmental documents, previous technical memoranda on submerged cultural resource predictive models (Krivor 2009; Southeastern Archaeological Research 2008, 2009a, b), national and international shipwreck databases, the National Register Information System, information repositories associated with State Historic Preservation Offices, online maps and data, and published sources, as cited.

National and international shipwreck databases researched included the National Oceanic and Atmospheric Administration Advanced Wreck and Obstruction Information System, National Oceanic and Atmospheric Administration Aids to Navigation, the United States Coast Guard Hazards to Navigation, the General Dynamics Global Maritime Wrecks Database, the Northern Shipwrecks Database, accessible state archaeological master site files (Alabama, Florida, Georgia, Mississippi, North Carolina, and Virginia), and secondary sources of historic (older than 50 years) shipwreck information such as the Lytle-Holdcamper List, *Shipwrecks in the Americas*, and the *Encyclopedia of American Shipwrecks* (Burns 2011). Many of the shipwreck databases and secondary sources overlap, generating repetitiveness in data. Many federal agencies “share” data as well as secondary sources. However, the intent of this analysis is not to provide a definitive number of shipwrecks, obstructions, or hazards within a defined area, but rather to provide an overview of potential resources within an area.

The online National Register Information System was reviewed to identify National Register of Historic Places-listed resources, historic districts, and National Historic Landmarks. Appropriate information repositories associated with the State Historic Preservation Offices were contacted and online databases reviewed for information on the location of submerged resources, type, and eligibility for listing on the state registers and National Register of Historic Places.

3.10.1.2.2 Cultural Context

Several types of cultural resources are associated with the Study Area: submerged prehistoric sites along the continental shelf, submerged historic resources and manmade obstructions, and historic architectural resources (e.g., Fort Jefferson in the Dry Tortugas). No Native American traditional use areas (i.e., fishing grounds) have been identified in the Study Area. The context within which these types of resources were formed provides an understanding of the overall development of the resource base and information on relative locations.

About 20,000 years ago, at the height of the last major glaciation (the Late Wisconsinan), sea level was as much as 328 to 393 feet (ft.) (100 to 120 meters [m]) lower than present. Throughout the Holocene (since about 10,000 years ago), sea level has undergone a net rise, the rate of which has varied from as much as 0.39 inches (in.) (10 millimeters [mm]) per year to as little as 0.04 in. (0.10 cm) per year. The Holocene transgression has resulted in the landward migration of coastal habitats across the shelf and, in some cases, submergence and preservation of geomorphic features and landforms. Relative sea level varied considerably along the Atlantic and Gulf coasts. In the northeast, paleo-landscapes were depressed by glacial isostatic pressure; in the Gulf of Mexico, paleo-landscapes were depressed by tectonic processes and sediment loading associated with the abandoned lobes of the Mississippi River delta.

The lower sea level during and following the Wisconsinan glaciation is an important factor for determining the potential for prehistoric sites on drowned continental shelf surfaces. Development of vegetation and adaptation of natural resources would have made the exposed continental shelf attractive to human populations. Those paleo-environmental conditions provide the basis for theories concerning prehistoric subsistence and settlement patterns that are extrapolated for the continental shelf.

The potential for prehistoric and historic archaeological sites has been the subject of hypothesis and a number of detailed studies (Bourque 1979; Coastal Environments 1977; Garrison et al. 1989; Pearson et al. 2003; Science Applications 1981). These studies were commissioned to establish baselines for submerged cultural resource management policy by agencies responsible for those resources (Research Planning 2004). The North Atlantic cultural resources baseline study covered the continental shelf between Cape Hatteras, North Carolina and the Bay of Fundy just over the U.S. border in Canada. The report identified high-probability areas for both prehistoric and submerged historic resources (Bourque 1979). The South Atlantic cultural resources baseline study covered the continental shelf between Cape Hatteras, North Carolina and Key West, Florida. The research and predictive models for South Atlantic submerged cultural resources were published in 1979 (Science Applications 1981). The Gulf of Mexico cultural resources baseline study was carried out for the National Park Service and published in 1977. One of the most important management tools produced by this study was identification of high-probability areas for both prehistoric and submerged historic resources (Coastal Environments 1977).

Submerged prehistoric archaeological sites most likely represent Paleoindian (late Pleistocene) and Early Archaic to Middle Archaic (early Holocene) occupations on the continental shelves, when the post-glacial sea level rise inundated low-lying areas (Faught 2004) (Figure 3.10-1). Submerged prehistoric sites are most likely associated with relic landforms such as relic rivers and stream channels, relic estuary complexes, and relic berms, dunes, and hummocks.

Figure 3.10-1: Artifacts from a Submerged Prehistoric Resource
(Source: Florida Division of Historical Resources 2011a)

The Atlantic and the Gulf of Mexico continental shelves have become repositories for the remains of the entire spectrum of vessels that supported development of the Western Hemisphere from the early 16th century to modern day. While the distribution of shipwreck sites on the continental shelf cannot be associated specifically with the submerged ridge and swale features that currently represent major sources of sand, those deposits lie amid the historic routes of navigation. Although shipwrecks are somewhat random in their areal distribution, it is generally accepted that higher densities exist in association with established navigation routes, environmental obstructions to navigation, and by inshore areas (Research Planning 2004).

Historic shipwrecks (example provided in Figure 3.10-2), classified as archaeological resources, are numerous in the large marine ecosystems (53,436 known wrecks, obstructions, occurrences, or "unknowns") (Burns 2011). As the result of mechanical, chemical, and biological erosion and decay, shipwrecks exhibit differential preservation. Shipwrecks in high-energy zones, such as in shallow waters along the coastlines, are generally less well preserved because they have been scoured by the abundant fluvial sediments driven by coastal currents and heavy wave action (Pearson et al. 2003). However, if portions of the shipwreck are buried in sediment and protected from scouring, preservation may be high. Ferrous metal oxidation is accelerated by elevated seawater temperature, and shipworms consume wooden ship members. Deep-water wrecks may be better preserved because the lower seawater temperatures at depth slow the oxidation of ferrous metals and reduce the number of wood-eating shipworms; however, preservation of deep-water shipwrecks does vary (Pearson et al. 2003).

In accordance with the Abandoned Shipwreck Act, abandoned shipwrecks in state waters on the Atlantic coast and in the Gulf of Mexico are considered the property of the U.S. Government (Barnette 2010). Warships or other vessels used for military purposes at the time of their sinking retain sovereign immunity (e.g., German U-boats) (Figure 3.10-3). According to the principle of sovereign immunity, foreign warships sunk in U.S. territorial waters are protected by the U.S. Government, which acts as custodian of the sites in the best interest of the sovereign nation (Neyland 2001).

Figure 3.10-2: Submerged Historic Resource (Spanish Galleon)
(Source: Florida Division of Historical Resources 2011b)

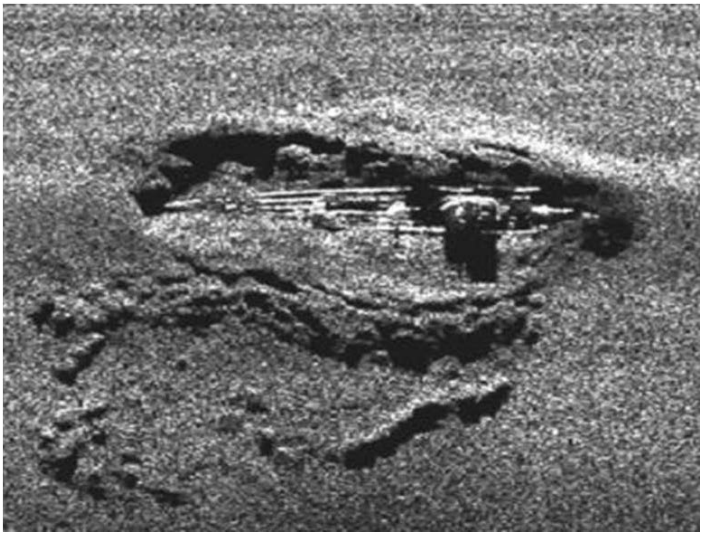

Figure 3.10-3: High-Resolution Side-Scan Sonar Image of Submerged Historic Resource (World War II Vessel)
(Source: Warren 2004)

Estimated numbers of historic submerged resources used in this EIS/OEIS are compiled from information obtained from various databases. Data changes are made yearly as exploration systems become more sophisticated and additional discoveries are made. Because no comprehensive survey or evaluation of submerged historic resources has occurred in the entire Study Area and because some areas (e.g., coastal zones and continental shelf) are considered high probability for historic shipwrecks, discoveries of additional historic shipwrecks may occur. Additionally, some existing and unrecorded historic shipwrecks could be considered eligible for the National Register of Historic Places.

3.10.1.3 Methods for Impact Analysis

Impact analysis for cultural resources is based on different parameters defined by geographical location. Within U.S. territorial waters, Section 106 of the National Historic Preservation Act and NEPA evaluation are the guiding mandates. In general, impacts are assessed by the importance of the resource, the sensitivity of the resource to proposed activities, and the duration of the effects on the environment.

3.10.2 AFFECTED ENVIRONMENT

Seven large marine ecosystems are located entirely or partially within the Study Area: the West Greenland Shelf, the Newfoundland-Labrador Shelf, the Scotian Shelf, the Northeast U.S. Continental Shelf, the Southeast U.S. Continental Shelf, the Caribbean Sea, and the Gulf of Mexico. These ecosystems exhibit similar types of cultural resources in similar submerged settings.

3.10.2.1 Submerged Prehistoric Resources

Submerged prehistoric sites have been documented in shallow offshore areas in the Northeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems.

Submerged prehistoric sites have been identified offshore in southern New England (Merwin et al. 2003). Submerged prehistoric sites are most likely associated with relic landforms such as relic rivers and stream channels, relic estuary complexes, and relic berms, dunes, and hummocks (Research Planning 2004) and may occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem.

Geologic features in the eastern Gulf of Mexico (karst topography, relic barrier islands with back barrier bays and lagoons, and coastal dune lakes) are used as indicators of potential cultural resources and have a high probability of containing prehistoric sites. Sites in high-probability zones may date from the Paleoindian to the Archaic periods. Submerged prehistoric sites have been identified offshore in northwestern Florida (Faught 2004). Submerged prehistoric archaeological sites have been identified out to a distance of 9 nm in Florida (Faught 2010), but sites are predicted as far as 85 linear miles (136 km) offshore at a depth of 130 ft. (40 m), along the inundated Paleoindian or Clovis Shoreline (Faught 2010).

3.10.2.2 Known Wrecks, Obstructions, Occurrences, or "Unknowns"

Freighters, tankers, ships-of-war, passenger ships, submarines, and fishing vessels have been sunk, lost, or run aground. Natural activities and features have played important roles in creating submerged cultural resources; those include powerful currents (e.g., the Labrador Current), winds (including cold fronts), rough seas (gales, hurricanes, blizzards), coastal topography (e.g., Cape Cod, Vineyard Sound, Cape Hatteras, Cape Fear), and shallow water and sandbars (Isles of Shoals, Nantucket Shoals, Diamond Shoals, Lookout Shoals, and Frying Pan Shoals). The Revolutionary War, the War of 1812, and the Civil War contributed to numerous ship losses from the northeast to the Gulf of Mexico. World Wars I and II used submarine warfare, which destroyed numerous cargo ships. Wrecks are concentrated in the Cape Hatteras area, where the intersection of cold northern currents and the northbound Gulf Stream forms shoals and submerged shifting sandbars that, in combination with powerful currents, treacherous seas, and wind, create hazards for mariners.

Review of all databases indicates the presence of 13,606 known wrecks, obstructions, occurrences, or sites marked as "unknown" in U.S. territorial waters in the seven large marine ecosystems and 3,774 resources beyond U.S. territorial waters (outside 12 nm) (Table 3.10-1; Figures 3.10-4, 3.10-5 and

3.10-6). Most "unknown" obstructions tend to be modern debris but cannot be ruled out as potential cultural resources.

Because no comprehensive survey or evaluation of submerged historic resources has occurred in the Study Area, additional shipwrecks may exist, and some existing and newly discovered shipwrecks could be considered eligible for the National Register of Historic Places. A predictive model was used to determine the probability of encountering additional shipwrecks in portions of the Study Area (Burns 2011; Roberts 2012). The predictive model is based on a point system, where the higher point assumes a higher probability for submerged cultural resources. This model assigns points to various factors, including ports/anchorages, obstructions/hazards, shipping routes, and known shipwreck locations; the model assumes there is a higher probability of vessel loss near a port/anchorage, near an obstruction/ navigational hazard or near a designated shipping route. This model also acknowledges that if other known shipwreck sites are nearby, the probability increases for additional sites within that area. Results of the predictive model indicate that the portions of the Study Area within the large marine ecosystems exhibit moderate to high potential to contain submerged cultural resources (Burns 2011; Roberts 2012) (Table 3.10-1).

3.10.2.2.1 Cultural Resources Eligible for or Listed in the National Register of Historic Places

Three National Historic Landmarks or monuments, two National Register of Historic Places historic districts or Multiple Property Sites, and at least 12 individual resources considered eligible for or listed on the National Register of Historic Places are associated with the large marine ecosystems (Table 3.10-2).

Table 3.10-1: Cultural Resource Types in the Large Marine Ecosystems

Large Marine Ecosystem	Potential for Submerged Prehistoric Resource	Known wrecks, obstructions, occurrences, or sites marked as "unknown"					Resources Listed in or Eligible for the National Register of Historic Places or National Historic Landmarks
		Estimate in U.S. Territorial Waters (within 12 nm)	Estimate outside U.S. Territorial Waters (beyond 12 nm)	Total	Overall Density	Relative Probability	
West Greenland Shelf	No	Not Applicable	5	5	N/A	Low	No
Newfoundland-Labrador Shelf/ Scotian Shelf	No	Not Applicable	1,572	1,572	1 per 164 nm^2	Moderate	Not applicable
Northeast United States Continental Shelf	Yes	5,560	651	6,211	1 per 14 nm^2	Moderate	Yes
Southeast United States Continental Shelf	No	899	174	1,073	1 per 79 nm^2	Moderate	Yes
Caribbean Sea	No	74	130	204	N/A	Moderate	Yes
Gulf of Mexico	Yes	7,071	1,242	8,313	1 per 53 nm^2	Moderate	Yes
Pierside Locations	No	2	0	2	N/A	N/A	Yes
Total		**13,606**	**3,774**	**17,380**			

N/A: Not applicable; nm^2: square nautical miles

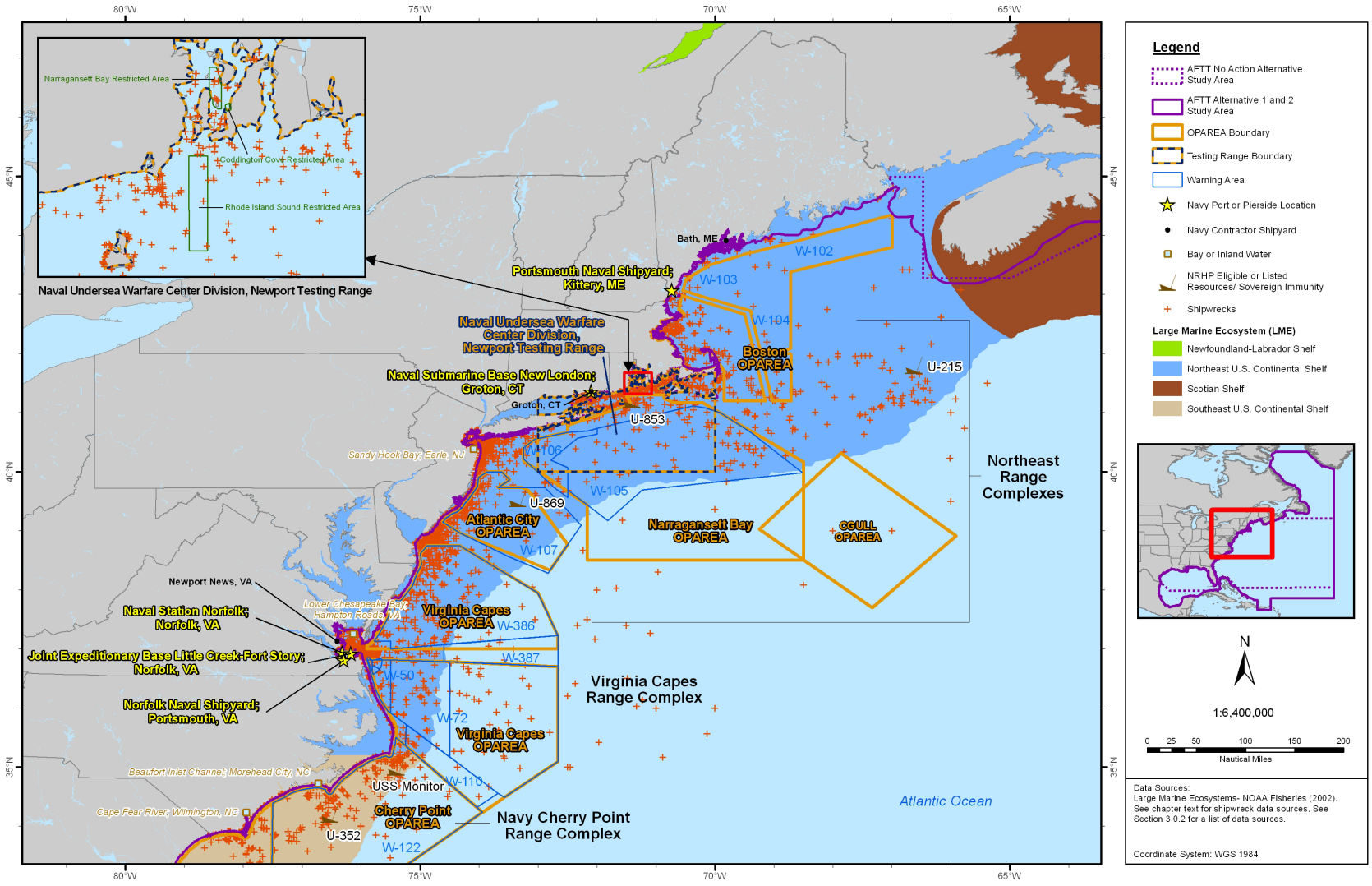

Figure 3.10-4: Known Wrecks, Obstructions, Occurrences, or Sites Marked as "Unknown" in the Northeast United States Continental Shelf Large Marine Ecosystem

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; ME: Maine; NC: North Carolina; NJ: New Jersey; NOAA: National Oceanic and Atmospheric Administration; NRHP: National Register of Historic Places; OPAREA: Operating Area; VA: Virginia

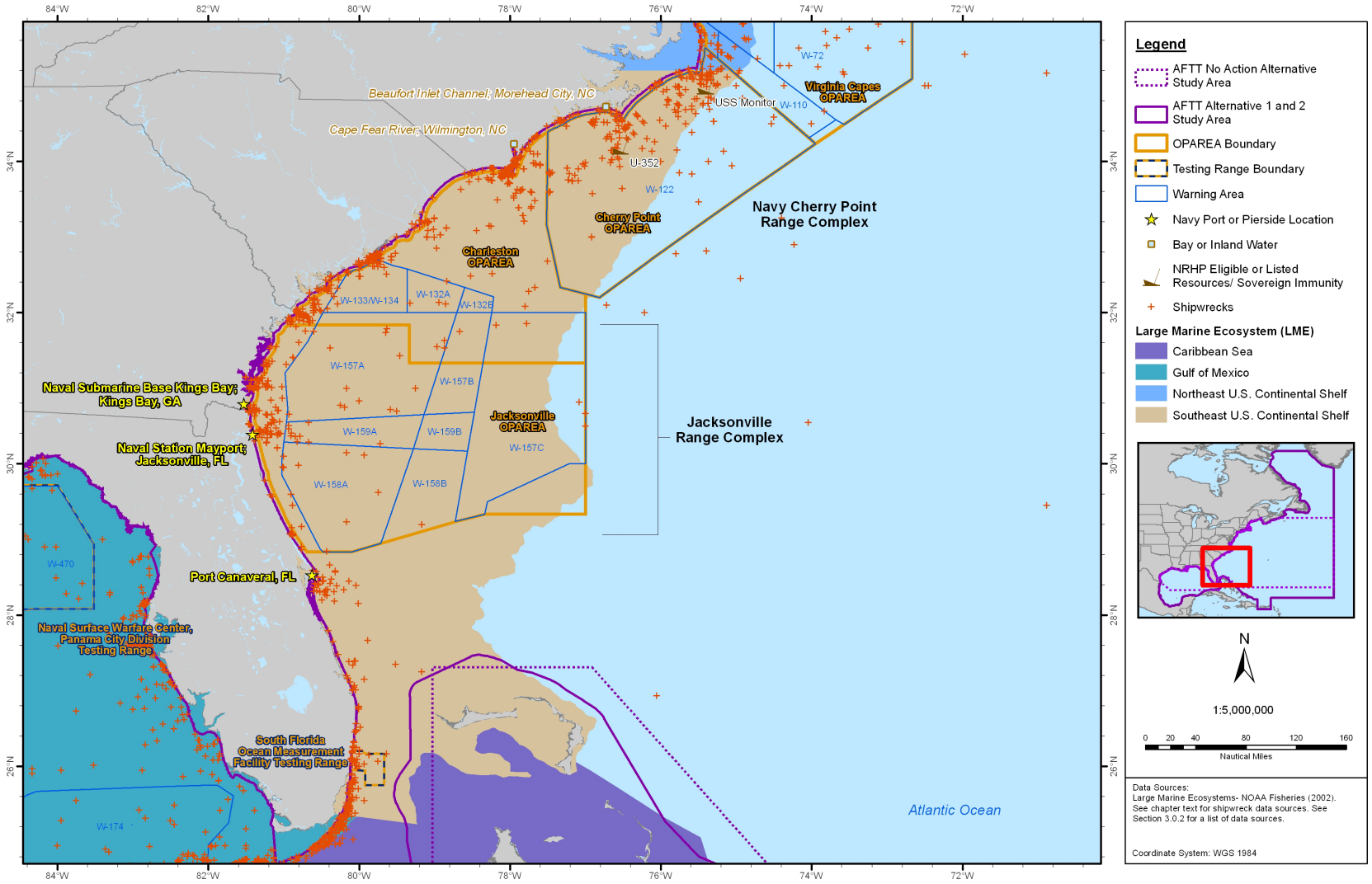

Figure 3.10-5: Known Wrecks, Obstructions, Occurrences, or Sites Marked as "Unknown" in the Southeast United States Continental Shelf Large Marine Ecosystem

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; NC: North Carolina; NOAA: National Oceanic and Atmospheric Administration; NRHP: National Register of Historic Places; OPAREA: Operating Area

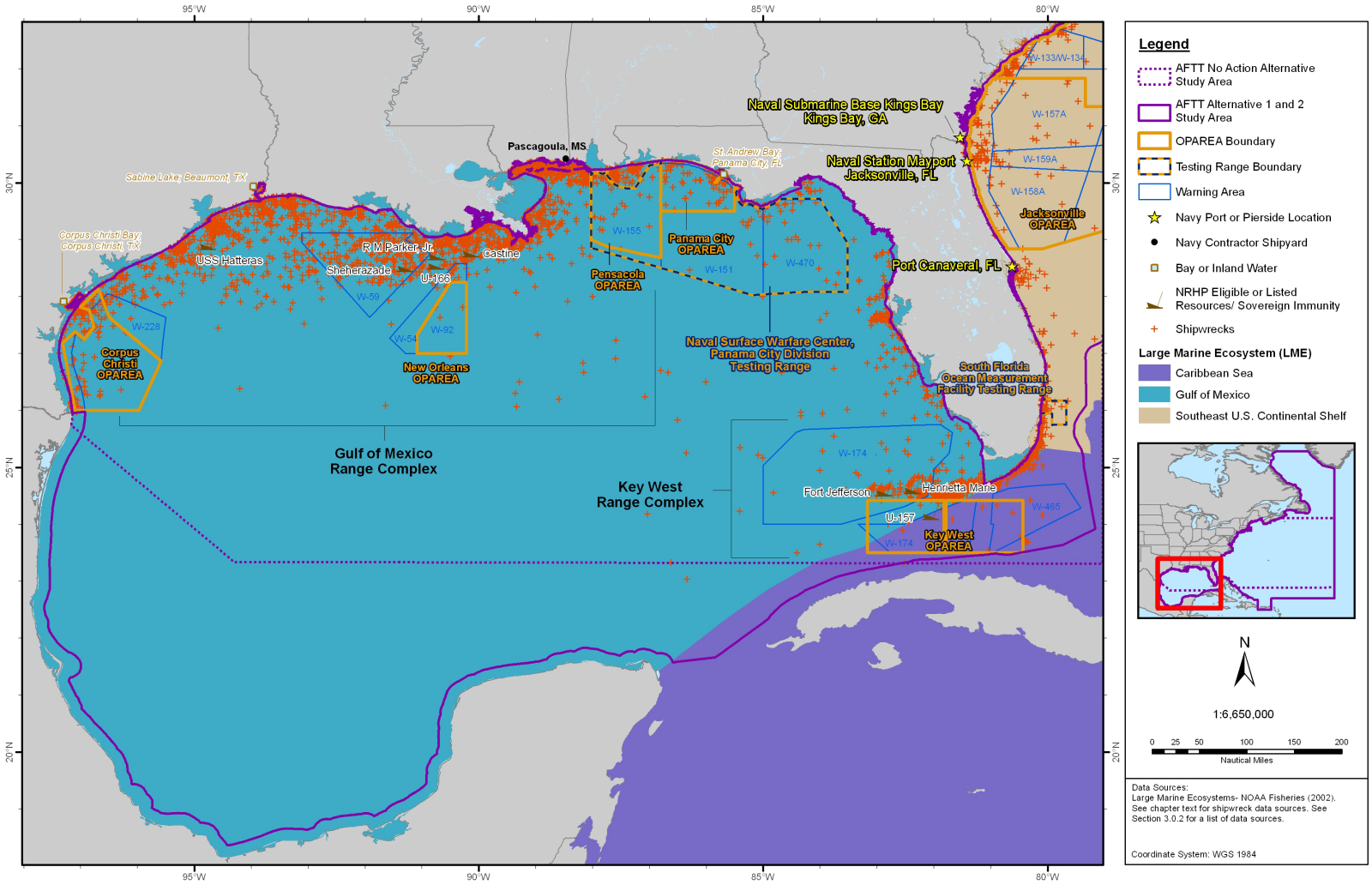

Figure 3.10-6: Known Wrecks, Obstructions, Occurrences, or Sites Marked as "Unknown" in the Southeast United States Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; MS: Mississippi; NOAA: National Oceanic and Atmospheric Administration; NRHP: National Register of Historic Places; OPAREA: Operating Area; TX: Texas

Table 3.10-2: National Historic Landmarks, Monuments, and Cultural Resource Listed in the National Register of Historic Places

Resource	Large Marine Ecosystem	Description	National Register of Historic Places	National Historic Landmark/ Monument	Reference
HMS Orpheus	Northeast U.S. Continental Shelf	British vessel, 1773–1778	Listed	No	National Park Service 2010
USS Cumberland	Northeast U.S. Continental Shelf (pierside)	Wooden frigate, 1842-1862	Listed	No	Judge 2007, National Park Service 2010, Virginia Department of Historic Resources 2010
CSS Florida	Northeast U.S. Continental Shelf (pierside)	Three-masted, wooden-hulled vessel, 1864	Listed	No	Judge 2007, Virginia Department of Historic Resources 2010
USS Monitor	Southeast U.S. Continental Shelf	Ironclad Civil War gunship, 1862	Listed	Yes	Naval Historical Center 2008, Neyland 2001, National Register Information System 2008, National Park Service 2008, USS Monitor Center 2008
USS Huron	Southeast U.S. Continental Shelf	Iron vessel, 1875–1877	Listed	No	North Carolina Office of State Archaeology 2010, National Register Information System 2010
Cape Fear Civil War Shipwrecks Discontiguous District	Southeast U.S. Continental Shelf	Civil War shipwrecks, 1861–1864 (16 blockade-running steamers, four Union vessels, and one Confederate vessel)	Historic District	No	Wilde-Ramsing and Angley 1985
Barge Wreck	Southeast U.S. Continental Shelf	19th-century barge	Listed	No	Burns 2011a
Cape Gull	Southeast U.S. Continental Shelf	United States Coast Guard cutter	Listed	No	Burns 2011a
1733 Spanish Plate Fleet Shipwrecks	Southeast U.S. Continental Shelf	Spanish Fleet, 1733 (*Angustias*, *Chavas*, *El Gallo Indiano*, *El Infante*, *El Rubi*, *Herrara*, *Populo*, *San Felipe*, *San Francisco*, *San Jose*, *San Pedro*, *Sueco de Arizon*, and *Tres Puentes*)	Multiple Property Site	No	McKinnon et al. 2006
SS Antonio Lopez	Caribbean	Spanish blockade runner, 1989	Listed	Yes	National Register Information System 2011
Fort Jefferson	Gulf of Mexico	Third System seacoast fortification, 1846	Listed	Yes	Morrison et al. 1974, Clark 2008

Table 3.10-2: National Historic Landmarks, Monuments, and Cultural Resource Listed in the National Register of Historic Places (Continued)

Resource	Large Marine Ecosystem	Description	National Register of Historic Places	National Historic Landmark/ Monument	Reference
Henrietta Marie	Gulf of Mexico	English merchant/slave ship, 1700	Eligible	No	Mel Fisher Maritime Heritage Society 2001
Vamar	Gulf of Mexico	Reinforced metal hulled vessel, 1919–1942	Listed	No	Burns 2011a
SS Tarpon	Gulf of Mexico	Cargo ship, 1896–1937	Listed	No	Florida Department of State 1997, Florida Department of State 2007
USS Massachusetts	Gulf of Mexico	Battleship, 1896–1921	Listed	No	Florida Department of State 2008
USS Hatteras	Gulf of Mexico	Iron-hulled, side-wheel steamer, 1861–1863	Listed	No	Bureau of Ocean Energy Management 2011
R.M. Parker, Jr.	Gulf of Mexico	Tanker, 1919–1942	Eligible	No	Enright et al. 2006
Castine	Gulf of Mexico	Steel-hulled gunboat, 1892–1924	Eligible	No	Enright et al. 2006
Sheherazade	Gulf of Mexico	French tanker, 1935–1942	Eligible	No	Enright et al. 2006

3.10.2.2.2 Resources with Sovereign Immunity

German U-boats retain sovereign immunity and include the *U-869* (Uboat.net 2010c) and the *U-853* (Uboat.net 2010b) in the Northeast U.S. Continental Shelf Large Marine Ecosystem, *U-352* (North Carolina Wreck Diving 2008) in the Southeast U.S. Continental Shelf Large Marine Ecosystem, and *U-166* (Warren 2004) and *U-157* (Uboat.net 2010a) in the Gulf of Mexico Large Marine Ecosystem.

3.10.2.3 Current Practices

Established baseline practices employed by the Navy include avoidance of underwater obstructions and overflight restrictions associated with the Tortugas Military Operations Area.

3.10.2.3.1 Avoidance of Obstructions

The Navy routinely avoids known obstructions, including submerged cultural resources such as historic shipwrecks, by providing the locations of known shipwrecks and other submerged cultural resources to operators prior to and well in advance of training and testing activities. Known obstructions are avoided to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises. In addition, ships will not anchor in areas known to contain submerged cultural resources.

In the event the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate State Historic Preservation Officer in accordance with 36 C.F.R. § 800.13(a)(3).

3.10.2.3.2 Tortugas Military Operations Area

The Tortugas Military Operations Area is not a traditional military operations area but rather an air exclusion zone established to protect Fort Jefferson and Dry Tortugas National Park. Tactical maneuvers resulting in supersonic flight are not conducted in the Tortugas Military Operations Area above Fort Jefferson and Dry Tortugas National Park between 5,000 ft. and 18,000 ft. The Military Operations Area is that airspace within an area bounded by a line 12 nm from and parallel to the shoreline of the Dry Tortugas Islands, creating a circular area (Federal Aviation Administration 2009).

Previous research indicates that fragile mortar in the brick masonry at Fort Jefferson may be susceptible to damage from sonic booms (Hanson et al. 1991; James et al. 2009). No supersonic flight activity is authorized in the Tortugas Military Operations Area; therefore, no sonic booms are intentionally generated below 18,000 ft. and within 12 nm from the shoreline of all the islands encompassing Fort Jefferson. Sonic booms are occasionally generated by military aircraft and are logged by National Park Service staff at Fort Jefferson. Due to the increase in sonic booms logged at Fort Jefferson in 2008 and early 2009, the Navy took precautionary measures to minimize the number of sonic booms reaching Fort Jefferson. In April 2009, the Naval Air Station Key West Air Operations Department incorporated Tortugas Military Operations Area flight avoidance awareness briefings into pre-flight planning guidance provided to all aircrew. Increased awareness of the airspace restrictions helps minimize inadvertent supersonic flight in the vicinity of Dry Tortugas. Additionally, air combat maneuver engagement zones and basic fighter maneuvering areas have been modified in W-174 so that the resulting flight activities generate fewer sonic booms in the airspace adjacent to Fort Jefferson. Furthermore, training flights predisposed to supersonic conditions are segregated and only conducted in redesignated airspace at least 30 nm from Fort Jefferson. Avoidance and mitigation measures were enacted in May 2009.

3.10.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact cultural resources of the Study Area. Tables 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Table F-1 in Appendix F (Training and Testing Activities Matrices) shows all the warfare areas and associated stressors that were considered for analysis of cultural resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to cultural resources in the Study Area and that are analyzed include the following:

- Acoustic Stressors
    - Impacts from Explosives- Shock (pressure) waves from underwater explosions
    - Impacts from Explosives- Cratering
    - Impacts from Aircraft Noise- Vibration from sonic booms
- Physical Disturbance and Strike Stressors
    - Impacts from Military Expended Materials
    - Impacts from Seafloor Devices

The use of sonar does not affect the structural elements of historic shipwrecks, and no further analysis is required for cultural resources in this document. Archaeologists use multi-beam sonar and side-scan sonar as a regular practice in effectively exploring shipwrecks without disturbance. Based on the physics of underwater sound, the shipwreck would need to be very close (less than 22 ft. [6.5 m]) to the sonar sound source for the shipwreck to potentially experience any slight oscillations from the induced pressure waves. Any oscillations experienced at less than 22 ft. (6.5 m) would be negligible up to less than a few yards from the sonar source. This distance is smaller than the typical safe navigation and operating depth for most sonar sources and therefore is not expected to impact historic shipwrecks.

3.10.3.1 Acoustic Stressors

Acoustic stressors that have the potential to impact cultural resources are shock waves and vibrations from both underwater explosions and aircraft activities, and cratering created by underwater explosions. A shock wave and oscillating bubble pulses resulting from any kind of underwater explosion such as explosive torpedoes, missiles, bombs, projectiles, and mines could affect the exposed portions of submerged historical resources in the vicinity. Shock waves generated from underwater explosions would be episodic rather than continuous and could create overall structural instability and eventual collapse of architectural features of submerged historic resources. The amount of damage would depend on factors such as size of the charge, distance from the historic shipwreck, water depth, and topography of the seafloor.

In addition, impacts from aircraft noise (i.e. vibration from sonic booms) could create increased structural instability and damage to Fort Jefferson, a fragile historic architectural resource in the Gulf of Mexico Large Marine Ecosystem (Hanson et al. 1991; James et al. 2009).

3.10.3.1.1 Impacts from Explosives – Shock Waves from Underwater Explosions

Explosions associated with bombs, missiles, and projectiles occur at or immediately below the ocean surface (within one meter). In addition, explosions associated with torpedoes and certain mine warfare

events typically occur deeper in the water column. These types of explosions are within the water column and shock waves would not reach submerged historic resources on the seafloor. Underwater detonations of high explosives from other mine warfare events would occur near or on the seafloor. Shock waves have the potential to damage architectural features of submerged historic resources.

3.10.3.1.1.1 No Action Alternative

Training and Testing

Under the No Action Alternative, training and testing activities would continue within existing designated areas within the Northeast U.S. Continental Shelf, the Southeast U.S. Continental Shelf, the Caribbean Sea, and the Gulf of Mexico Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged historic resources located in the large marine ecosystems are expected from shock waves created by underwater detonations.

3.10.3.1.1.2 Alternative 1

Training

Under Alternative 1, the number of explosive round detonations (high explosives) will increase within the Northeast U.S. Continental Shelf (Virginia Capes [VACAPES] Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and Jacksonville [JAX] Range Complexes), and the Gulf of Mexico (Key West and Gulf of Mexico [GOMEX] Range Complexes) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of training activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged historic resources located in the large marine ecosystems are expected from shock waves created by underwater detonations.

Testing

Under Alternative 1, the number of explosive round detonations (high explosives) associated with testing activities will increase within the Northeast U.S. Continental Shelf Large Marine Ecosystem (Naval Undersea Warfare Center Division, Newport Testing Range and VACAPES Range Complex) and the Gulf of Mexico Large Marine Ecosystem (Naval Surface Warfare Center, Panama City Division Testing Range). Because measures were previously implemented to protect submerged cultural resources and overall types and locations of testing activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged historic resources located in the large marine ecosystems are expected from shock waves created by underwater detonations.

3.10.3.1.1.3 Alternative 2 (Preferred Alternative)

Training

Under Alternative 2, the number of explosive round detonations (high explosives) will increase from the No Action Alternative, but are the same as Alternative 1 within the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), and the Gulf of Mexico (Key West and GOMEX Range Complexes) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of training activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged historic resources located in the large marine ecosystems are expected from shock waves created by underwater detonations.

Testing

Under Alternative 2, the number of explosive round detonations (high explosives) will increase within Northeast U.S. Continental Shelf Large Marine Ecosystem (Naval Undersea Warfare Center Division, Newport Testing Range and VACAPES Range Complex) and the Gulf of Mexico Large Marine Ecosystem (Naval Surface Warfare Center, Panama City Division Testing Range). Because measures were previously implemented to protect submerged cultural resources and overall types and locations of testing activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged historic resources located in the large marine ecosystems are expected from shock waves created by underwater detonations.

3.10.3.1.2 Impacts from Explosives – Cratering

Underwater explosions near or on the sea floor could create sediment displacement in the form of cratering and could affect submerged prehistoric sites and unrecorded historic resources at or near the explosive impact. Cratering of unconsolidated soft bottom habitats would result from charges set on or near the bottom. For a specific explosive charge size, crater depths and widths would vary depending on depth of the charge and sediment type. However, crater dimensions generally decrease as bottom depth increases. Cratering could disrupt the horizontal patterning and vertical stratigraphy of submerged prehistoric sites and unrecorded historic resources, and could subsequently destroy those characteristics that would make them eligible for listing on the National Register of Historic Places.

3.10.3.1.2.1 No Action Alternative

Training

Under the No Action Alternative, mine warfare training activities would continue within existing designated areas within the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), and the Gulf of Mexico (GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

Testing

Under the No Action Alternative, mine warfare testing activities would continue within existing designated areas within the Northeast U.S. Continental Shelf (VACAPES Range Complex) and the Gulf of Mexico (Naval Surface Warfare Center, Panama City Division Testing Range and GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

3.10.3.1.2.2 Alternative 1

Training

Compared with the No Action Alternative, the number of high explosive rounds associated with mine warfare activities under Alternative 1 would increase within the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), the Caribbean Sea (Key West Range Complex), and the Gulf of Mexico (GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of training activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged prehistoric sites

or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

Testing

Compared with the No Action Alternative, the number of high explosive rounds associated with mine warfare activities under Alternative 1 would increase within the Northeast U.S. Continental Shelf (VACAPES Range Complex) and the Gulf of Mexico (Naval Surface Warfare Center, Panama City Division Testing Range and GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of testing activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

3.10.3.1.2.3 Alternative 2 (Preferred Alternative)

Training

Under Alternative 2, the number of high explosive rounds and locations associated with mine warfare activities are the same as under Alternative 1 within the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), the Caribbean Sea (Key West Range Complex), and the Gulf of Mexico (GOMEX Range Complex) Large Marine Ecosystems. As concluded in Alternative 1, cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the sea floor and archaeological deposits buried in the ocean sediments in the large marine ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of training activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

Testing

Compared with the No Action Alternative, the number of high explosive rounds associated with mine warfare activities under Alternative 2 would increase within the Northeast U.S. Continental Shelf (VACAPES Range Complex) and the Gulf of Mexico (Naval Surface Warfare Center, Panama City Division Testing Range and GOMEX Range Complex) Large Marine Ecosystems. The number of high explosive rounds increases slightly compared with Alternative 1. As concluded in Alternative 1, cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the sea floor and archaeological deposits buried in the ocean sediments in the large marine ecosystems. Because measures were previously implemented to protect submerged cultural resources and overall types and locations of testing activities are not expected to change from those undertaken in the No Action Alternative, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from cratering created by deep underwater explosions.

3.10.3.1.3 Impacts from Aircraft Noise – Vibration from Sonic Booms

Supersonic aircraft flights can occur and are usually limited to altitudes above 30,000 ft. and locations more than 30 nm from shore. Several factors influence sonic booms: weight, size, and shape of the aircraft; altitude; flight paths; and atmospheric conditions. A larger and heavier aircraft displaces more air and creates more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft.

Vibration and shock waves from sonic booms could create increased structural instability and damage to a fragile historic architectural resource in the Study Area (Fort Jefferson in the Key West Range Complex) (Hanson et al. 1991; James et al. 2009).

3.10.3.1.3.1 No Action Alternative

Training

Only the Key West Range Complex in the Gulf of Mexico Large Marine Ecosystem contains a cultural resource that could be susceptible to sonic booms; no other regions are associated with supersonic flight activities where susceptible cultural resources occur.

The Key West Range Complex contains a National Register of Historic Places-listed resource, Fort Jefferson, which is susceptible to damage from vibration and shock waves generated from sonic booms. A recent sonic boom study was conducted as part of the Key West Range Complex Environmental Assessment/Overseas Environmental Assessment (James et al. 2009). The study concluded that restored sections of Fort Jefferson are not susceptible to sonic boom damage (James et al. 2009). Because the exclusionary Military Operations Area exists around the Dry Tortugas National Park, and with the Navy's existing avoidance and protective measures enacted, sonic boom vibration has little potential for structural damage to historic structures and features associated with National Register of Historic Places-listed Fort Jefferson.

Testing

No testing activities that could create sonic booms would occur in or near the Dry Tortugas National Park in the Gulf of Mexico Large Marine Ecosystem.

3.10.3.1.3.2 Alternative 1

Training

As indicated in the No Action Alternative discussion, only the Key West Range Complex in the Gulf of Mexico Large Marine Ecosystem contains a cultural resource that could be susceptible to sonic booms; no other regions are either associated with activities generating sonic booms or contain susceptible cultural resources.

The supersonic activity under Alternative 1 is the same as under the No Action Alternative. Sonic boom vibration has little potential for structural damage to historic structures and features associated with National Register of Historic Places-listed Fort Jefferson.

Testing

No testing activities that could create sonic booms would occur in or near the Dry Tortugas National Park in the Gulf of Mexico Large Marine Ecosystem.

3.10.3.1.3.3 Alternative 2 (Preferred Alternative)

Training

As indicated in the No Action Alternative discussion, only the Key West Range Complex in the Gulf of Mexico Large Marine Ecosystem contains a cultural resource that could be susceptible to sonic booms; no other large marine ecosystems are either associated with activities generating sonic booms or contain susceptible cultural resources.

There would be increased aircraft activity in the Key West Range Complex under Alternative 2 compared with the No Action Alternative. However, the exclusionary Military Operations Area exists around the Dry Tortugas National Park, and with the Navy's existing avoidance and protective measures, sonic boom vibration has little potential for structural damage to historic structures and features associated with National Register of Historic Places-listed Fort Jefferson.

Testing

No testing activities that could create sonic booms would occur in or near the Dry Tortugas National Park in the Gulf of Mexico Large Marine Ecosystem.

3.10.3.1.4 Regulatory Conclusions of Acoustic Stressors

In accordance with Section 106 of the National Historic Preservation Act, acoustic stressors resulting from underwater explosions creating shock (pressure) waves or cratering of the seafloor during training and testing activities would not affect submerged cultural resources in state territorial waters from the No Action Alternative, Alternative 1, and Alternative 2 because the Navy previously implemented measures to protect these resources.

3.10.3.2 Physical Disturbance and Strike Stressors

Any physical disturbance on the continental shelf and seafloor, such as ship anchoring, targets or mines resting on the seafloor, moored mines, bottom-mounted tripods, and bottom crawling unmanned underwater vehicles could inadvertently damage or destroy submerged prehistoric sites and historic resources. Expended materials, such as flares, projectiles, casings, target fragments, missile fragments, non-explosive practice munitions, munitions fragments, rocket fragments, ballast weights, sonobuoys, torpedo launch accessories, and mine shapes can be deposited on or in the vicinity of submerged prehistoric sites and historic resources. Heavier expended materials have the potential to damage intact fragile shipwreck features if they land on this resource type with velocity.

3.10.3.2.1 Impacts from Military Expended Materials

Deposition of non-explosive practice munitions, sonobuoys, and military expended materials other than ordnance may affect submerged cultural resources through possible sudden impact of resources on the seafloor or the simple settling of military expended materials on top of submerged cultural resources. These potential impacts are combined in this discussion.

The large marine ecosystems cover 1,255,365 nm^2, and 53,436 known wrecks, obstructions, occurrences, or sites marked as "unknown" have been recorded. The large marine ecosystems have the potential to contain submerged prehistoric sites (on the continental shelf associated with the Northeast U.S. Continental Shelf and the Gulf of Mexico Large Marine Ecosystems). The highest density of historic resources (see Table 3.10-1) ranges from one possible historic resource in 7 nm^2 (combined Newfoundland-Labrador Shelf and Scotian Shelf Large Marine Ecosystems) to one possible historic resource in 79 nm^2 (Southeast U.S. Continental Shelf Large Marine Ecosystem). The likelihood of expended materials either impacting or landing on submerged cultural resources is very low given the size of the regions.

Most of the anticipated expended munitions will be small objects and fragments that will slowly drift to the seafloor after striking the ocean surface. Larger and heavier objects such as non-explosive practice munitions and ship hulls could strike the ocean surface with velocity, but their acceleration will slow as they move through the water. It is possible these larger and heavier objects could impact a submerged

prehistoric site by creating sediment and artifact displacement. A historic resource could be impacted by damaging structural elements and artifacts in the regions with higher cultural resources probability and density.

If expended materials should sink in the vicinity of or on either type of submerged cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource that would contribute to their eligibility for the National Register of Historic Places. The presence of expended materials on submerged sites would reflect post-depositional processes.

3.10.3.2.1.1 No Action Alternative

Training

Under the No Action Alternative, training activities would continue within existing designated areas in the Northeast U.S. Continental Shelf, the Southeast U.S. Continental Shelf, the Caribbean Sea, and the Gulf of Mexico Large Marine Ecosystems. Expended materials could be deposited on or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. Because of the size of the large marine ecosystems, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Under the No Action Alternative, testing activities would continue. Expended materials could be deposited on or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. Because of the size of the large marine ecosystems, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.1.2 Alternative 1

Training

Under Alternative 1, the number of expended items from training activities would increase when compared with the No Action Alternative. Expended materials could be deposited on the seafloor or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Compared with the No Action Alternative, the number of expended items from testing activities under Alternative 1 would increase. Expended materials could be deposited on or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.1.3 Alternative 2 (Preferred Alternative)

Training

Under Alternative 2, the number of expended items from training activities would increase from the No Action Alternative. Expended materials could be deposited on or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Under Alternative 2, the number of expended items from testing activities would increase from the No Action Alternative. Expended materials could be deposited on or in the vicinity of submerged prehistoric sites and known and unrecorded historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink in the vicinity of either type of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.2 Impacts from Seafloor Devices

Any physical disturbance on the continental shelf and seafloor, such as precision anchoring, targets or mines resting on the seafloor, moored mines, bottom-mounted tripods, and bottom crawling unmanned underwater vehicles could inadvertently damage or destroy submerged prehistoric sites and historic resources. Precision anchoring could crush or snag structural elements of historic resources and damage intact sediments of submerged prehistoric sites. Divers are used to set bottom and moored mine anchors (blocks of concrete weighing several hundred pounds) in waters less than 150 ft. (45.7 m) deep and routinely avoid known obstructions, which include historic resources and any unrecorded obstructions they might encounter. Seafloor devices could disrupt the horizontal patterning and vertical stratigraphy of submerged prehistoric sites and historic resources as well as damage structural elements of the historic resources through crushing and snagging.

3.10.3.2.2.1 No Action Alternative

Training and Testing

Under the No Action Alternative, training and testing activities using seafloor devices would continue within existing designated areas within the Northeast U.S. Continental Shelf, the Southeast U.S. Continental Shelf, and the Gulf of Mexico Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from the use of seafloor devices.

3.10.3.2.2.2 Alternative 1

Training

Compared with the No Action Alternative, the number of training activities using seafloor devices would increase under Alternative 1 in the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), and the Gulf of Mexico (GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from the use of seafloor devices.

Testing

Under Alternative 1, the number of testing activities using seafloor devices would increase from the No Action Alternative in the Northeast U.S. Continental Shelf (Northeast and VACAPES Range Complexes) and the Gulf of Mexico (Naval Surface Warfare Center, Panama City Division Testing Range) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from the use of seafloor devices.

3.10.3.2.2.3 Alternative 2 (Preferred Alternative)

Training

Under Alternative 2, the number of training activities using seafloor devices is the same as under Alternative 1 within the Northeast U.S. Continental Shelf (VACAPES Range Complex), the Southeast U.S. Continental Shelf (Navy Cherry Point and JAX Range Complexes), and the Gulf of Mexico (GOMEX Range Complex) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from the use of seafloor devices.

Testing

Under Alternative 2, the number of testing activities using seafloor devices would increase from the No Action Alternative in the Northeast U.S. Continental Shelf (Northeast and VACAPES Range Complexes) and the Gulf of Mexico (Naval Surface Warfare Center, Panama City Division Testing Range) Large Marine Ecosystems. Because measures were previously implemented to protect submerged cultural resources, no impacts on submerged prehistoric sites or submerged historic resources located in the large marine ecosystems are expected from the use of seafloor devices.

3.10.3.2.3 Regulatory Conclusions of Physical Disturbance and Strike Stressors

In accordance with Section 106 of the National Historic Preservation Act, physical stressors resulting from military expended materials and use of seafloor devices during training and testing activities would not affect submerged cultural resources in state territorial waters from the No Action Alternative, Alternative 1, and Alternative 2 because the Navy previously implemented measures to protect these resources.

3.10.4 SUMMARY OF POTENTIAL IMPACTS

3.10.4.1 Combined Impact of All Stressors

3.10.4.1.1 No Action Alternative

Training and testing activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources.

3.10.4.1.2 Alternative 1

An increase in training and testing activities occurs with Alternative 1. Training and testing activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources.

3.10.4.1.3 Alternative 2 (Preferred Alternative)

An increase in training and testing activities occurs with Alternative 2. Training and testing activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources.

3.10.4.2 Regulatory Determinations

Table 3.10-3 summarizes effects in accordance with Section 106 of the National Historic Preservation Act for the No Action Alternative, Alternative 1, and Alternative 2. Consultation with the appropriate State Historic Preservation Office will continue, as needed, for cultural resources located within state territorial waters (within 3 nm) with the exception of Texas, Puerto Rico, and Florida (Gulf coast only), which have a 9-nm limit.

Table 3.10-3: Summary of Section 106 Effects on Cultural Resources

Alternative and Stressor	Section 106 Effects
No Action Alternative	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the sea floor would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Physical Stressors	Physical stressors resulting from military expended materials and the use of seafloor devices during training and testing activities would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Regulatory Determination	***No effect would occur to submerged cultural resources because measures were previously implemented to protect these resources.***
Alternative 1	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Physical Stressors	Physical stressors resulting from military expended materials and use of seafloor devices during training and testing activities would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Regulatory Determination	***Alternative 1 contains increases in the number of training and testing activities compared with the No Action Alternative. No effect would occur to submerged cultural resources because measures were previously implemented to protect these resources.***
Alternative 2	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Physical Stressors	Physical stressors resulting from military expended materials and the use of seafloor devices during training and testing activities would not affect submerged cultural resources because measures were previously implemented to protect these resources.
Regulatory Determination	***Alternative 2 contains increases in the number of training and testing activities compared with the No Action Alternative. No effect would occur to submerged cultural resources because measures were previously implemented to protect these resources.***

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3.11 SOCIOECONOMIC RESOURCES

SOCIOECONOMIC RESOURCES SYNOPSIS

The Navy considered all potential stressors and the following have been analyzed for socioeconomic resources:

- Accessibility (availability of access on the ocean and in the air)
- Airborne acoustics (weapons firing, aircraft and vessel noise)
- Physical disturbance and strikes (aircraft, vessels and in-water devices, military expended materials)
- Secondary impacts from availability of resources

Preferred Alternative (Alternative 2)

Impacts from the Preferred Alternative would be short term and temporary. Therefore, impacts on socioeconomic resources would be negligible.

3.11.1 INTRODUCTION AND METHODS

This section provides an overview of the characteristics of socioeconomic resources in the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) and describes in general terms the methods used to analyze potential impacts on these resources from the Proposed Action.

The Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) state that when economic or social effects and natural or physical environmental effects are interrelated, the Environmental Impact Statement (EIS) will discuss these effects on the human environment (40 Code of Federal Regulations [C.F.R.] § 1508.14). The Council on Environmental Quality regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the ongoing and proposed Navy training and testing activities in the Study Area could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment might be affected. The Navy identified six broad socioeconomic elements based on their association with human activities and livelihoods in the Study Area. Each of these socioeconomic resources is an aspect of the human environment that involves economics (i.e., employment, income, or revenue) and social conditions (i.e., enjoyment and quality of life) associated with the marine environment of the Study Area. Therefore, this evaluation considered potential impacts on six elements:

- Sources for energy production and distribution (water, wind, oil and gas)
- Mineral extraction
- Commercial transportation and shipping
- Commercial and recreational fishing
- Aquaculture
- Tourism

The baseline for identifying the socioeconomic conditions in the Study Area was derived using relevant published information from sources that included federal, state, regional, and local government

agencies and databases, academic institutions, conservation organizations, technical and professional organizations, and private groups. Previous environmental studies were also reviewed for relevant information.

The alternatives were evaluated based on the potential and the degree to which training and testing activities could impact socioeconomic resources. The potential for impacts depends on the likelihood that the training and testing activities would interface with public activities or infrastructure. Factors considered in the analysis include whether there would be temporal or spatial interfaces between the public or infrastructure and Navy training and testing. If there is potential for this interface, factors considered to estimate the degree to which an exposure could impact socioeconomics include whether there could be an impact on livelihood, quality of experience, resource availability, income, or employment. If there is no expected potential for the public to interface with an activity, the impacts would be considered negligible.

3.11.2 AFFECTED ENVIRONMENT

The primary area of interest for assessing potential impacts on socioeconomic resources is the United States (U.S.) territorial waters of the east and gulf coasts (seaward of the mean high water line to 12 nautical miles [nm]). Limited socioeconomic resources outside this area of interest (i.e., U.S. Exclusive Economic Zone between 3 and 200 nm from shore) are also described when relevant to human activities. This section describes the six socioeconomic elements associated with human activities and livelihoods in the Study Area.

3.11.2.1 Sources of Energy Production and Distribution

There are three primary sources of energy production in the Study Area: water, wind, and oil and gas. Each of these activities is described in this section.

3.11.2.1.1 Water

Hydropower is derived from the force of moving water. The Federal Energy Regulatory Commission licenses hydropower projects. The Bureau of Ocean Energy Management has jurisdiction to issue leases, easements, and rights-of-way regarding hydropower projects on the outer continental shelf.

Several small-scale projects on rivers have been permitted in Maine, New Jersey, New York, and Massachusetts. A variety of academic institutions conduct research projects and do preliminary testing of water energy technology along the Atlantic coast. Their activities may include sea trials, small-scale prototype testing, and research that may use instruments like acoustic Doppler profile current sensors, digital recording sonar, underwater video, and still photography. Several wave and tidal energy projects in state waters are in the early permitting stages.

The U.S. Department of Agriculture and the U.S. Navy signed a Memorandum of Understanding in early 2010 to advance the production of renewable energy by sharing technical, program management, and financial expertise (U.S. Department of the Navy 2010). As a result, the number of water energy projects could increase. The Federal Energy Regulatory Commission has issued 15 tidal and 12 wave preliminary permits for projects on the east coast. Although a preliminary permit does not authorize construction, it allows the applicant to conduct investigations and secure data necessary to determine feasibility of the project.

The United States has no commercial offshore wave, tidal, or ocean thermal energy conversion generating capacity at this time. There are no hydropower projects operating or planned in the Study Area.

3.11.2.1.2 Wind

Wind energy is derived from the force of moving air. The United States has no offshore wind energy generating facilities at this time. *A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States* was prepared in 2011 to support development of a world-class offshore wind industry in the United States (U.S. Department of Energy and U.S. Department of Interior 2011). The Bureau of Ocean Energy Management developed a regulatory framework to review proposed offshore wind projects in federal waters and launched the "Smart from the Start" initiative to facilitate siting, leasing, and construction of new projects (Bureau of Ocean Energy Management 2013a). In general, this process includes the following steps:

- Wind energy areas that appear most suitable for wind energy development are identified.
- Requests for interest and calls for information are issued for new wind energy areas to support lease sale environmental assessments.
- Environmental assessments are completed for the wind energy areas, allowing the lease sale process to move forward.
- A lease sale is held. Issuance of a commercial lease gives the lessee the exclusive right to subsequently seek Bureau of Ocean Energy Management approval for development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the leased area to gather resource and site characterization information and develop plans, which must be approved by the Bureau of Ocean Energy Management before the lessee can move on to the next stage of the process.
- Project-specific NEPA review (typically an EIS) is conducted, and plans for construction and operation are approved before beginning construction of individual wind power facilities.

Two wind energy projects, Cape Wind Energy and Fishermen's Atlantic City Windfarm, have been approved within the Study Area, but construction had not started as of March 2013. The 2011 and 2012 initiatives to speed offshore wind energy development off the Atlantic coast include activities in the following states:

- Maine (requests for leasing and notice of intent to prepare an EIS)
- Massachusetts (approval of the Cape Wind Energy Project and preparation of an environmental assessment for designating a wind energy area)
- Rhode Island (preparation of an environmental assessment for designating a wind energy area and notice of a proposed lease sale)
- New Jersey (issuance of interim policy leases and approval of the Fishermen's Atlantic City Windfarm)
- Delaware (executed a lease with Bluewater Wind Delaware)
- Maryland (call for information and nominations)
- Virginia (proposed lease sale notice)
- North Carolina (call for information and nominations)
- Georgia (submittal of an interim policy lease application and publication of a notice of intent to prepare an environmental assessment)
- Florida (preparation of an environmental assessment for an interim policy lease)

3.11.2.1.3 Oil and Gas

The Bureau of Ocean Energy Management administers Outer Continental Shelf Oil and Gas Leasing Programs. As of 1 April 2011, there were 6,323 active oil and gas leases totaling 33,905,799 acres in the Gulf of Mexico Continental Shelf Oil Region (Western Planning Area, 1,403 leases and 7,889,290 acres leased; Central Planning Area, 4,805 leases and 25,397,566 acres leased; and Eastern Planning Area, 115 leases and 618,944 acres leased) (Bureau of Ocean Energy Management 2011). Oil and gas exploration and production may occur in these areas of the Gulf of Mexico (Figures 3.11-1 and 3.11-2).

As a result of the lessons learned from the *Deepwater Horizon* oil spill, areas in the eastern Gulf of Mexico subject to the congressional moratorium on oil and gas exploration and production activities will not be considered for potential leasing before 2017. In addition, the Mid- and South Atlantic Planning Areas are no longer under consideration for potential development through 2017. The western, central, and eastern (portion not under the moratorium) Gulf of Mexico will continue to be considered for potential leasing before 2017 (U.S. Department of the Interior 2010).

Drilling for oil and gas has taken place in offshore Canadian Atlantic waters since 1967; however, Canada has imposed a moratorium on drilling in the Canadian portion of the Georges Bank until 31 December 2012 (Canadian Broadcasting Corporation 2008; Government of Nova Scotia 1999). Gas was discovered on the Sable Offshore Energy project offshore Nova Scotia in 1971; natural gas production began in 2000 and is continuing. The Sable project platforms are on the Scotian Shelf, approximately 124.3 mi. (200 km) off the coast of Nova Scotia. Gas production at this offshore location is accomplished with an undersea, offshore pipeline to link the production wells with gas markets. In 2010, the Sable Offshore Energy Project averaged daily production of approximately 300 million cubic feet ($ft.^3$) (0.849 million cubic meters [m^3]) of natural gas and 14,000 barrels of liquids (ExxonMobil 2011).

The Gulf of Mexico is the only part of the Study Area that contains energy production from oil and gas in U.S. territorial waters. Approximately 90 percent of all outer continental shelf leases are in the Gulf of Mexico. Louisiana produces more than 80 percent of the total United States' outer continental shelf oil and approximately 80 percent of the total United States' outer continental shelf natural gas (National Ocean Economics Program 2011b).

3.11.2.2 Mineral Extraction

Extraction of minerals along the Atlantic and Gulf coasts involves primarily hard minerals (e.g., sand, gravel, and other minerals) extracted from the outer continental shelf. The Bureau of Ocean Energy Management is responsible for assessing the United States' outer continental shelf resources to determine if they can be developed in an environmentally sound manner. If these areas are leased, the Bureau of Ocean Energy Management regulates their activities to protect the environment and ensure safety of personnel and the public (Bureau of Ocean Energy Management 2013b).

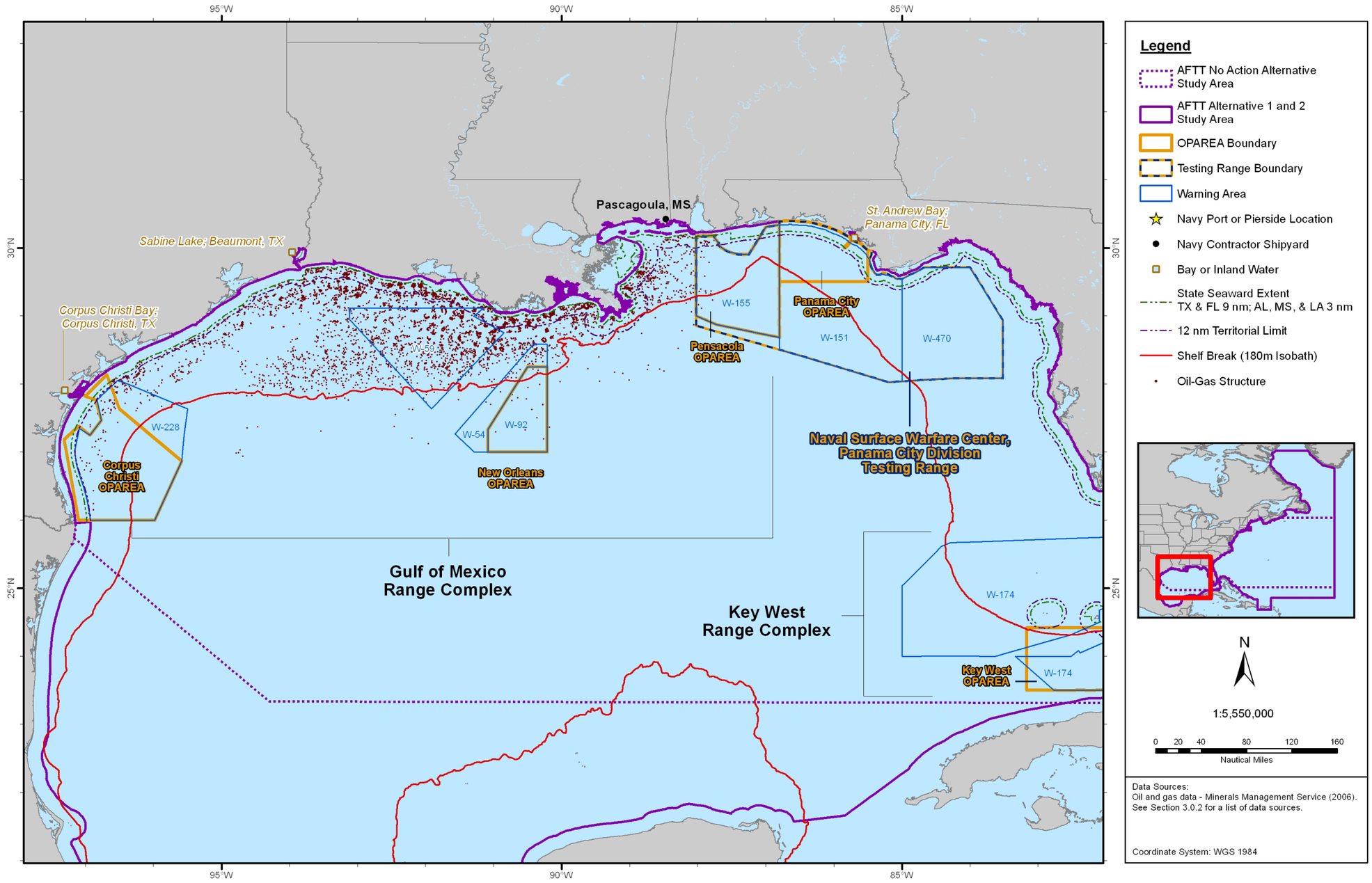

Figure 3.11-1: Oil and Gas Structures in the Gulf of Mexico

AFTT: Atlantic Fleet Training and Testing; AL: Alabama; FL: Florida; LA: Louisiana; m: meter; MS: Mississippi; nm: nautical mile; OPAREA: Operating Area; TX: Texas

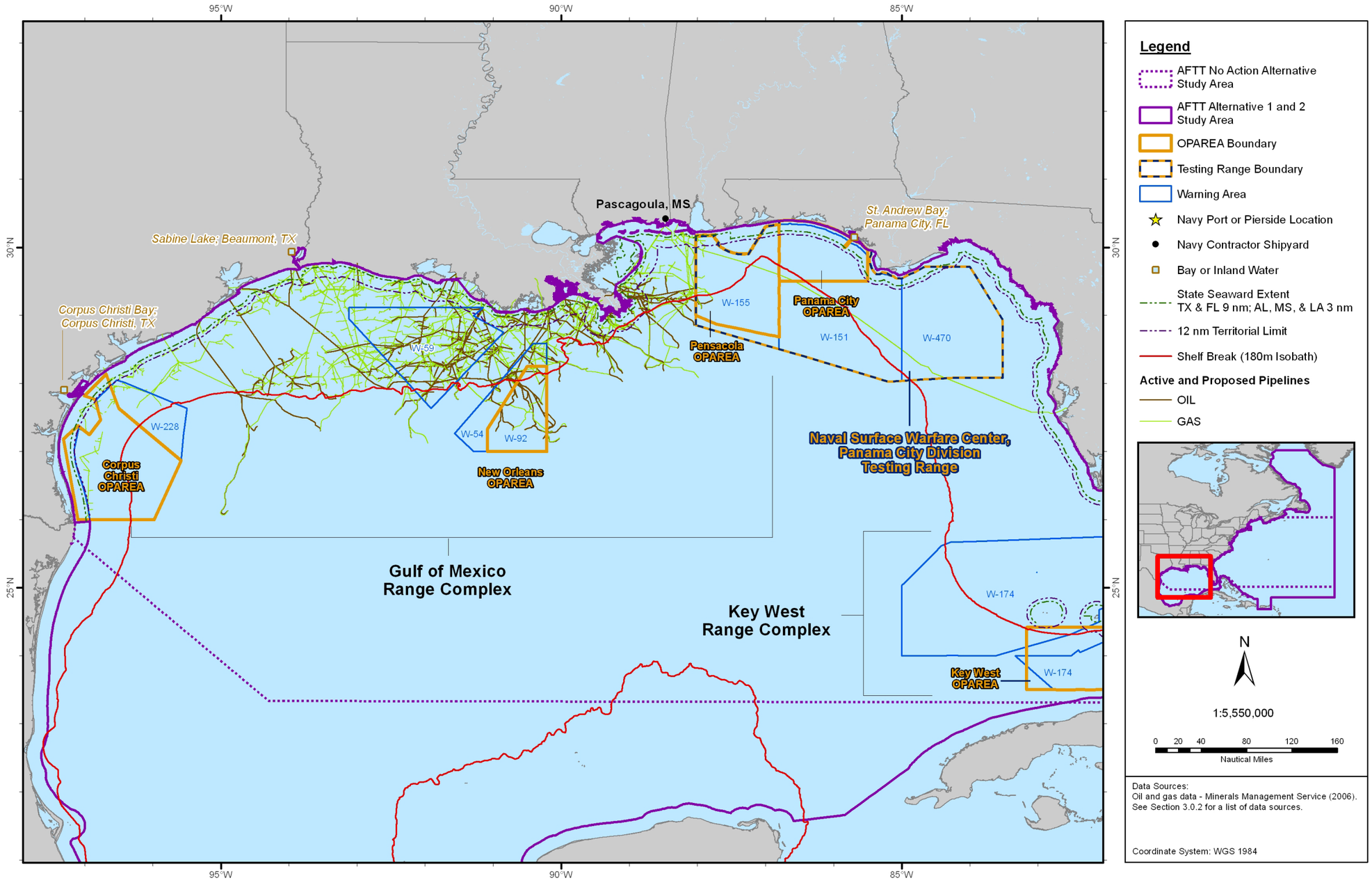

Figure 3.11-2: Active and Proposed Oil and Gas Pipelines in the Gulf of Mexico

AFTT: Atlantic Fleet Training and Testing; AL: Alabama; FL: Florida; LA: Louisiana; m: meter; MS: Mississippi; nm: nautical mile; OPAREA: Operating Area; TX: Texas

Two types of lease conveyances for sand and gravel and other nonenergy minerals are used by the Bureau of Ocean Energy Management: 1) noncompetitive negotiated agreements, which can only be used for public works projects funded by federal, state, or local government agencies, and 2) competitive lease sales, for which any qualified person may submit a bid. Corresponding documentation is required for review of each lease request. The recent (2009-2012) marine mineral projects (Bureau of Ocean Energy Management 2013c) include the following state leases:

- Virginia (Dam Neck, Sandbridge, and Wallops Flight Facility)
- North Carolina (Bogue Banks)
- South Carolina (Charleston Offshore Dredged Material Disposal Site Sand Borrow Project)
- Florida (Patrick Air Force Base, Longboat Key, Martin County, Pinellas County, Duval County, and Brevard South Reach)
- Louisiana (Caminada Headlands, Cameron Parish, and Raccoon Island Phase B)

3.11.2.3 Commercial Transportation and Shipping

Commercial transportation and shipping encompasses marine and air traffic within the Study Area. Military use of the offshore sea and air areas is generally compatible with civilian use, with Navy ships accounting for 3 percent of the total ship presence out to 200 nm (Center for Naval Analyses 2001). U.S. Navy vessels and aircraft that conduct activities not compatible with commercial or recreational transportation (e.g., weapons firing) typically occur in operating areas (OPAREAs) away from commercially used waterways and inside Special Use Airspace, as described in Section 3.11.2.3.2 (Air Transportation) as well as in transit and on testing ranges. Activities are communicated to vessel and aircraft operators by use of Notices to Mariners issued by the U.S. Coast Guard and Notices to Airmen issued by the Federal Aviation Administration. The Navy procedures for planning and management of activities are provided in the Chief of Naval Operations Instruction 3770.2K, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy 2007). Scheduling and planning procedures for activities on range complexes (including testing activities in the Northeast Range Complexes) are issued through the Navy's Fleet Area Control and Surveillance Facilities Virginia Capes (U.S. Department of the Navy 2011b) and Jacksonville (U.S. Department of the Navy 2011a). Testing ranges have their own procedures for aviation safety, such as the Naval Surface Warfare Center, Panama City Division Instruction (U.S. Department of the Navy 2008) and Naval Undersea Warfare Center Division, Newport Instruction (U.S. Department of the Navy 2009).

3.11.2.3.1 Ocean Transportation

Most of the waterways in the Study Area are accessible to commercial vessels; however, some areas are restricted. These restrictions can be permanent or temporary. The National Oceanic and Atmospheric Administration issues nautical charts that reflect designated restricted zones. In accordance with Title 33 C.F.R. Part 72, the U.S. Coast Guard and Department of Homeland Security publish marine information pertaining to waterways (i.e., danger zones and restricted areas; see Section 3.11.3.1 [Accessibility] for a description of these areas). Notices to Mariners provide information to private and commercial vessels on temporary closures. These navigational warnings are disseminated by broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and global positioning system navigation charts. They provide information about duration and location of closures due to activities that are potentially detrimental to surface vessels. Vessels are responsible for being aware of designated danger areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard.

The east coast of the United States and the Gulf of Mexico are heavily traveled by marine vessels, with several commercial ports near U.S. Navy OPAREAs, as shown on Figure 3.11-3. Commercially used shipping lanes traverse the range complexes but, as referenced above, vessels are responsible for being aware of any temporary closures. Traffic flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible.

Recreational boats use ranges throughout the coastal waters, depending on season and weather conditions. There are over 12 million registered recreational boats in the United States. Recreational vessels registered in the 18 coastal states within the Study Area account for approximately 41 percent of this total (U.S. Department of Homeland Security 2008).

Sections 3.11.2.3.1.1 (Northeast Range Complexes) through 3.11.2.3.1.12 (Pierside Locations [Gulf of Mexico]) provide more detailed information on and accessibility to ocean transportation within the Study Area.

3.11.2.3.1.1 Northeast Range Complexes

The Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA are referred to collectively as the Northeast Range Complexes. These range complexes include Special Use Airspace with associated warning areas and surface and subsurface sea space of the Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA. A portion of the CGULL OPAREA also overlaps the Narragansett Bay OPAREA.

Military Ocean Traffic

The Fleet Forces Atlantic Coordination Center is responsible for coordinating OPAREA training assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, Large Area Tracking Range, and electronic attack. Testing activities are conducted in accordance with Narragansett Bay Shallow Water Test Facility Instruction 8590.1E (U.S. Department of the Navy 2009). The Fleet Forces Atlantic Coordination Center coordinates with all Department of Defense (DoD), government, and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services.

Civilian Ocean Traffic

The northeastern Atlantic coast of the United States has some of the busiest shipping lanes in the world, and a large volume of ship traffic transits the area. Maritime traffic includes ships traveling within New England and mid-Atlantic ports in the United States, as well as traffic to eastern Canada and the eastern Atlantic Ocean. Commercial (domestic and international) shipping constitutes the majority of this traffic while commercial ferries operate from every coastal state from Maine to Maryland, with the exception of New Hampshire. One primary shipping lane is off northern New England, with many arteries leading to ports in Massachusetts, New Hampshire, and Maine. The majority of the eastern portion of the Boston OPAREA is free from commercial traffic, but commercial traffic can be expected in the western part of the OPAREA. Several primary shipping lanes crisscross the Narragansett Bay OPAREA, leading to the major ports of New York City, New York; Newark, New Jersey; and Providence, Rhode Island. Similarly, the Atlantic City OPAREA contains several primary shipping lanes leading from New York City and Newark to ports in Delaware Bay and the mid-Atlantic United States. It is, therefore, highly likely that commercial ship traffic would be encountered throughout the greater part of all the northeastern OPAREAs. Approximately 15 shipping lanes exist in this area, with the same representative routes as the northeastern United States, including the Atlantic-Puerto Rico Access and the Atlantic-Panama Access.

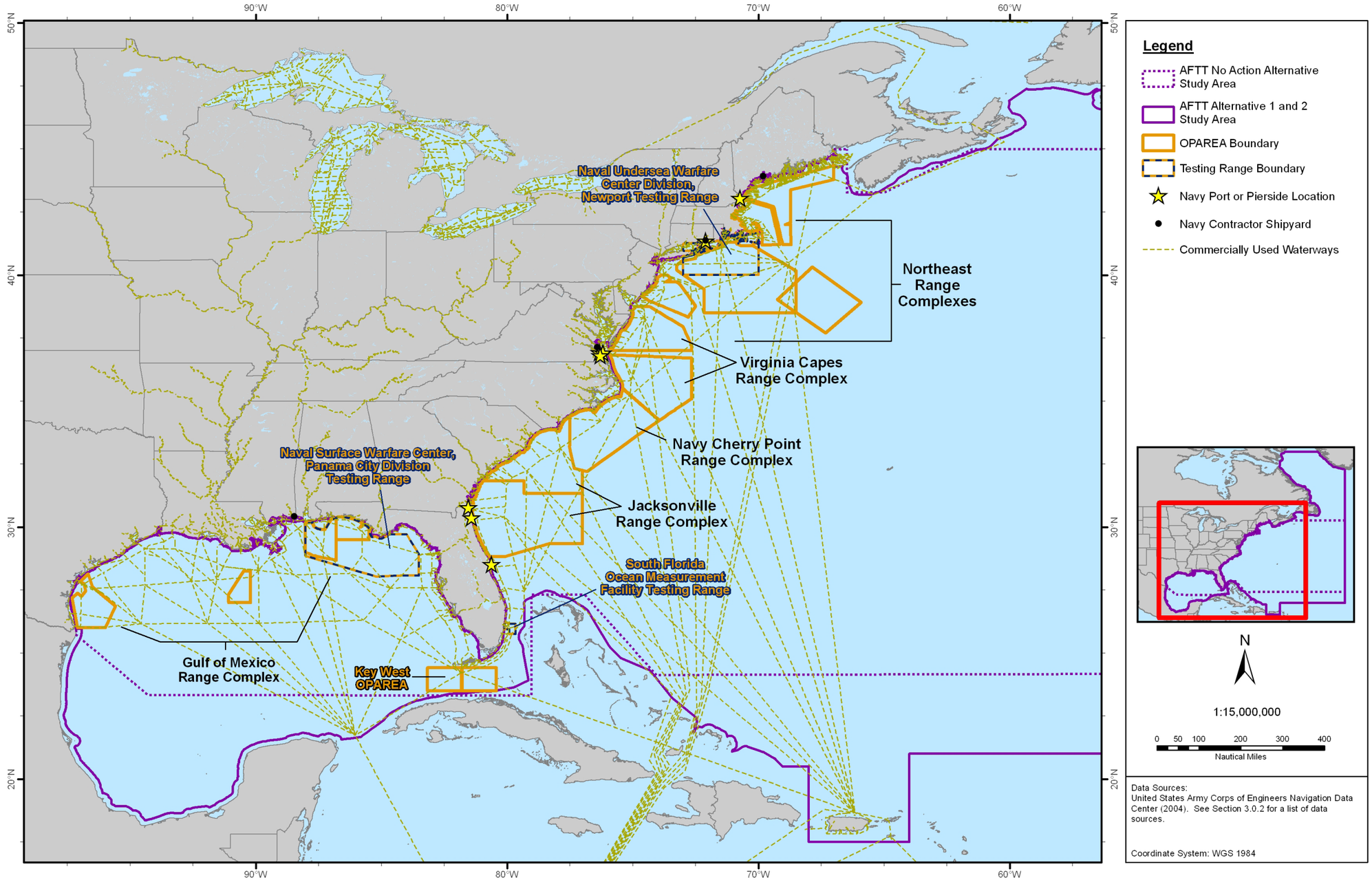

Figure 3.11-3: Commercially Used Waterways in the Study Area
AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

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Some of the largest ports in the United States are near the northeastern OPAREAs. The port complex of New York City/Newark is ranked third in total trade in the United States, while New England's largest port, Boston, is ranked thirty-fourth in total trade in the United States, as determined by the American Association of Port Authorities (2009). The port complex of New York City/Newark has more scheduled services to a wider variety of trade lanes than any other port in North America. This port complex is the leading container volume gateway on the east coast of the United States. Since Halifax, Canada, is closer to northern Europe than any other major North American port, the complex is frequently used as the first inbound port or last outbound port in North America. The Boston port is rapidly becoming one of the fastest growing high-end cruise ship markets in the country.

Recreational boating off the northeastern Atlantic coast takes place from Maine to Maryland. Many sites known as fishing hotspots attract both recreational fishers and divers depending on the species and season of the year. Sales generated by recreational fishing in these nine coastal states, while mostly related to expenditures on durable fishing equipment, account for over $5.5 billion. These fishing hotspots and other dive sites (including artificial reefs and shipwrecks) are used throughout the year by recreational vessels, but use is highest during the summer. Most recreational boating occurs within a few miles of shore, while U.S. Navy activities normally occur farther offshore. The U.S. Navy would typically conduct exercises in and beyond federal waters, not in nearshore state waters, where recreational boaters could be present.

Many popular dive sites are located at the mouth of Massachusetts Bay within the Gerry E. Studds Stellwagen Bank National Marine Sanctuary. The 638-nm^2 marine sanctuary also offers several submerged shipwrecks (National Oceanic and Atmospheric Administration 2010a).

3.11.2.3.1.2 Naval Undersea Warfare Center Division, Newport Testing Range

The Naval Undersea Warfare Center Division, Newport Testing Range includes the waters of Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, and Long Island Sound. Three restricted areas are within the Naval Undersea Warfare Center Division, Newport Testing Range:

- The Coddington Cove restricted area (adjacent to Naval Undersea Warfare Center Division, Newport Testing Range) provides an area with piers and ships representative of a working harbor area for harbor/swimmer defense type testing.
- The Narragansett Bay Restricted Area (6.1-nm^2 area surrounding Gould Island) includes the Hole Test Area, which provides a deepwater test capability, and the Gould Island Acoustic Communications and Tracking Range, an undersea range, within the boundaries of the North Test Area.
- The Rhode Island Sound Restricted Area is a rectangular box (27.2 nm^2) in Rhode Island and Block Island Sounds.

3.11.2.3.1.3 Virginia Capes Range Complex

Military Ocean Traffic

The VACAPES OPAREA covers approximately 27,661 nm^2 of sea space off the coast of Delaware, Maryland, Virginia, and North Carolina. About 70 surface ships and submarines are homeported in Norfolk, Virginia. The Fleet Forces Atlantic Coordination Center is responsible for coordinating training OPAREA assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, Large Area Tracking Range, and electronic attack. The Fleet Forces Atlantic Coordination Center coordinates with all

DoD, government, and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services. The Fleet Area Control and Surveillance Facility, Virginia Capes has authority to coordinate services and firing notices, issue weekly target and OPAREA schedules, and prescribe necessary additional regulations governing matters within the VACAPES Range Complex.

Civilian Ocean Traffic

Ships transiting the lower Chesapeake Bay area follow two primary commercially used shipping lanes: the Thimble Shoals Channel, which leads to Hampton Roads, and the Chesapeake Channel, which leads to points north, including the Port of Baltimore. These two channels pass over the underwater (tunnel) sections of the Chesapeake Bay Bridge-Tunnel system. The Chesapeake Bay Bridge-Tunnel crosses the mouth of Chesapeake Bay and connects the City of Virginia Beach to Cape Charles on the Eastern Shore.

The nearshore areas of the VACAPES OPAREA, in particular, are heavily traveled because they are near commercial ports in both Delaware and Virginia. Commercial ferries operate off the shores of Delaware, Maryland, Virginia and North Carolina. The lower Chesapeake Bay is home to the Port of Virginia in Norfolk, Virginia, the third busiest port facility on the east coast. In 2005, the port accommodated nearly 16 million short tons of imports and exports, amounting to 20 percent of the total of east coast maritime trade. The port handled 2,815 vessel calls, an average of about seven per day.

Recreational transportation activities offshore consist of game and sport fishing, charter boat fishing, sport diving, water skiing, swimming, dolphin and whale watching, sailing, and power cruising. The seven coastal states from Delaware to Florida maintained 2.6 million registered boats in 2008 (U.S. Department of Homeland Security 2008).

3.11.2.3.1.4 Pierside Locations (mid-Atlantic area)

Military Pierside Locations

Eight pierside locations in the mid-Atlantic area are considered in this EIS/Overseas Environmental Impact Statement (OEIS). The pierside locations are the Navy-contractor shipyard in Bath, Maine; Portsmouth Naval Shipyard in Kittery, Maine; the Navy-contractor shipyard and the Naval submarine base in Groton, Connecticut; the Navy-contractor shipyard in Newport News, Virginia; Naval Station Norfolk, Norfolk, Virginia; Joint Expeditionary Base Little Creek-Fort Story, Virginia Beach, Virginia; and Norfolk Naval Shipyard, Portsmouth, Virginia.

The shipyard in Bath, Maine, is on the Kennebec River approximately 12 mi. (19 km) above the mouth of the river in southern Maine. There is little waterborne traffic to Bath except barge traffic to the shipyard and vessels bound for repairs. Some fish carriers travel to a cannery north of Bath (Marine World Database 2009). The U.S. Coast Guard established a 150-yard (48-m) radius safety zone around the dry dock associated with the contractor facility. The safety radius is only activated when the dry dock is deployed in its dredged basin hole near the center of the Kennebec River (U.S. Department of Homeland Security 2002).

The Portsmouth Naval Shipyard in Kittery, Maine, is on Seavey Island in Portsmouth Harbor on the Piscataqua River. On average, 5 million metric tons of cargo transit the Piscataqua River annually. This cargo includes petroleum fuels and oils, gypsum, salt, asphalt, fiber optic telecommunications cable, and road salt. The primary mission of the Portsmouth Naval Shipyard is the overhaul, repair, and modernization of *Los Angeles* class submarines. Military ocean traffic is composed of submarines entering and leaving the facility for maintenance.

The Navy-contractor shipyard and the Naval Submarine Base New London in Groton, Connecticut, are on the Thames River, a short river and tidal estuary stretching 15 mi. (24 km) and emptying in the New London Harbor and Long Island Sound. Military ocean traffic is from vessels traveling to and from the shipyard and the Naval Submarine Base. The U.S. Coast Guard operates a cutter and miscellaneous small craft in the Thames River and New London Harbor. Recreational boating, fishing vessels and ferry services also use the Thames River. Hess Oil operates a privately-owned dock that supports oil and chemical barges.

The Navy-contractor shipyard in Newport News, Virginia, designs, builds, and refuels the U.S. Navy's nuclear-powered aircraft carriers and is one of two facilities within the United States that design and build nuclear-powered submarines. The shipyard is situated along 2 mi. (3.2 km) of the James River, a tributary of the Chesapeake Bay.

Naval Station Norfolk, the largest naval complex in the world, supports the operational readiness of the U.S. Atlantic Fleet. Situated at the mouth of the Chesapeake Bay, this naval station is homeport to more than 70 surface and subsurface vessels. Joint Expeditionary Base Little Creek–Fort Story is used as a cantonment area and for outdoor training; it is also at the mouth of the Chesapeake Bay, seven miles east of Naval Station Norfolk. Joint Expeditionary Base West (Little Creek) is homeport to a variety of surface vessels. The Norfolk Naval Shipyard, situated along the Elizabeth River, is one of the largest shipyards in the world. It has the ability to overhaul and repair any ship in the U.S. Fleet. The shipyard also repairs, overhauls, and modernizes various submarine classes.

Civilian Pierside Locations

The Port of Virginia operates the Norfolk International Terminals, Portsmouth Marine Terminal, and Newport News Marine Terminal. The Port of Virginia had 1,758 ship calls, transported 992,543 container units, and moved 14,908,490 short tons of cargo in 2009 (Virginia Port Authority 2010). Norfolk also offers cruise line and ferry services and is a port of call for several other cruise ships.

3.11.2.3.1.5 Navy Cherry Point Range Complex

Military Ocean Traffic

The Cherry Point OPAREA sea space covers 18,617 nm² off the east coasts of North Carolina and South Carolina. The Fleet Forces Atlantic Coordination Center is responsible for coordinating training OPAREA assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, Large Area Tracking Range, and electronic attack. The Fleet Forces Atlantic Coordination Center coordinates with all DoD, government, and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services. The Fleet Area Control and Surveillance Facility, Virginia Capes has authority to coordinate services and firing notices, issue weekly target and OPAREA schedules, and prescribe necessary additional regulations governing matters within the Navy Cherry Point Range Complex.

Civilian Ocean Traffic

The southeast coast of the United States is heavily traveled by marine vessels, with several commercial ports near U.S. Navy OPAREAs like Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; and Jacksonville, Florida. Recreational boats range throughout the coastal waters, depending on season and weather conditions. North Carolina has 371,879 registered recreational boats and is ranked 11th nationwide (U.S. Department of Homeland Security 2008). There are 185 water access areas along the North Carolina coast (North Carolina Wildlife Resources Commission 2011).

Travel between the most popular cruising destinations in the area does not require traversing the OPAREA; however, larger recreational vessels, in particular sailboats and motor cruisers in the 50-ft. (15-m) and larger class, travel considerable distances offshore.

Recreational dive vessels travel to shipwrecks that provide habitat suitable for development of artificial reefs and are popular destinations for divers. Divers frequent the Cape Hatteras offshore area because of its volume of artificial reefs provided by shipwrecks (Dive Hatteras 2003). Billed as the "Graveyard of the Atlantic," the waters of North Carolina, especially Cape Lookout, Cape Fear, Cape Hatteras, and Oregon Inlet, offer many opportunities for wreck diving (Thomas 2011). For information on shipwrecks within the OPAREAs, see Section 3.10 (Cultural Resources).

The Monitor National Marine Sanctuary is a dive site approximately 16 miles (26 km) south-southeast of Cape Hatteras, North Carolina. This sanctuary was established in 1975 to protect the remains of the U.S.S. Monitor. Maritime archaeological expeditions are conducted in the summer, and public diving at this site is available by permit. Waters surrounding the sanctuary are known as the Graveyard of the Atlantic and contain thousands of other shipwrecks (National Oceanic and Atmospheric Administration 2010a).

3.11.2.3.1.6 Jacksonville Range Complex

Military Ocean Traffic

The JAX and Charleston OPAREAs, within the JAX Range Complex, cover 50,068 nm² of sea space off the coasts of North Carolina, South Carolina, Georgia, and Florida. The Fleet Forces Atlantic Coordination Center is responsible for coordinating training OPAREA assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, the Large Area Tracking Range system, and electronic attack. The Fleet Forces Atlantic Coordination Center coordinates with all DoD, government, and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services. The Fleet Area Control and Surveillance Facility, Jacksonville has authority to coordinate services and firing notices, issue weekly target and OPAREA schedules, and prescribe necessary additional regulations governing matters within the JAX Range Complex.

Civilian Ocean Traffic

The nearshore areas of the JAX Range Complex, near the Jacksonville commercial port in particular, are heavily traveled. Recreational activities consist primarily of motorboating, game and sport fishing, jetskiing, waterskiing, shellfishing, shrimping, sailing, sport diving, and bird and whale watching. Recreational boats range throughout the coastal waters, depending on season and weather conditions. A commercial ferry crosses the St. Johns River between Mayport, Florida, and Fort George Island, Florida.

Popular sport diving sites within the range complex consist of natural and artificial reefs. Off the South Carolina coast, these include shipwrecks (with about 30 wrecks in the Charleston OPAREA), as well as artificial and natural reefs. Popular shipwreck and submerged artificial reefs can be found at various depths from 13 to over 30 m (43 to 98 ft.) of water, both close to shore and at farther distances (Coastal Scuba 2007). One of the most popular dive sites off the Georgia coast is Gray's Reef. The area is one of the largest nearshore live-bottom reefs of the southeastern United States (National Oceanic and Atmospheric Administration 2010a). The associated Gray's Reef National Marine Sanctuary, which is used little by divers because of depth, strong current, and frequent turbidity, is 17.5 nm off Sapelo Island, Georgia, and encompasses 17 nm² of live-bottom habitat. Divers access the reef from numerous

facilities between Savannah and Brunswick, Georgia (National Oceanic and Atmospheric Administration 2006).

3.11.2.3.1.7 South Florida Ocean Measurement Facility Testing Range

The Naval Surface Warfare Center Carderock Division, South Florida Ocean Measurement Facility operates an offshore testing area in support of various Navy and non-Navy programs. The South Florida Ocean Measurement Facility Testing Range is adjacent to the Port Everglades entrance channel in Fort Lauderdale, Florida. This test area includes an extensive cable field within a restricted anchorage area, as well as two designated submarine operating areas.

The South Florida Ocean Measurement Facility Testing Range does not include identified Special Use Airspace. The airspace adjacent to South Florida Ocean Measurement Facility Testing Range is managed by the Fort Lauderdale International Airport. Air operations at the South Florida Ocean Measurement Facility Testing Range are coordinated with Fort Lauderdale International Airport by the air units involved in the test events.

3.11.2.3.1.8 Key West Range Complex

Military Ocean Traffic

The Key West OPAREA is 8,288 nm² of offshore surface and subsurface area south of Key West, Florida within the Straits of Florida between the United States and Cuba. Because the Key West Range Complex is offshore of mainland areas, air and boat travel are possible within the range complex. Commander, Submarine Force, U.S. Atlantic Fleet, is the Submarine Operations Control Authority for the Eastern Seaboard and, as such, controls all water-space management and prevention of mutual interference for subsurface activities in the Key West Range Complex (U.S. Department of the Navy 2005). Units are required to obtain clearance for all hazardous or exclusive activities within the OPAREA from the Commanding Officer, Naval Air Station Key West.

Within the Key West OPAREA and warning areas, all units conducting firing or other hazardous activity must comply with Section 8, Chapter 1 of the U.S. Atlantic Fleet Instruction Manual 3120.26 and all Fleet Exercise Publications. Officers in charge of exercises are not permitted to fire ordnance or jettison aerial targets unless the area is confirmed to be clear of nonparticipating civilian and military units (U.S. Department of the Navy 2005). Naval Air Station Key West issues Notices to Mariners and Notices to Airmen, as applicable.

Civilian Ocean Traffic

Commercial and recreational boat traffic is common throughout the Florida Keys and the Gulf of Mexico. Cruise ships have regular routes in the area, and commercial fishing boats use this area frequently. Commercial ferries cross the Florida Straits between Key West, Florida, and Dry Tortugas National Park, Florida. Additionally, dive and tourist boats cruise the waters and take visitors to the Dry Tortugas National Park.

Large cargo ships, including tankers and dry cargo carriers, cruise ships, fishing vessels, recreational vessels, and research vessels, operate in the Straits of Florida. Most of the cargo and cruise ships are foreign-flagged vessels, while the majority of recreational, fishing, and research vessels are domestic. Historically, the Straits of Florida have been the access route for all ships entering the Gulf of Mexico and those transiting from the north and east to the Panama Canal, making the Florida Straits one of the most heavily trafficked areas in the world (Roberts 2007). According to the International Maritime

Organization, approximately 8,000 large cargo ships and several hundred cruise ships transit the area on an annual basis (International Maritime Organization 2010).

In 2002, the Florida Keys National Marine Sanctuary and surrounding waters were designated a Particularly Sensitive Sea Area under the International Maritime Organization (International Maritime Organization 2010). As a result of this designation, some restrictions have been imposed on commercial maritime transit through the Straits of Florida. Commercial maritime vessels may be required to transit farther out to sea and within the boundaries of the Key West Range Complex.

3.11.2.3.1.9 Pierside Locations (Southeast Atlantic Area)

Three pierside locations in the southeast Atlantic area are considered in this EIS/OEIS: Naval Submarine Base Kings Bay, Kings Bay, Georgia; Naval Station Mayport, Jacksonville, Florida; and Port Canaveral, Port Canaveral, Florida.

Located near the mouth of the St. Mary's River in Cumberland Sound, Naval Submarine Base Kings Bay is the east coast home to the Trident nuclear power submarines. Kings Bay is approximately 30 mi. (48.3 km) from both the Port of Brunswick, Georgia, and the Port of Jacksonville, Florida. Traffic in the Cumberland Sound is primarily recreational boats, and some of the marine traffic in the area is submarine traffic to and from the Naval Submarine Base Kings Bay.

Naval Station Mayport is located where the St. Johns River meets the Atlantic Ocean. This facility is home to 22 U.S. Navy ships and can accommodate 34 ships in its harbor. The St. Johns River supports heavy recreational and commercial traffic, and it provides the Port of Jacksonville access to the Atlantic Ocean. Cruise lines offer passenger cruise service from the Port of Jacksonville to the Caribbean.

Port Canaveral is the second busiest port in the world for multiday passenger cruises, with six terminals exclusively for cruise passenger use. Commercial cargo traffic moved over 2.5 million short tons of cargo in 2009 (Canaveral Port Authority 2010). The port is shared with the Navy, which uses Trident Wharf and Poseidon Wharf to service U.S. Navy submarines.

3.11.2.3.1.10 Naval Surface Warfare Center, Panama City Division Testing Range

The Naval Surface Warfare Center, Panama City Division Testing Range is located off the panhandle of Florida and Alabama, extending from the shoreline to 120 nm seaward, and includes St. Andrew Bay. Special Use Airspace associated with Naval Surface Warfare Center, Panama City Division Testing Range includes warning areas overlying and east of the Pensacola and the Panama City OPAREAs. The warning areas include W-151, W-155, and W-470. This testing range includes the sea space within the Gulf of Mexico from the mean high tide line to 120 nm offshore.

3.11.2.3.1.11 Gulf of Mexico Range Complex

Military Ocean Traffic

The OPAREAs associated with the Gulf of Mexico (GOMEX) Range Complex, including the Panama City, Pensacola, New Orleans, and Corpus Christi OPAREAs cover 17,520 nm² of ocean. The Fleet Forces Atlantic Coordination Center is responsible for coordinating training OPAREA assignments, ranges, airspace, mobile sea range assets, fixed and mobile targets, Large Area Tracking Range, and electronic attack. The Fleet Forces Atlantic Coordination Center coordinates with all DoD, government, and civilian agencies to ensure compliance with all requirements and regulations for the safe use of ranges, assets, and services. The Fleet Area Control and Surveillance Facility, Jacksonville has authority to coordinate services and firing notices, issue weekly target and OPAREA schedules, and prescribe necessary

additional regulations governing matters within the GOMEX Range Complex. The scheduling authority issues Notices to Mariners and Notices to Airmen, as applicable. Through close coordination, controlling authorities ensure that hazardous activities are carefully scheduled to avoid conflicts with civilian activities and that safety standards are maintained while allowing the maximum amount of civilian access to airspace and sea space.

Civilian Ocean Traffic

The Gulf of Mexico is heavily traveled by marine vessels, with several commercial ports near U.S. Navy OPAREAs. Two major ports within the GOMEX Range Complex, Corpus Christi and New Orleans, were ranked in the top 10 U.S. ports by tonnage (Research and Innovative Technology Administration 2009). Recreation activities offshore consist of game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, and other recreational boating activities. Commercial ferries operate off the shores of Texas (Corpus Christi and Galveston), Louisiana (Cameron), Mississippi (Ship Island and Gulfport), and Alabama (Dauphin Island and Fort Morgan).

Popular sport diving sites within the area consist of natural and artificial reefs, including shipwrecks. In 1999, an estimated 83,780 dive trips occurred offshore between Texas and Alabama (Heitt and Milon 2002). A popular diving destination in the Gulf of Mexico is the Flower Garden Banks National Marine Sanctuary, which consists of the East and West Flower Garden Banks and Stetson Bank. The sanctuaries are approximately 130 mi. (209 km) northeast of the Corpus Christi OPAREA and approximately 190 mi. (306 km) west of the New Orleans OPAREA.

3.11.2.3.1.12 Pierside Locations (Gulf of Mexico)

One pierside location in the Gulf of Mexico is considered in this EIS/OEIS. The Navy-contractor shipyard in Pascagoula, Mississippi, is strategically located where the Pascagoula River flows into the Mississippi Sound. Construction services for surface combatants, amphibious assault and transport, U.S. Coast Guard cutters, and fleet support occur at this shipyard. Port of Pascagoula, at the mouth of the Pascagoula River, is the largest seaport in Mississippi and handles over 35 million tons of cargo annually (Jackson County Port Authority 2010).

3.11.2.3.2 Air Transportation

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft; however, like waterways, some areas are temporarily off limits to civilian and commercial use. The Federal Aviation Administration has established Special Use Airspace that refers to airspace of defined dimensions wherein activities must be confined because of their nature or in which limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration Order 7400.8). Special Use Airspace in the Study Area includes the following:

- Restricted Airspace: Areas where aircraft are subject to restriction due to the existence of unusual (often invisible) hazards to aircraft (e.g., release of ordnance). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies.
- Military Operations Area: Areas typically below 18,000 ft. used to separate or segregate certain nonhazardous military flight activities from instrument flight rules traffic and to identify visual flight rules traffic where these activities are conducted.
- Warning Area: Areas of defined dimensions, extending from 3 nm outward from the coast of the United States that serve to warn nonparticipating aircraft of potential danger.

- Air Traffic Controlled Assigned Airspace: Airspace that is Federal Aviation Administration-defined and is not over an existing OPAREA. This airspace is used to contain specified activities, such as military flight training, that are segregated from other instrument flight rules air traffic.

Notices to Airmen are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route or at a specific location. The Federal Aviation Administration issues Notices to Airmen to disseminate information on upcoming or ongoing military exercises with resulting airspace restrictions. Civilian aircraft operators are responsible for being aware of restricted areas in airspace and any Notices to Airmen in effect. Pilots have a duty to abide by aviation rules as administered by the Federal Aviation Administration.

Fleet Area Control and Surveillance Facilities, Virginia Capes and Jacksonville provide instruction for training activities involving military air operations (including Naval Air Systems Command testing activities). Naval Surface Warfare Center, Panama City Division Testing Range and Naval Undersea Warfare Center Division, Newport Testing Range instructions provide guidance for testing activities, including air operations. The Federal Aviation Administration has established Special Use Airspace (Chapter 2, Description of Proposed Action and Alternatives) overlying the Study Area for military activities (i.e., restricted airspace and warning areas).

The Federal Aviation Administration has established commercial air corridors for commercial traffic. The use of commercial air corridors, along with the use of Notices to Airmen, provides for safe and efficient air traffic control.

3.11.2.4 Commercial and Recreational Fishing

3.11.2.4.1 Commercial Fishing

The U.S. Coast Guard enforces regulations of the U.S. commercial fishing fleet. The U.S. Commercial Fishing Industry Vessel Safety Act of 1988 requires that fishing industry vessels carry life rafts, radio beacons, and other safety equipment, depending on vessel size and the area of operation.

The U.S. Regional Fishery Management Council system was designed to allow regional, participatory governance by knowledgeable people with a stake in fishery management. The eight regional councils develop management plans for marine fisheries in waters seaward of state waters of their individual regions (Section 3.9, Fish).

Fishery Management Plans generally use geographic and seasonal fishery closures, catch limits and quotas, size and age limits, gear restrictions, and access controls to manage the fishery resources. Nationwide, 44 fishery management plans provide a framework for managing the harvest of 230 major fish stocks or stock complexes that make up 90 percent of the commercial harvest.

The National Marine Fisheries Service (NMFS) incorporates commercial landing data into its Statistics and Economics Division databases from comprehensive surveys of all coastal states landings through a system of cooperative state and federal collection systems (National Marine Fisheries Service 2007). The term landing is defined by NMFS as the number or weight of fish caught, kept, and brought to shore.

The number of pounds of fish caught in the United States by commercial fishing efforts has been decreasing since 1994, although the total value of fish caught has increased (National Oceanic and Atmospheric Administration 2011a). However, while the number of pounds of fish caught in the continental United States has increased by 2.5 percent from 2009 to 2010, the pounds of fish caught in

the 18 states within the Study Area has decreased by 8.2 percent during this time (National Marine Fisheries Service 2011). The National Marine Fisheries Service has determined that 16 percent of the managed U.S. marine fish stocks studied are subject to overfishing and that the rate of removal of these stocks is too high. The agency also determined that 23 percent of U.S. marine fish stocks studied are overfished, indicating that the population is too low or below a prescribed threshold (National Marine Fisheries Service 2010b).

Commercial fisheries take place seaward to 200 nm but also within state waters (out to 3 nm and 9 nm for Texas and Florida's west coast) and are managed by each state's natural resources or wildlife department. Similar to the structure of federal fisheries management, commercial species can have state quotas to manage landings, seasonal closures, and gear restrictions.

Table 3.11-1 summarizes the values of 2011 revenue from landings of the top commercial fishing species for each of the 18 coastal states in the Study Area. Additional information on commercially important species is in Sections 3.8 (Marine Invertebrates) and 2.9 (Fish).

Table 3.11-1: Value of Top Commercial Fish Caught off Coastal States in the Study Area, 2011

State	Species	Pounds	Landed Value
Maine	American lobster	104,693,316	$334,183,027
New Hampshire	American lobster	3,917,461	$16,337,205
Massachusetts	Sea scallop	33,016,384	$330,921,154
Rhode Island	Longfin squid	9,916,508	$11,342,043
	American lobster	2,752,505	$12,756,267
Connecticut	Silver hake	2,040,124	$1,615,219
	Sea scallops	1,318,181	$13,007,181
New York	Longfin squid	5,628,873	$7,248,539
New Jersey	Sea scallop	14,542,661	$142,482,039
Delaware	Blue crab	3,501,968	$4,819,108
Maryland	Blue crab	50,019,015	$59,137,787
Virginia	Menhaden	413,835,360	$32,977,529
	Sea scallop	8,260,487	$79,426,406
North Carolina	Blue crab	28,964,480	$18,016,541
South Carolina	White shrimp	1,683,238	$4,464,201
	Blue crab	5,415,179	$4,945,233
Georgia	White shrimp	3,373,483	$9,624,290
Florida (Atlantic coast)	White shrimp	6,056,017	$15,766,513
Florida (Gulf coast)	Caribbean spiny lobster	5,298,974	$35,589,513
Alabama	White shrimp	6,836,267	$20,864,688
	Brown shrimp	10,643,220	$20,096,416
Mississippi	Atlantic menhaden	266,774,325	$9,870,790
	Brown shrimp	7,025,206	$9,810,122
Louisiana	White shrimp	52,585,254	$98,342,143
	Menhaden	1,106,930,772	$93,546,503
Texas	Brown shrimp	59,394,882	$132,776,779

Source: National Marine Fisheries Service (2012)

3.11.2.4.2 Recreational Fishing

Sport fishing has long been one of America's most popular recreational activities. Recreational fishing also influences the economies in many coastal communities by providing jobs, income, and sales. In 2010, approximately 10 million recreational anglers across the United States took 71 million saltwater fishing trips around the country. Approximately 92 percent of these recreational angler trips were taken in the 18 states composing the Study Area (National Marine Fisheries Service 2011). Marine recreational fishing and their related expenditures in the mid-Atlantic and New England coastal states contributed $5.3 billion in economic activity for these coastal state economies (National Oceanic and Atmospheric Administration 2011b). Of the United States' key recreational species or species groups, herring (32 million fish), Atlantic croaker (8 million fish) and spotted seatrout (11 million fish) were most often caught by recreational anglers in 2010 (National Marine Fisheries Service 2010a). The most commonly caught non-bait species for Atlantic states were summer flounder, bluefish, Atlantic croaker, black sea bass, and scup. The species most commonly caught on Atlantic coast trips that fished primarily in federally managed waters were black sea bass, Atlantic cod, summer flounder, dolphinfish, and bluefish. The most commonly caught non-bait species for Gulf of Mexico states were spotted seatrout, red drum, sand seatrout, Atlantic croaker, and Spanish mackerel. The species most commonly caught on Gulf of Mexico trips that fished primarily in federally-managed waters were red grouper, red snapper, white grunt, gag, and yellowtail snapper (National Marine Fisheries Service 2010a).

Private or rental boat trips accounted for most of the fishing trips taken in the United States, accounting for 52 percent of total U.S. fishing trips or 44.5 million trips. This fishing mode made up the majority of the trips in the New England area (54 percent of trips), mid-Atlantic area (57 percent of trips), south Atlantic area (50 percent of trips), and Gulf of Mexico (60 percent of trips). Shore-based fishing trips accounted for 44 percent of total U.S. fishing trips, or 37 million trips. For-hire fishing boat trips accounted for 3.9 percent of total trips taken, with 3.4 million trips (National Marine Fisheries Service 2010a).

Favored fishing areas change over time with fluctuations in fish populations and communities, preferred target species, or fishing modes and styles. Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fish. Fishermen focusing on areas of bottom relief not only catch reef-associated fish but also coastal open water species that may be attracted to the habitat.

The NMFS database for recreational fishing in 2010 indicates that in the Atlantic coast states, the largest harvests by weight were striped bass, bluefish, Atlantic cod, dolphinfish, and scup. In the Gulf of Mexico, the largest harvests by weight were red drum, spotted seatrout, sheepshead, black drum, Spanish mackerel, and sand seatrout (National Marine Fisheries Service 2010a). The most common fish species caught in each of the 18 coastal states in the Study Area are summarized in Tables 3.11-2 through 3.11-4.

It is unlikely that a substantial amount of recreational fishing occurs on the high seas (greater than 200 nm from shore). The size of a ship able to reach the distance of the high seas would exceed most recreational boat sizes registered with the U.S. Coast Guard (U.S. Department of Homeland Security 2008).

The economic characteristics of recreational fishing for the 10-state mid-Atlantic area are summarized in Table 3.11-2.

Table 3.11-2: Economic Characteristics of Recreational Fishing in the Mid-Atlantic

Economic Factor	State									
	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA
Number of Recreational Anglers (million)	0.310	0.118	1.300	4.650	5.050	9.670	1.200	0.315	1.200	0.891
Percent of Anglers Living Outside the State	58	39	36	64	24	12	37	58	42	38
Percent of Saltwater Trips Taken by Private or Rental Boat	45	42	52	48	64	55	53	52	58	69
Percent of Recreational Fishing Conducted from the Shore	51	34	43	48	29	40	41	44	38	30
Percent of Saltwater Fishing Trips Taken by Charter Boat	4	23	5	4	3	5	6	4	4	2
Percent of Fishing Trips Taken in State Waters Inland or < 3 mi. (4.8 km) Offshore	96	75	91	98	~99	97	93	94	98	98
Percent of Fishing Trips Taken in U.S. Exclusive Economic Zone between 3 and 200 nm from Shore	3	24	8	1	<1	2	7	6	2	2
Jobs Supported by Recreational Fishing	1,286	357	5,900	1,467	4,884	5,766	9,612	1,462	7,244	5,564
Sales from Recreational Fishing (million)	$108	$39	$786	$166	$743	$875	$1,600	$224	$1,000	$619
Value-Added Impact from Recreational Fishing (million)	$57	$21	$427	$82	$427	$457	$820	$103	$504	$329
Fish Species Most Commonly Caught (common name)	Atlantic mackerel	Atlantic mackerel	Striped bass	Porgies (scup)	Striped bass	Summer flounder	Summer flounder	Drum (Atlantic croaker)	White perch	Drum (Atlantic croaker)

Source: National Marine Fisheries Service (2010a)

CT: Connecticut; DE: Delaware; km: kilometer; MA: Massachusetts; MD: Maryland; ME: Maine; mi.: mile; NH: New Hampshire; NJ: New Jersey; nm: nautical mile; NY: New York; RI: Rhode Island; VA: Virginia

Various organizations host recreational fishing tournaments throughout the year along the northeastern Atlantic coast from Maine to Virginia. Tournaments and derbies for bass, rockfish, tuna, and billfish are held for several days each.

The economic characteristics of recreational fishing for the four states in the southeast Atlantic area are summarized in Table 3.11-3.

Table 3.11-3: Economic Characteristics of Recreational Fishing in the Southeast Atlantic

Economic Factor	State			
	NC	SC	GA	FL (east coast)
Number of Recreational Anglers (million)	2.0	0.942	0.441	2.000
Percent of Anglers Living Outside the State	55	64	22	35
Percent of Saltwater Trips Taken by Private or Rental Boat	36	49	58	458
Percent of Recreational Fishing Conducted from the Shore	61	46	40	41
Percent of Saltwater Fishing Trips Taken by Charter Boat	4	5	1	1
Percent of Fishing Trips Taken in State Waters Inland or < 3 mi. (4.8 km) Offshore	93	92	94	86
Percent of Fishing Trips Taken in U.S. Exclusive Economic Zone between 3 and 200 nm from Shore	7	7	6	14
Jobs Supported by Recreational Fishing	22,000	5,500	2,500	35,000
Sales from Recreational Fishing (million)	$2,300	$488	$311	$4,000
Value-Added Impact from Recreational Fishing (million)	$1,100	$266	$162	$2,100
Fish Species Most Caught (common name)	Drum (Atlantic croaker)	Drum (Atlantic croaker)	Southern kingfish	Spotted sea trout

Source: National Marine Fisheries Service (2010a)
FL: Florida; GA: Georgia; km: kilometer; mi.: mile; NC: North Carolina; nm: nautical mile; SC: South Carolina

Various organizations host recreational fishing tournaments throughout the year along the southeastern Atlantic coast from Virginia to Florida. Most tournaments take place on weekends (Friday through Sunday) or from the middle of the week through the weekend (Wednesday to Sunday). Most fishing takes place at hotspots like canyons and seamounts. Species fished include bluefin tuna, yellowfin tuna, wahoo, dolphinfish, big eye tuna, white marlin, and blue marlin.

As shown in Table 3.11-3, recreational fishing on the east coast of Florida supports the greatest number of jobs and generates the highest sales value of all the states along the southeast Atlantic coast. Recreational fishing in Monroe County and the City of Key West is a major generator of economic activity and contributes $500 million annually (National Oceanic and Atmospheric Administration 2005). The diverse fishing opportunities are reflected in an abundance of tournaments offered year round. Species include sailfish, bonefish, kingfish, snook, redfish, tarpon, dolphinfish, grouper, snapper, blackfin tuna, marlin, wahoo, and others. Tournaments can take place on the weekends, but many occur during the week (Monroe County Tourist Development Council 2010).

Five states (Florida, Alabama, Mississippi, Louisiana, and Texas) are adjacent to the GOMEX Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range. The economic characteristics of recreational fishing in the Gulf of Mexico (including the west coast of Florida) are summarized in Table 3.11-4.

Table 3.11-4: Economic Characteristics of Recreational Fishing in the Gulf of Mexico

Economic Factor	State				
	FL (west coast)	AL	MS	LA	TX
Number of Recreational Anglers (million)	3.800	0.545	0.194	1.100	--
Percent of Anglers Living Outside the State	53	43	25	16	--
Percent of Saltwater Trips Taken by Private or Rental Boat	57	57	61	75	--
Percent of Recreational Fishing Conducted from the Shore	40	40	37	21	--
Percent of Saltwater Fishing Trips Taken by Charter Boat	4	3	1	4	--
Percent of Fishing Trips Taken in State Waters Inland or < 3 mi. (4.8 km) Offshore	93	91	97	97	--
Percent of Fishing Trips Taken in U.S. Exclusive Economic Zone between 3 and 200 nm from Shore	7	9	3	3	--
Jobs Supported by Recreational Fishing	54,600	4,700	2,900	25,600	25,500
Sales from Recreational Fishing (million)	$5,650	$455	$383	$2,300	$3,300
Value-Added Impact from Recreational Fishing (million)	$3,100	$235	$149	$1,200	$1,700
Fish Species Most Caught (common name)	Spotted sea trout	Drum (Atlantic croaker)	Spotted sea trout	Spotted sea trout	Spotted sea trout

Source: National Marine Fisheries Service (2010a)
AL: Alabama; FL: Florida; km: kilometer; LA: Louisiana; mi.: mile; MS: Mississippi; nm: nautical mile; TX: Texas
(--) Data Not Available

As shown in Table 3.11-4, recreational fishing on the west coast of Florida supports the greatest number of jobs and generates the highest sales value of all the states along the Gulf of Mexico. There were 3.2 million resident recreational fishermen who took fishing trips in the Gulf of Mexico in 2008. Almost 92 percent of those anglers were residents of a regional coastal county. Of the 24 million fishing trips taken in 2008, over 60 percent were taken from a private or rental boat. The most commonly caught key species or species groups were spotted sea trout, with 32.6 million fish harvested or released in 2008. This key species accounted for 49 percent of fish caught by anglers in the Gulf of Mexico (National Marine Fisheries Service 2010a).

Three major fishing tournaments are held each year in the eastern GOMEX Range Complex: two in Orange Beach, Alabama, and one in Panama City, Florida. The Panama City event is part of the World Billfish Series and draws approximately 10,000 spectators (National Marine Fisheries Service 1999). Major fishing tournaments in the western GOMEX Range Complex occur from Venice, Louisiana, to South Padre Island, Texas. These events occur over the weekend, and participants target popular fishing locations. Most fishing takes place on artificial reefs and at hotspots like canyons and seamounts. Species fished include bluefin tuna, yellowfin tuna, wahoo, dolphinfish, big eye tuna, white marlin, and blue marlin.

3.11.2.5 Aquaculture

Aquaculture is the farming of aquatic organisms such as fish, shellfish, and plants. Aquaculture operations are often in coastal environments and can be on land with a nearby water source or in bays, estuaries, or marine waters (National Oceanic and Atmospheric Administration 2010b). The National Oceanic and Atmospheric Administration regulates offshore marine aquaculture and crafted the

National Offshore Aquaculture Act of 2007, which charges National Oceanic and Atmospheric Administration with establishing stringent standards and coordination of offshore efforts with states (Carlowicz 2007).

The U.S. marine aquaculture industry is relatively small compared with overall U.S. and world aquaculture production. Total U.S. aquaculture production is about $1 billion annually, compared to world aquaculture production of about $70 billion. Only about 20 percent of U.S. aquaculture production is marine species. The largest single sector of the U.S. marine aquaculture industry is molluscan shellfish culture (oysters, clams, mussels), which accounts for about two-thirds of total U.S. marine aquaculture production, followed by salmon (about 25 percent) and shrimp (about 10 percent). Current production takes place mainly on land, in ponds, and in coastal waters under state jurisdiction (National Oceanic and Atmospheric Administration 2012).

Aquaculture has become a fast-growing food industry because of consumer demands. The U.S. Department of Agriculture maintains a database on sales value from aquaculture. In 2007, sales of aquaculture products in the United States accounted for $1.4 billion. The export of shellfish (shrimp, oysters, mussels, and clams) and frozen Atlantic salmon, much of it cultivated in the Atlantic and Gulf coastal states, accounted for over 13 percent of this revenue (U.S. Department of Agriculture 2005).

Most aquaculture farms within the Study Area are located in state waters. Based on 2007 census data compiled by the U.S. Department of Agriculture (2005), aquaculture operations in the 18 states of the Study Area represent approximately 58 percent of total aquaculture operations in the United States, with over 11 percent of these farms in Louisiana.

Massachusetts and New Hampshire are conducting aquaculture research projects in offshore federal waters. In 2007, both states received funding for these projects from the National Oceanic and Atmospheric Administration (National Oceanic and Atmospheric Administration 2008). The University of New Hampshire's Atlantic Marine Aquaculture Center has been raising finfish in the open ocean since 1999 for noncommercial purposes. The demonstration site is 6 mi. (9.6 km) off the coast of New Hampshire.

Atlantic salmon are cultivated in coastal waters off the coast of Maine. The 2011 harvest of 24 million pounds attributed revenue of $55 million. Maine also cultivated blue mussels, American and European oysters, Atlantic cod, quahogs, sea scallops, and green sea urchins (Maine Department of Marine Resources 2012). The dominant industry along the northeastern coastline is shellfish production in estuaries, bays, and wetlands (Morse and Pietrak 2009). The only estuary that falls in part of the Northeast Range Complexes is Narragansett Bay, on the north side of Rhode Island Sound. Rhode Island cultivates eastern oysters and northern quahogs. About 123 acres (50 hectares) are leased for aquaculture production (Rice and Leavitt 2009).

In the mid-Atlantic area, aquaculture is composed of shellfish production in estuaries, bays, and wetlands. In 1980, the lower Chesapeake Bay, near the VACAPES Range Complex, accounted for 50 percent of the U.S. oyster harvest. However, in recent years, overharvesting and disease have depleted the oyster beds to less than 1 percent of their peak abundance (Kearney 2003). States in the area are encouraging shellfish aquaculture to aid in the restoration (Webster et al. 2009). Virginia cultivates eastern oysters and hard clams using bottom cultivation. However, methods of cultivation for the oyster are evolving from the traditional planting on the bottom to a more intensive method using

cages, racks, and floats (Murray and Oesterling 2009). The mine warfare training areas in the Chesapeake Bay are not in the immediate vicinity of shellfish aquaculture.

Aquaculture in the southeast region includes farms for hybrid striped bass, red drum, saltwater shrimp, and eastern oysters. Approximately 41 percent of eastern oyster farms in the United States are located in Texas, which accounts for nearly 90 percent of foodsize saltwater shrimp sold in the country. Louisiana sells approximately 87 percent of the eastern oysters produced in the United States, with approximately 34 percent of farms located in this state (U.S. Department of Agriculture 2005).

3.11.2.6 Tourism

Coastal tourism and recreation include the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, and second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, and recreational fishing facilities). Also included are ecotourism and recreational activities such as recreational boating, cruises, swimming, snorkeling, diving, and sight-seeing (National Oceanic and Atmospheric Administration 1998).

Tourism is a component of the regional economy of coastal states included in the Study Area. Although there is no comprehensive database for tourism, available data show that tourist activities bring billions of dollars to communities within the coastal states. Benefits from tourism include direct spending as well as indirect benefits from contributions to key business sectors such as food, lodging, arts, culture, and music. Table 3.11-5 (Tourism Data Summary by State) presents the available data for the overall economic impact of tourism on the coastal states within the Study Area. These data include all aspects of a state's tourism industry and are not limited to coastal counties or ocean-related activities.

Table 3.11-5: Tourism Data Summary by State, 2008

State	Total Expenditures (in billions)	Impact on State Economy (in millions)	Direct Jobs	Total Jobs (direct + indirect)	Wages (in billions)
Alabama	$9.6	$702	--	169,000	$3.7
Connecticut	--	--	--	--	--
Delaware	--	$1.5	--	--	--
Florida	$65.2	$3.9	1,007,000	--	--
Georgia	$20.8	$1.557	--	241,500	$6.3
Louisiana	$9.3	--	--	101,700	$1.9
Maine	$5.8	--	--	--	--
Maryland	--	--	--	--	--
Massachusetts	$15.6	--	--	128,000	$3.7
Mississippi	$6.0	--	85,000	115,790	$2.56
New Hampshire	$4.51	$11.5	62,477	--	$1.5
New Jersey	$38.8	$27.9	--	443,094	--
New York	--	--	--	--	--
North Carolina	$20.2	$15.6	--	326,000	$9.0
Rhode Island	$5.73	$2.26	--	45,538	--
South Carolina	$18.4	$1.2	115,000	185,873	$4.9
Texas	$60.4	--	--	542,000	$16.6
Virginia	$19.2	$2.5	--	210,000	$4.4

Sources: (Alabama Tourism Department 2009; Davidson-Peterson Associates 2009; Dean Runyan Associates 2010; Goss 2010; IHS Global Insight Inc. 2009; Massachusetts Office of Travel and Tourism 2009; Mississippi Development Authority/Tourism Division 2009; North Carolina Department of Commerce 2010; Tourism Economics 2010; U.S. Travel Association 2009, 2010; Virginia Tourism Corporation 2010; Visit Florida 2010)
(--) Data Not Available

The National Ocean Economics Program provides a range of socioeconomic information along the U.S. coast and in coastal waters. The National Ocean Economics Program defines the ocean economy as the economic activity that indirectly or directly uses the ocean as an input. Table 3.11-6 (Ocean Economy Data for the Tourism and Recreation Sector by State) contains ocean economy data by state specific to the tourism and recreation sector for 2004. The table shows the impact of the tourism and recreation industry in coastal counties on states' employment and gross domestic product.

Table 3.11-6: Ocean Economy Data for the Tourism and Recreation Sector by State, 2004

State	Gross Domestic Product	Percent Gross Domestic Product	Employment	Percent Employment
Alabama	$354,485,500	21	13,981	63
Connecticut	$1,323,004,100	50	36,612	75
Delaware	$373,863,400	76	12,997	83
Florida	$10,721,166,200	70	262,643	84
Georgia	$690,828,500	62	19,739	75
Louisiana	$2,164,629,100	18	61,495	55
Maine	$966,728,600	50	30,603	67
Maryland	$1,119,400,700	46	35,014	67
Massachusetts	$2,080,336,200	59	54,062	77
Mississippi	$209,650,800	13	8,671	29
New Hampshire	$253,422,100	35	8,337	60
New Jersey	$2,198,637,500	47	58,787	66
New York*	$12,197,767,500	4	227,974	90
North Carolina	$868,232,500	50	31,933	79
Rhode Island	$869,969,700	70	23,416	79
South Carolina	$1,499,943,200	80	38,301	87
Texas	$1,913,357,200	23	69,533	61
Virginia	$1,432,917,800	51	46,827	51

Source: National Ocean Economics Program (2010a)

Shows percent of tourism and recreation employment and gross domestic product compared to all other ocean industries: construction, living resources, minerals, ship and boat building, transportation, and tourism recreation.

* Includes data from counties adjacent to the Great Lakes.

The tourist and recreation industry surrounding recreational boating is significant along the coast of the Atlantic Ocean and the Gulf of Mexico. Self-contained underwater breathing apparatus (SCUBA) diving is a popular recreational activity in this area due to the occurrence of numerous reefs and shipwrecks. Typical considerations for recreational SCUBA divers relevant to all portions of the Study Area are dive depth limitations. Specifically, the Professional Association of Diving Instructors (one of several scuba diving instructional organizations) suggests that certified open-water divers limit their dives to 18 m (59 ft.). More experienced divers are generally limited to 30 m (98 ft.) (Professional Association of Diving Instructors 2011). Many shipwrecks and artificial reefs that are popular diving spots in Florida are at depths ranging from 50 to 90 ft. (15.2 to 27.4 m) (Associated Oceans 2011).

Marine mammal watching, often referred to as whale watching, includes any cetacean species such as dolphins, whales, and porpoises. Tours are conducted by boat, aircraft, or from land. This type of marine tourism includes any of these activities, formal or informal, that possess at least some commercial component whereby consumers view, swim with, or listen to any of these approximately 83 cetacean species (Hoyt 2001). Cruises for seal watching are also available in Connecticut (Groton, Stony Creek, and Niantic), Maine (New Harbor), Massachusetts (Cape Cod), and Rhode Island (Newport).

Hoyt conducted the most recent, comprehensive survey of the whale-watching industry (Hoyt 2001). In the northeast, the industry focuses on the various whales summering in waters off New England. Whale watching occurs in 22 communities in New England. The majority of operations occur within

Massachusetts, where 17 operators conduct whale watching out of popular ports such as Gloucester, Provincetown, Boston, Barnstable, and Plymouth. The 25-year focus of whale watching on the Stellwagen Bank area contributed to its popularity and helped establish the Gerry E. Studds Stellwagen Bank National Marine Sanctuary, which sits at the mouth of Massachusetts Bay. In the southeast, concentrations of the whale watching industry are highest in Hilton Head Island, South Carolina; St. Petersburg, Florida; Panama City, Florida; and Jupiter, Florida. Numerous single operators exist in cities extending along the entire west coast of Florida, all the way to Key West. During a comprehensive survey, approximately 4.3 million people participated in the industry, contributing nearly $357 million in sales to operators of whale watching tours.

3.11.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact socioeconomic resources of the Study Area. Tables 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Each socioeconomic resource stressor is introduced, analyzed by alternative, and analyzed for training and testing activities. Table F-3 in Appendix F (Training and Testing Activities Matrices) shows the human stressors that were considered for analysis of socioeconomic resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The primary stressors applicable to socioeconomic resources in the Study Area and that are analyzed include the following:

- Accessibility (availability of access on the ocean and in the air)
- Airborne acoustics (weapons firing, aircraft and vessel noise)
- Physical disturbance and strikes (aircraft, vessels and in-water devices, military expended materials)

This section evaluates the impacts of the alternatives on the economy of the region of influence as well as social impacts. The evaluation addresses how the action alters the way individuals live, work, play, relate to one another, and function as members of society. Because proposed AFTT activities are predominantly offshore, socioeconomic impacts would be associated with economic activity, employment, income, and social conditions (i.e., livelihoods) of industries or operations that use the ocean resources within the Study Area. Although there are no permanent population centers in the region of influence and the typical socioeconomic considerations such as population, housing, and employment are not applicable, this section will analyze the potential for fiscal impacts on marine-based activities and coastal communities. When considering impacts on recreational activities such as fishing, boating, and tourism, both the economic impact associated with revenue from recreational tourism and public enjoyment of recreational activities are considered.

The proposed AFTT training and testing activities were evaluated to identify specific components that could act as stressors by directly or indirectly affecting sources of energy generation, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, and tourism. For each stressor, a discussion of impacts on these sources is included for each alternative.

The evaluation indicated that the relative potential for socioeconomic impacts would be similar across various areas and marine ecosystems in the Study Area. Therefore, the analysis of environmental consequences was not broken down by large marine ecosystem. Based on an initial screening of potential impacts of sonar maintenance and testing, pierside locations have been eliminated from detailed consideration in the analysis of impacts on energy, mineral extraction, and transportation and

shipping. Elimination of these resources was based on the extremely limited potential for active sonar to damage infrastructure or interfere with transportation operations.

3.11.3.1 Accessibility

Navy training and testing activities have the potential to temporarily change access to the ocean or airspace for a variety of human activities associated with sources of energy generation, mineral extraction, commercial transportation and shipping, commercial recreation and fishing, aquaculture, tourism, and recreational activities in the Study Area. Warning Areas, Restricted Areas, and Danger Zones are designated along the Atlantic and Gulf coasts. These designated areas are shown on Figures 3.11-4 through 3.11-7. These small areas may be used for especially hazardous activities and are defined to prohibit or limit public access to the area. They generally provide security or protection for the public from risks of damage or injury arising from activities occurring in that area. Danger and restricted zones listed in the Code of Federal Regulations and presented by section number on Figures 3.11-4 through 3.11-7 may be closed to the public full time or intermittently, as stated in the regulations (33 C.F.R. §§ 334.10-1490).

When training or testing activities that require specific areas to be free of nonparticipating vessels and aircraft due to public safety concerns are scheduled, the Navy requests that the U.S. Coast Guard and Federal Aviation Administration issue Notices to Mariners and Notices to Airmen, respectively. Many training and testing activities occur in established restricted or danger areas as published on navigation and aeronautical charts. Some frequently used areas have standing Notices to Mariners and Notices to Airmen to allow real-time, immediate use.

As an environmental stressor on most socioeconomic resources for human activities in marine environments, changes in accessibility from Navy training and testing activities would essentially be the same as current conditions. If access is hindered to the extent that equipment cannot be monitored or used, there would be an impact if this condition would directly contribute to loss of income, revenue, or employment. Disturbance to human activities associated with payrolls, revenue, or employment is quantified by the amount of time the activity may be halted or rerouted and the ability to perform the task in another location.

The Navy is not proposing to add any new restricted areas and proposes to continue the same type of temporary area closures that have occurred for decades. Many of the restricted areas identified on these figures are artifacts of past military activities and are not currently scheduled (e.g., Small Point Mining Range off the coast of Maine).

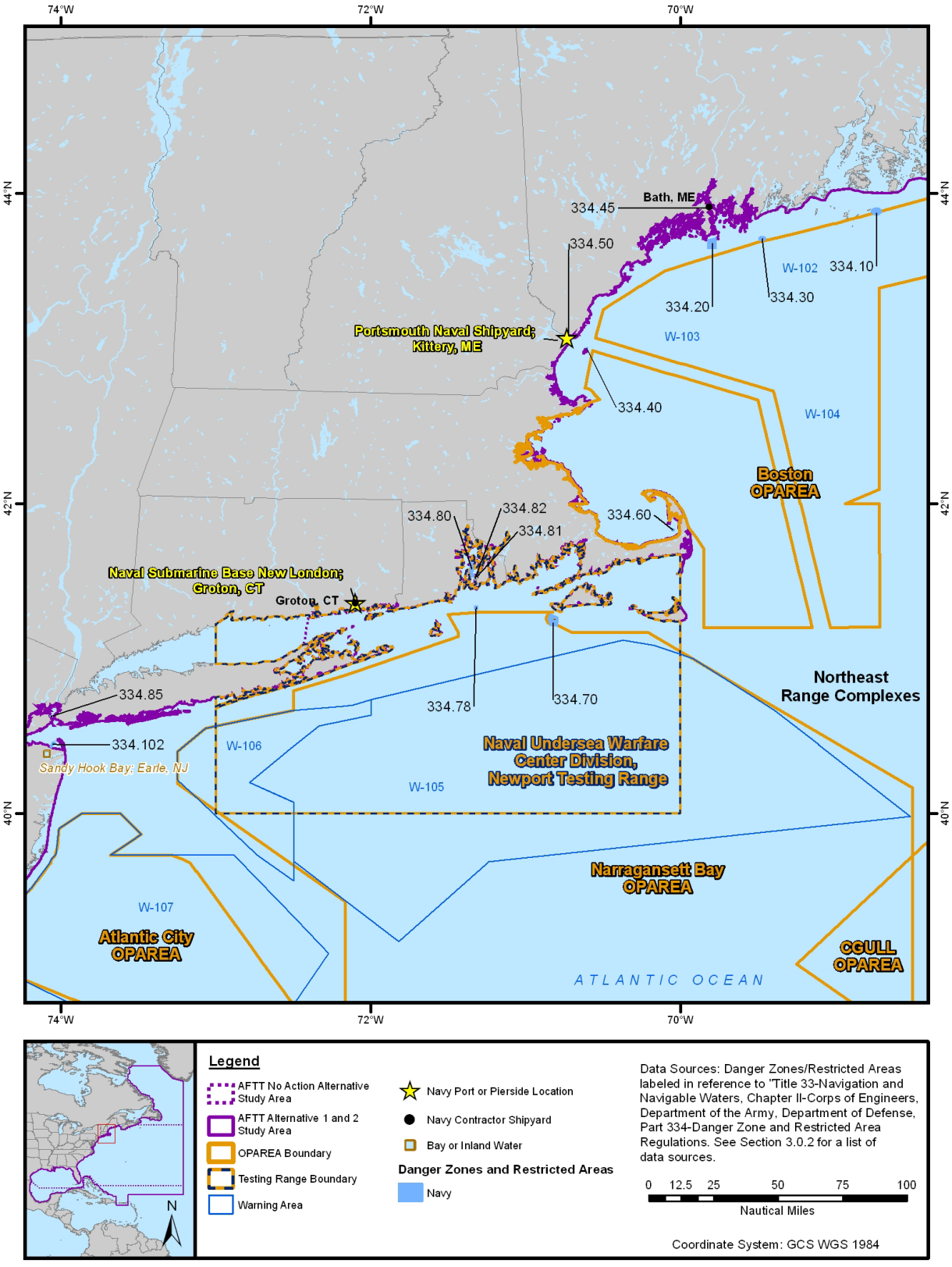

Figure 3.11-4: Danger Zones and Restricted Areas in the Northeast Atlantic Ocean

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; ME: Maine; NJ: New Jersey; OPAREA: Operating Area

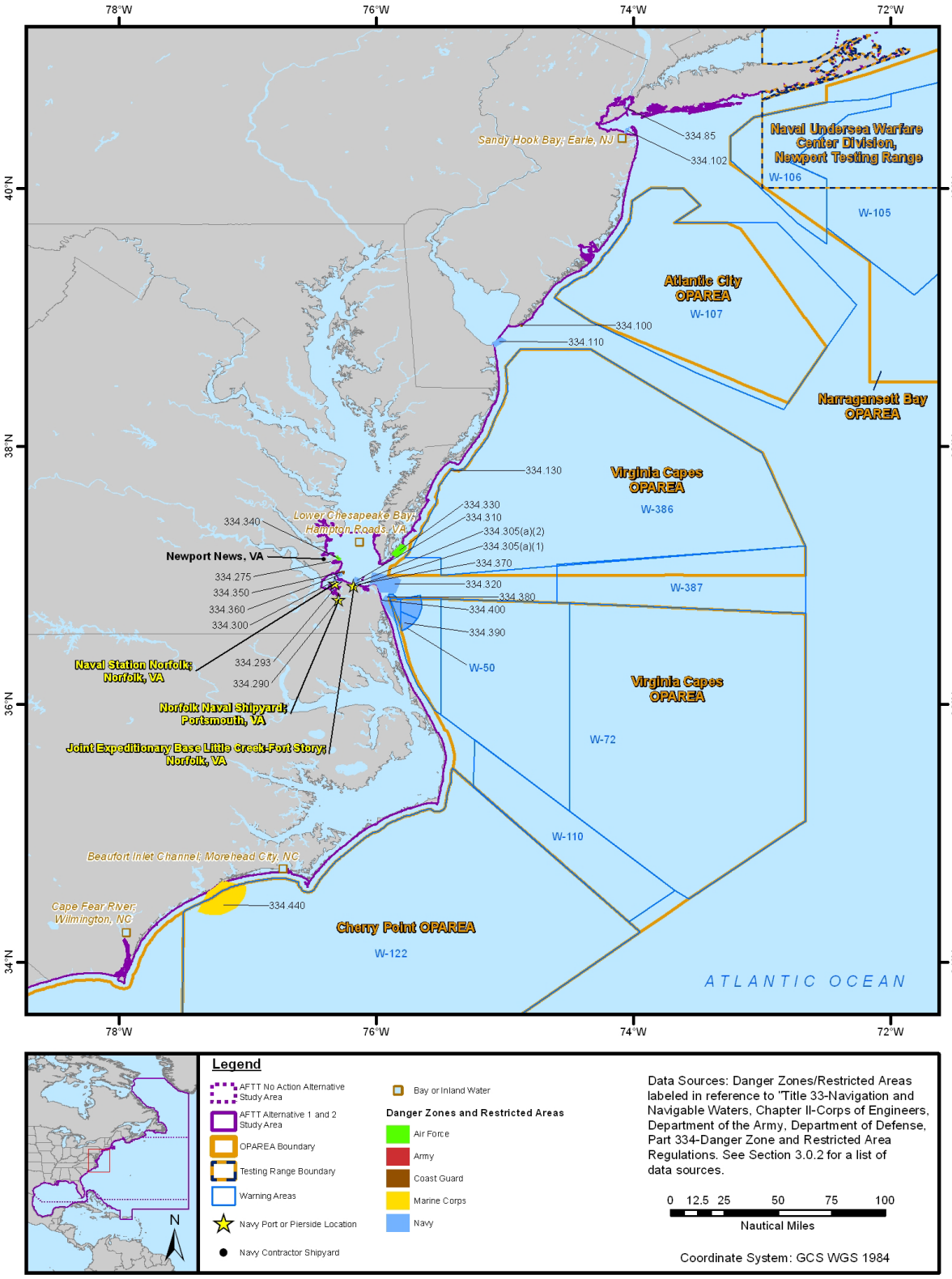

Figure 3.11-5: Danger Zones and Restricted Areas in the Mid-Atlantic Ocean
AFTT: Atlantic Fleet Training and Testing; NC: North Carolina; NJ: New Jersey; OPAREA: Operating Area; VA: Virginia

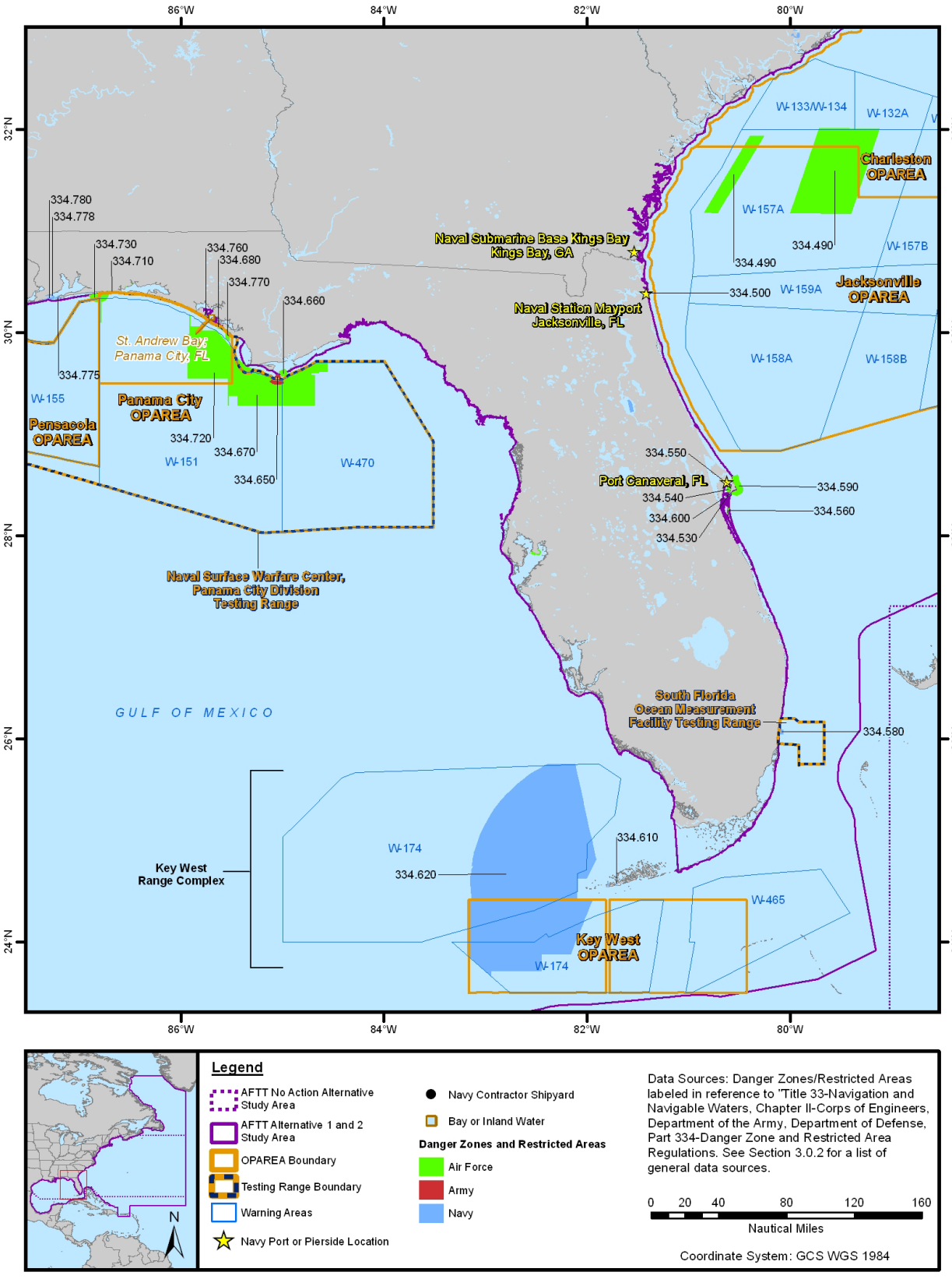

Figure 3.11-6: Danger Zones and Restricted Areas in the Southeast Atlantic Ocean

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; OPAREA: Operating Area

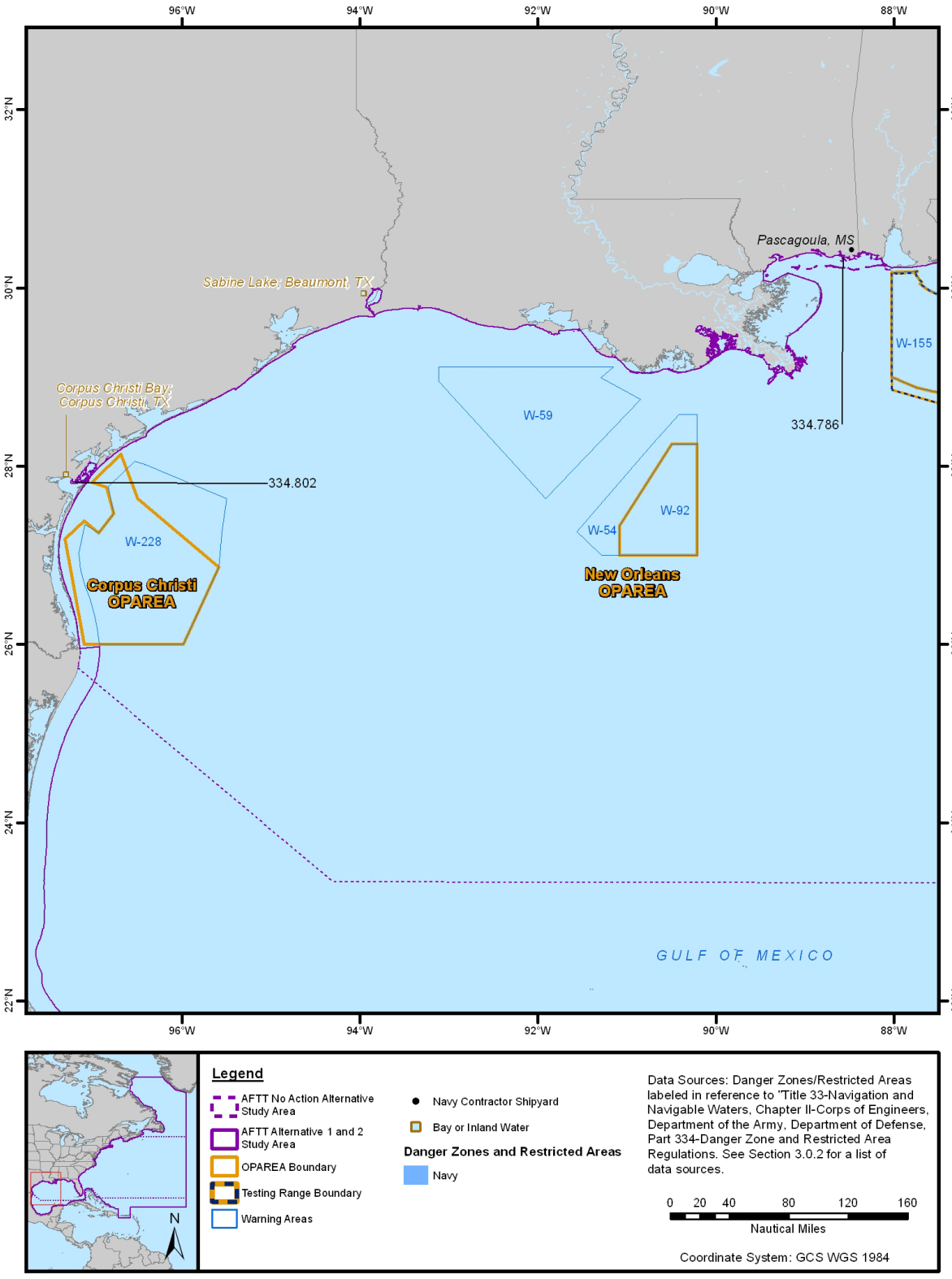

Figure 3.11-7: Danger Zones and Restricted Areas in the Gulf of Mexico

AFTT: Atlantic Fleet Training and Testing; MS: Mississippi; OPAREA: Operating Area; TX: Texas

Accessibility, or restrictions to the availability of air and ocean space, would be a temporary condition. While mariners and pilots have a responsibility to be aware of conditions on the ocean and in the air, it is not expected that direct conflicts in accessibility would occur. The locations of restricted areas are published and available to mariners and pilots, who typically review such information before boating or flying in any area. Restricted areas are typically avoided by mariners and pilots. The Navy would follow standard operating procedures to visually scan an area to ensure that nonparticipants are not present. If nonparticipants are present, the Navy delays, moves, or cancels the activity. Accessibility is no longer restricted once the activity concludes. In addition, project review and approval processes for many ongoing and planned offshore projects in the Study Area (i.e., oil and gas leasing, and wind energy projects) have integrated Navy input and review to reduce the potential for conflicts to air and ocean space. Therefore, there would be minimal potential for access to the ocean and airspace to directly impact human activities.

3.11.3.1.1 Socioeconomic Activities

3.11.3.1.1.1 Sources of Energy Production and Distribution

Water

Water-related energy generation facilities are planned in state waters along the east coast, and preliminary permits have been issued by the Federal Energy Regulatory Commission for production of renewable energy (tidal and wave energy), including a residential tidal energy project for underwater turbines along the shoreline near the shipyard in Bath, Maine. In accordance with the 2010 Memorandum of Understanding between the U.S. Department of Agriculture and the U.S. Navy (U.S. Department of the Navy 2010), the Navy participates in the siting and review of renewable energy projects by sharing technical information with the objective of ensuring compatibility and minimizing conflicts in shared space. Research and testing activities by academic institutions for water energy technology is conducted along the Atlantic coast and Florida and would continue to be conducted in consideration of existing restricted areas on the ocean. Therefore, access to water-related sources of energy generation in the Study Area would not be hindered and there would be no change to operations during AFTT training or testing activities.

Wind

While the United States has no offshore wind energy generating capacity at this time, such projects are in the early planning stages. The U.S. Department of the Interior has approved an ocean lease to Cape Wind Associates, LLC to construct 130 wind turbines in Nantucket Sound within the Study Area. There are no Navy activities at or immediately near the Cape Wind Associates, LLC lease blocks. Access to this future wind energy site would not be hindered, and there would be no change to operations during AFTT training or testing activities.

Similar projects have been proposed along the east coast. In November of 2010, the Department of the Interior announced the “Smart from the Start” initiative to accelerate development of wind energy along the Atlantic Outer Continental Shelf. The initiative calls for the identification of areas on the Atlantic Outer Continental Shelf that appear most suitable for commercial wind energy and for the opening of these areas for leasing and site assessment. Areas from Maine to Florida have been identified for offshore wind energy development. The resultant wind energy areas will be developed and refined through extensive consultation with other federal agencies, to include the Navy and the Intergovernmental Renewable Energy Task Force of each affected state.

Future offshore wind energy projects projected along the Atlantic coast and Florida will be proposed and developed in consideration of existing DoD restricted airspace and sea space required in support of military operations. Therefore, access to future offshore wind energy sites would not be hindered, and there would be no change to operations during AFTT training or testing activities.

Oil and Gas Production

While there are many oil and natural gas leases and an extensive oil and natural gas pipeline network in the Gulf of Mexico, conflicts with military activities are avoided through cooperative efforts between the DoD and oil and gas operators. Because the DoD plays an active role in the oversight of proposed oil and gas lease areas on the outer continental shelf, lease areas would generally not be approved in, or in conflict with, established or otherwise restricted offshore military use areas. In cases where such areas are leased, stipulations to the leases are established to resolve conflicts. Future oil and natural gas production interests along the Atlantic coast and Gulf of Mexico would operate in consideration of existing restricted areas on the ocean and in the air. Therefore, access to future oil and natural gas infrastructure would not be hindered, and there would be no change to operations during AFTT training or testing activities.

3.11.3.1.1.2 Mineral Extraction

Mineral extraction sites operate with the use of vessels and equipment that traverse the open ocean or are stationary (e.g., suction hopper dredges). Extraction of sand and gravel can be accomplished with the use of submerged or floating pipelines. Any changes in accessibility to offshore sites would not be expected to result in rerouting of vessels or postponing of operations. Any changes in accessibility for sand and gravel mining, or borrow sites, would have a short-term duration (typically 1.5 to 4 hours per location). Direct impacts on mineral extraction activities would be negligible.

3.11.3.1.1.3 Commercial Transportation and Shipping

There are no anticipated impacts on commercial shipping activities in the Study Area since naval vessels conducting hazardous activities generally occur away from commercially used waterways.

Any direct impacts on private civilian transportation activities from rerouting or postponing activities would be negligible due to advance public notification through the use of Notices to Mariners and Notices to Airmen and the primarily short-term duration (typically 1.5 to 4 hours per location) of military activities.

3.11.3.1.1.4 Commercial and Recreational Fishing

Favored fishing areas change over time with fluctuations in fish populations and communities, preferred target species, or fishing modes and styles. Popular fishing sites are characterized by relative ease of access (most recreational fishing trips occur in state waters), ability to anchor or secure the boat, and abundant presence of target fish. Impacts on commercial and recreational fishing result when Navy activities restrict access to fishing areas. The Navy strives to conduct its operations in a manner compatible with commercial and recreational ocean users by minimizing temporary access restrictions. Notices to Mariners allow commercial and recreational fishing boats to adjust their routes to avoid temporary restricted areas. Given the size of the Study Area, the opportunities for Navy activities to interfere with commercial and recreational fishing are minimal because the majority of fishing would occur closer to the shore. Because the proposed activities would not lead to a noticeable change in Navy presence, and because the proposed locations for these activities do not differ much from historical use,

it is unlikely commercial and recreational fishing activities would be noticeably affected by Navy activities requiring area restrictions.

3.11.3.1.1.5 Aquaculture

As discussed for commercial and recreational fishing, the federal government, through the U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Fish and Wildlife Service, NMFS, and U.S. Environmental Protection Agency, implements an assurance that U.S. navigational routes are maintained when approving aquaculture lease stipulations. Thus, it is assumed that whenever possible, close coordination between all users of the waterway would be required under the aquaculture lease stipulations. Navy activities that could impact aquaculture would not be planned close to inshore or offshore areas with aquaculture activities. Because the proposed activities would not lead to a noticeable change in Navy presence and because the proposed locations for these activities do not differ much from historical use, there would be no direct effect on the use of remotely operated feed buoys at the University of New Hampshire offshore demonstration site or on divers who monitor the growth cages at shellfish or vegetation aquaculture sites.

3.11.3.1.1.6 Tourism

The Navy strives to conduct its operations in a manner compatible with recreational ocean users by minimizing temporary access restrictions. Published notices allow recreational users to adjust their routes to avoid temporary restricted areas.

Mariners and pilots engaged in tourism-related activities have a responsibility to be aware of conditions on the ocean and in the air. The locations of restricted areas are published and available to mariners and pilots, who typically review such information before boating or flying in any area. Restricted areas are typically avoided by mariners and pilots. The Navy would follow standard operating procedures to visually scan an area to ensure that nonparticipants are not present. If nonparticipants are present, the Navy delays, moves, or cancels its activity. Accessibility is no longer restricted once the activity concludes. Any changes to accessibility of air and ocean space would be a temporary condition for marine-related tourist and recreational activities. Further, the revenues listed in Tables 3.11-5 and 3.11-6 would not be impacted by restricted access because the restrictions are temporary. The proposed activities would not lead to a noticeable change in Navy presence, and the proposed locations for these activities do not differ much from historical use; therefore, it is unlikely tourism would be noticeably affected by Navy activities requiring area restrictions.

3.11.3.1.2 Evaluation of Alternatives

3.11.3.1.2.1 No Action Alternative

Training

Under the No Action Alternative, potential accessibility issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, and naval special warfare. Training activities in these warfare areas would continue at current levels and within established ranges and training locations, including the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes and Other AFTT Areas. There would be no anticipated impacts on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because inaccessibility to areas of co-use would be temporary and of short duration (typically 1.5 to 4 hours per location). Based on the Navy's standard operating procedures and the large expanse of the training ranges, accessibility issues would be negligible.

Testing

Under the No Action Alternative, potential accessibility issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, naval special warfare, sea trials, shock trials, and other weapons platform testing. Testing activities would continue at current levels and within established training and testing ranges, including the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; CGULL OPAREA; Naval Surface Warfare Center, Panama City Division Testing Range; and Other AFTT Areas. There would be no anticipated impacts on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because inaccessibility to areas of co-use would be temporary and of short duration (typically 1.5 to 4 hours per location). Based on the Navy's standard operating procedures and the large expanse of the training ranges, accessibility issues would be negligible.

3.11.3.1.2.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus the expansion of the Study Area boundary and adjustments to locations and tempo of training and testing activities. Alternative 1 would include adjustments to the baseline and additional weapons, platforms, and systems. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 1, potential accessibility issues would be the same as those associated with the No Action Alternative. Training activities in the same warfare areas would continue but with adjustments to locations and tempo of activities. There would be no changes to the Navy's standard operating procedures for public access to ocean and airspace. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 training activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because inaccessibility to areas of co-use would be temporary and short duration (typically 1.5 to 4 hours per location). Based on the Navy's standard operating procedures and the expansion of the Study Area, accessibility issues would be minor.

Testing

Under Alternative 1, potential accessibility issues would be the same as those associated with the No Action Alternative. Testing would increase in tempo and adjustments to locations within the Study Area including testing activities that occurred at the South Florida Ocean Measurement Facility Testing Range. There would be no changes to the Navy's standard operating procedures for public access to testing ranges and other areas used for testing. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 testing activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because inaccessibility to areas of co-use would be temporary and short duration (typically 1.5 to 4 hours per location). Based on the Navy's standard operating procedures and the expansion of the Study Area, accessibility issues would be minor.

3.11.3.1.2.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative, plus it establishes new range capabilities, modifies existing capabilities, and adjusts the type and tempo of training and testing. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 2, potential accessibility issues would be the same as those associated with the No Action Alternative. Training activities in the same warfare areas would continue within the Study Area but with adjustments to locations and tempo of activities. There would be no changes to the Navy's standard operating procedures for public access to ocean and airspace. As in Alternative 1, there would be no anticipated impacts from Alternative 2 training activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because inaccessibility to areas of co-use would be temporary and short duration (typically 1.5 to 4 hours per location). Based on the Navy's standard operating procedures and the expansion of the Study Area, accessibility issues would be minor.

Testing

Under Alternative 2, potential accessibility issues would be the same as those associated with the No Action Alternative. There would be no anticipated impacts from testing activities associated with Alternative 2 on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism. Accessibility issues associated with testing activities associated with Alternative 2 would be minor.

3.11.3.1.3 Conclusions

Access restrictions in the Navy training and testing areas would be temporary, and these conditions would return to normal upon completion of training and testing activities. These conditions would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience.

3.11.3.2 Airborne Acoustics

As an environmental stressor, loud noises, sonic booms, and vibrations generated from Navy activities such as weapons firing, in-air explosions, and aircraft transiting have the potential to disrupt wildlife and humans in the Study Area. The public might intermittently hear noise from ships or aircraft overflights if they are in the general vicinity of a training or testing event, but there would be no impact on public health and safety because of the infrequency and duration of events. Airborne noise would not impact energy generation, mineral extraction, commercial transportation and shipping, or aquaculture. Based on the analysis of impacts from the Proposed Action, fish would not experience substantial impacts from airborne acoustics (Section 3.9, Fish). Marine invertebrates (Section 3.8), also important commercial fishery resources, would not be affected by airborne acoustics because most species' ability to sense sound is very limited. Therefore, airborne noise from Navy activities would not impact commercial or recreational fishing.

Noise interference could decrease public enjoyment of recreational activities. These effects would occur on a temporary basis, only when weapons firing, in-air explosions, and aircraft transiting occur. Of these activities, Navy activities involving weapons firing and in-air explosions would only occur when the Navy

can confirm the area is clear of nonparticipants, reducing the likelihood these activities would be heard. Tourism and recreational activity revenue (Tables 3.11-5 and 3.11-6) is not expected to be impacted by airborne noise. Most naval training would occur well out to sea, while civilian recreational activities are largely conducted within a few miles of shore, resulting in negligible impacts.

3.11.3.2.1 Evaluation of Alternatives

3.11.3.2.1.1 No Action Alternative

Training

Under the No Action Alternative, potential airborne noise issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities in these warfare areas would continue at current levels and within established ranges and training locations, including the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. There would be no anticipated impacts on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, and aquaculture because acoustic conditions would have no effect on these activities and the training area would be free of nonparticipants. Navy operational procedures and practices are already in place to avoid impacts to ongoing activities in the training areas. Navy training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

Testing

Under the No Action Alternative, potential airborne noise issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, sea trials, and other weapons platform testing. Testing activities would continue at current levels and within established training and testing ranges, including the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; CGULL OPAREA; and Naval Surface Warfare Center, Panama City Division Testing Range. There would be no anticipated impacts on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, and aquaculture because acoustic conditions would have no effect on these activities and the testing area would be free of nonparticipants. Navy operational procedures and practices are already in place to avoid impacts to ongoing activities in the testing areas. Navy testing activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

3.11.3.2.1.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus the expansion of the Study Area boundary and adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 1, the number of training activities associated with airborne noise would increase compared to the No Action Alternative. Training activities in the same warfare areas would continue but with adjustments to locations and tempo of activities. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 activities on energy production, mineral extraction,

commercial transportation and shipping, commercial and recreational fishing, and aquaculture. Navy training activities producing airborne noise are normally short term, temporary, and away from populated areas. Therefore, airborne noise impacts on tourism would be negligible.

Testing

Under Alternative 1, the number of testing activities associated with airborne noise would increase compared to the No Action Alternative. Testing within the Study Area would increase in tempo and change slightly in location. Testing activities for Alternative 1 would include up to four ship shock trials per year. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 testing activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, or aquaculture. Navy testing activities producing airborne noise are normally short term, temporary, and away from populated areas. Therefore, airborne noise impacts on tourism would be negligible.

3.11.3.2.1.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 2, the number of training activities associated with airborne noise would increase compared to the No Action Alternative. Training activities in the same warfare areas would continue but with adjustments to locations and tempo of activities. Similar to Alternative 1, there would be no anticipated impacts from Alternative 2 training activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, or aquaculture. Navy training activities producing airborne noise are normally short term, temporary, and away from populated areas. Therefore, airborne noise impacts on tourism would be negligible.

Testing

Under Alternative 2, the number of testing activities associated with airborne noise would increase compared to the No Action Alternative. Testing activities for Alternative 2 would include ship shock trials. Testing would increase in tempo and within the Study Area. Similar to Alternative 1, there would be no anticipated impacts from Alternative 2 testing activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, or aquaculture. Navy testing activities producing airborne noise are normally short term, temporary, and away from populated areas. Therefore, airborne noise impacts on tourism would be negligible.

3.11.3.2.2 Conclusions

Because the majority of Navy training and testing activity areas are not located where tourism and recreational activities occur, the impact of airborne noise is negligible. The public might intermittently hear noise from ships or aircraft overflights if they are in the general vicinity of training or testing, but these would be infrequent events. The infrequent exposure to airborne noise would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience.

3.11.3.3 Physical Disturbance and Strikes

The evaluation of impacts on socioeconomic resources from physical stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (non-explosive practice munitions, other military expended materials, and in-water devices), or resting on the ocean floor (anchors, mines, and targets) that may damage or encounter civilian equipment. Physical disturbances that damage equipment and infrastructure could disrupt the collection and transport of products, which may impact industry revenue or operating costs.

Navy training and testing equipment and vessels moving through the water could collide with non-Navy vessels and equipment. Most of the activities included in the Proposed Action involve vessel movement and use of towed devices. The likelihood that a Navy vessel would collide with a non-Navy vessel is remote because of the use of navigational aids by both Navy and civilians.

Military expended materials can physically interact with civilian equipment and infrastructure. Many of the training and testing activities use military expended materials including chaff, flares, projectiles, casings, target fragments, missile fragments, rocket fragments, ballast weights, and mine shapes.

3.11.3.3.1 Socioeconomic Activities

3.11.3.3.1.1 Sources of Energy Production and Distribution

The evaluation of impacts on sources of energy generation in the Study Area from physical disturbances or strikes focuses on objects moving through the water or air, dropped into the water, or resting on the ocean floor that may damage equipment. Military expended materials that damage equipment and infrastructure could disrupt energy production and distribution, which may impact industry revenue or operating costs. The Navy does not perform activities that would release military expended materials near known submerged equipment or infrastructure because these are known areas that are avoided by the Navy. The Navy does not perform activities that potentially would interfere with equipment or infrastructure. Therefore, Navy activities disrupting or disturbing equipment and structures in the water by physical strikes would be negligible.

3.11.3.3.1.2 Mineral Extraction

Similar to the potential impacts on sources of energy production, physical disturbances or strikes could damage or encounter equipment. Strikes that inadvertently snag, entangle, and damage sand and gravel extraction equipment or disrupt the sand and gravel extraction process may impact industry revenue or operating costs. The Navy has standard operating procedures for clearing training and testing areas before initiating hazardous activities. Navy expended materials would not impede offshore sand and gravel extraction because these activities are conducted using controlled suction processes (i.e., dragheads and submerged or floating pipelines). The Navy would avoid conducting training and testing in areas of mineral extraction. Therefore, the potential for Navy activities to disrupt or disturb mineral extraction vessels or equipment by physical disturbances or strikes would be negligible.

3.11.3.3.1.3 Commercial Transportation and Shipping

There would be no anticipated impacts on commercial transportation activities in the Study Area since naval vessels and aircraft conducting training and testing generally conduct these activities away from commercially used waterways and airways. While physical disturbances or strikes could damage or encounter commercial marine vessels or aircraft, the Navy has standard operating procedures for clearing training and testing areas before initiating hazardous activities. The Navy's use of expended

materials (i.e., objects moving through the water or air, dropped into the water, or resting on the ocean floor) during training and testing activities are conducted away from commercially used waterways and airways. Therefore, the potential for Navy activities to disrupt or disturb commercial vessels or aircraft by physical disturbances or strikes would be negligible.

3.11.3.3.1.4 Commercial and Recreational Fishing

Any physical disturbance in the ocean or on the ocean floor, such as ship anchoring, targets or mines resting on the ocean floor, moored mines, bottom-mounted tripods, vessel movements, and use of towed system and attachment cables could inadvertently damage or destroy fisheries resources and associated habitat, as well as submerged fishing equipment and gear. Military expended materials, such as parachutes, cables, and guidance wires, can be deposited on the ocean bottom and could inadvertently snag, entangle, and damage fishing equipment. This could cause loss of income, revenue, and employment.

Section 3.9 (Fish) evaluated impacts on fish habitat from physical disturbances, strikes (by small-, medium-, and large-projectiles), and the use of electromagnetic and towed devices. Physical disturbances and strikes would be concentrated within designated gunnery box areas, resulting in localized disturbances of hard bottom areas, but could occur anywhere in the Study Area. Direct and indirect impacts on the fishes using hard bottom habitat in the Study Area could occur. Electromagnetic activities would not result in movement or behavioral responses, or in the destruction or adverse modification of critical habitats for fish in the Study Area. The use of towed devices may result in short-term and localized displacement of fishes in the water column or on the seafloor. There may be temporary movement of fish out of an area as a result of Navy training and testing activities; however, those relocations would not be permanent. Decreased populations of fish in the Study Area would not be expected and, therefore, loss of revenue or employment associated with commercial fishing would not occur. No change to recreational fishing in the Study Area would be anticipated.

Fishing activities have the potential to interact with equipment used during the proposed Navy training and testing operations. Commercial bottom-fishing activities, such as dredging, bottom trawling, long lines, and pots and traps, have the greatest potential for negative impacts. Interaction with bottom-fishing gear could result in the loss of or damage to both commercial and naval hardware and fishing gear. These bottom fishing commercial gear account for most fishing gear types used in the Study Area (Tables 3.11-1 through 3.11-3). Entanglement by cables and guidance wires expended during training activities would not result in destruction or adverse modification of fish habitat. Based on the large size of the Study Area, the limited areas of activities, and the advance public release of Notices to Mariners, impacts on commercial or recreational fishing in the Study Area would be unlikely.

3.11.3.3.1.5 Aquaculture

There are no anticipated direct impacts from physical stressors on the aquaculture industry because there are no aquaculture farms in any of the range complexes or testing ranges, the directional waterways used by naval vessels, or the training areas in the Chesapeake Bay. There is a limited possibility that physical disturbances on the ocean floor such as ship anchoring, targets or mines resting on the ocean floor, moored mines, bottom-mounted tripods, vessel movements, and use of towed systems and attachment cables could inadvertently damage or destroy aquaculture gear; however, aquaculture activities have specific depth requirements that would not coincide with activities that would have an impact.

3.11.3.3.1.6 Tourism

Navy training and testing involving non-explosive practice munitions, aircraft, ship movement, towed in-water devices, and ocean bottom-deployed devices occur in the Study Area. Most naval training and testing would occur well out to sea, while many popular civilian recreational activities are conducted within a few miles of land. Recreational diving and snorkeling activities within the Study Area take place primarily at known diving sites, including shipwrecks and artificial reefs. The locations of these popular sites are well documented, boats are typically well marked, and diver-down flags would be visible from, and avoided by, Navy ships conducting training and testing activities. As a result, conflicts between training and testing activities within the offshore areas and recreational diving and snorkeling would not occur. Changes to tourism activities in the Study Area would not be expected and, therefore, loss of revenue or employment associated with tourism would not occur.

Other tourism activities such as whale watching, boating, or use of other watercraft occur farther out to sea and are conducted by boat, by aircraft, or from land. These activities would be conducted with boats that are typically well marked and visible to Navy ships conducting training and testing activities. Individual boaters engaged in tourism activities such as whale watching, monitor navigational information to avoid Navy training and testing areas. Vessel operators are responsible for being aware of designated danger areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard. At the same time, Navy vessels ensure that an area is clear of nonparticipants before training and testing exercises. As a result, conflicts between Navy training and testing activities in offshore areas and whale watching or other offshore recreational use would not occur. Changes to offshore tourism activities in the Study Area would not be expected and, therefore, loss of revenue or employment associated with tourism would not occur.

The Navy would continue to recover many of the targets used in training and testing so they would not pose a collision risk. Unrecoverable pieces are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function is completed, so they would not represent a collision risk to recreational vessels.

3.11.3.3.2 Evaluation of Alternatives

3.11.3.3.2.1 No Action Alternative

Training

Under the No Action Alternative, potential physical disturbance and strike issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities in these warfare areas would continue at current levels and within established ranges and training locations, including the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. There would be no anticipated impacts on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because the Navy clears the area before training activities take place and the Navy does not train in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the large expanse of the training ranges, the likelihood of a physical disturbance or strike on civilian property (i.e., equipment or vessels) in the Study Area would be negligible. Therefore, loss of revenue or employment changes to human activities in the Study Area would not be expected.

Testing

Under the No Action Alternative, potential physical disturbance and strike issues would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, sea trials, and other weapons platform testing. Testing activities would continue at current levels and within established training and testing ranges, including the Northeast, VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; CGULL OPAREA; and Naval Surface Warfare Center, Panama City Division Testing Range. There would be no anticipated impacts on energy production and distribution, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because the Navy clears the area before testing activities take place and the Navy does not test in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the large expanse of the Study Area, the likelihood of a physical disturbance or strike on civilian property would be negligible.

3.11.3.3.2.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus the expansion of the Study Area boundary and adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 1, potential physical disturbance and strike issues would be the same as those associated with the No Action Alternative. Training activities in the same warfare areas would continue within the Study Area but with adjustments to locations and tempo of activities. There would be no changes to the Navy's standard operating procedures for training activities performed in the Study Area. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 training activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because the Navy clears the area before training activities take place and the Navy does not train in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the size of the Study Area, the likelihood of a physical disturbance or strike on civilian property would be negligible.

Testing

Under Alternative 1, potential physical disturbance and strike issues would be the same as those associated with the No Action Alternative with the addition of ship shock trials. Testing within the Study Area would increase in tempo and testing locations may vary. There would be no changes to the Navy's standard operating procedures for public access to testing ranges. Similar to the No Action Alternative, there would be no anticipated impacts from Alternative 1 testing activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because the Navy clears the area before testing activities take place and the Navy does not test in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the size of the Study Area, the likelihood of a physical disturbance or strike on civilian property would be negligible.

3.11.3.3.2.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area boundary into the north Atlantic Ocean and part of the Gulf of Mexico, as shown on Figure 2.1-1.

Training

Under Alternative 2, potential physical disturbance and strike issues would be the same as those associated with the No Action Alternative. Training activities in the same warfare areas would continue but with adjustments to locations and tempo of activities. There would be no changes to the Navy's standard operating procedures for public access to ocean and airspace. As in Alternative 1, there would be no anticipated impacts from Alternative 2 training activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, and tourism because the Navy clears the area before training activities take place and the Navy does not train in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the size of the Study Area, the likelihood of a physical disturbance or strike on civilian property would be negligible.

Testing

Under Alternative 2, potential physical disturbance and strike issues would be the same as those associated with the No Action Alternative with the addition of ship shock trials. Testing within the Study Area would increase in tempo and testing locations may vary. There would be no changes to the Navy's standard operating procedures for public access to test ranges. As in Alternative 1, there would be no anticipated impacts from Alternative 2 testing activities on energy production, mineral extraction, commercial transportation and shipping, commercial and recreational fishing, aquaculture, or tourism because the Navy clears the area before testing activities take place and the Navy does not test in areas close to infrastructure or civilian activities. Based on the Navy's standard operating procedures and the size of the Study Area, the likelihood of a physical disturbance or strike on civilian property would be negligible.

3.11.3.3.3 Conclusions

Because the Navy clears areas before performing training and testing activities and the Navy does not train in areas close to infrastructure or civilian activities, physical disturbances and strikes are unlikely. Therefore, the activities would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience.

3.11.4 Summary of Potential Impacts

3.11.4.1 Analysis of Secondary Stressors

Socioeconomics could be impacted if the proposed activities led to changes to physical and biological resources to the extent that they would alter the way industries can use those resources. Any potential impact on sediment and water quality, or on air quality, was considered to be a secondary stressor to socioeconomic resources. Secondary stressors may affect resource availability of minerals (e.g., offshore extraction of sand) and fisheries within the Study Area.

Mineral extraction activities could be impacted if the proposed activities alter marine habitats in a way that reduces the availability of sand for beach nourishment projects. Long-term deposition of Navy

expended materials on the ocean bottom was examined as a condition that could diminish availability of suitable sand for extraction. Mineral extraction operations could also be impacted if there were increases in costs due to the need to find alternate sites or if removal of military expended materials from active sites was required before extraction could continue. Because of the large size of the Study Area and the availability of offshore mineral resources, loss of revenue would not be expected. As discussed in Section 3.1 (Sediments and Water Quality), military expended materials would not impact sediment quality and availability or cost of extracting mineral resources. Therefore, there would be no indirect impacts associated with the Proposed Action on mineral extraction.

Fishing, aquaculture, and tourism could be impacted if the Proposed Action altered fish population levels to such an extent that these socioeconomic activities could no longer find sufficient abundance of targeted species. Sections 3.4 (Marine Mammals), 3.8 (Invertebrates), and 3.9 (Fish) determined, however, that there would be no population level impacts on marine species from training and testing activities. For these reasons, there would be no indirect impacts on commercial or recreational fishing, aquaculture, or tourism.

3.11.4.2 Combined Impacts of All Stressors

Stressors described in this EIS/OEIS that have potential impacts on socioeconomic resources include accessibility to air and sea space within the Study Area, airborne acoustics, physical disturbances and strikes, and indirect impacts from availability of resources (e.g., mineral resources and fisheries). Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the Study Area. Such activities also are dispersed temporally (i.e., few stressors would operate at the same time). Therefore, no greater impacts from the combined operation of more than one stressor are expected. The aggregate effect on socioeconomic resources would not observably differ from existing conditions.

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3.12 PUBLIC HEALTH AND SAFETY

PUBLIC HEALTH AND SAFETY SYNOPSIS

The Navy considered all potential stressors and the following have been analyzed for public health and safety:

- Underwater energy
- In-air energy
- Physical interactions
- Indirect impacts from sediment and water quality changes

Alternative 2 (Preferred Alternative)

Because of the Navy's standard operating procedures, impacts to public health and safety would be unlikely.

3.12.1 INTRODUCTION AND METHODS

3.12.1.1 Introduction

This section analyzes potential impacts on public health and safety within the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area). Unlike military training and testing activities conducted within a fenced-in boundary of an installation on land, public access to areas at sea or overlying airspace cannot be physically controlled. The Navy coordinates use of these areas internally by scheduling activities and by issuing warnings and notices to the public before conducting potentially hazardous activities (Section 3.12.2.2, Safety and Inspection Procedures). Areas of heightened sensitivity to public health and safety concerns within the Study Area include areas where the public may be close to certain activities (e.g., pierside sound navigation and ranging [sonar testing] or littoral training).

Generally, the greatest potential for a proposed activity to affect the public is in coastal areas because of the concentration of public activities. These coastal areas could be close to dive sites and other recreational areas where the collective health and safety of groups of individuals who could be exposed to the hazards associated with training and testing would be of concern. Most commercial and recreational marine activities (with the exception of commercial shipping) are close to the shore, usually limited by the capabilities of the boat used. Commercial and recreational fishing activities may extend as far out as 100 nautical miles (nm) from shore, but many are closer to the shoreline.

3.12.1.2 Methods

The baseline for public health and safety was derived from federal regulations, Department of Defense (DoD) directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution that describe criteria for public health and safety considerations. The baseline for public health and safety was derived from training and testing activities under the No Action Alternative and under the Study Area shown in Figure 2.6-1.

The alternatives were evaluated based on two factors: the potential that a training or testing activity could impact public health and safety and the degree to which those activities could have an impact. The likelihood that the public would be near a training or testing activity determines the potential for

exposure to the activity. If the potential for exposure exists, the degree of the potential impacts on public health and safety, including increased risk for injury or loss of life, was determined. If the potential for exposure does not exist, there would be no impacts on public health and safety. Isolated incidents and other conditions that affect single individuals, although important for safety awareness, are not considered in this assessment (e.g., airborne noise effects are not addressed in this section).

3.12.2 AFFECTED ENVIRONMENT

3.12.2.1 Overview

The area of interest for assessing potential impacts on public health and safety is the United States (U.S.) territorial waters of the east and gulf coasts (seaward of the mean high water line to 12 nm). Military, commercial, institutional, and recreational activities take place simultaneously in the Study Area (Figure 3.12-1) and have coexisted safely for decades. These activities coexist because there are rules and practices that lead to safe use of the waterway or airspace. The following paragraphs briefly discuss the rules and practices for recreational, commercial, and military use in sea surface areas and airspace.

Figure 3.12-1: Simultaneous Activities within the Study Area

3.12.2.1.1 Sea Space

Most of the sea space in the Study Area is accessible to recreational and commercial activities; however, some activities are prohibited or restricted in certain areas. These restrictions can be permanent or temporary. The National Oceanic and Atmospheric Administration issues nautical charts that reflect designated restricted zones. In accordance with Title 33 Code of Federal Regulations (C.F.R.) Part 72, the U.S. Coast Guard and the Department of Homeland Security publish marine information pertaining to sea space (e.g., danger zones and restricted areas, Figures 3.11-4 through 3.11-7 in Section 3.11, Socioeconomic Resources). Notices to Mariners provide information to private and commercial vessels

regarding temporary closures of areas. These navigational warnings are disseminated by broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and global positioning system navigation charts. They provide information about duration and location of closures due to activities that are hazardous to surface vessels. Civilian vessel operators are responsible for being aware of designated danger areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard.

3.12.2.1.2 Airspace

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft; however, like waterways, some areas are temporarily off limits to civilian and commercial use. The Federal Aviation Administration has established Special Use Airspace that refers to airspace of defined dimensions wherein activities must be confined because of their nature or wherein limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration 2011). Special Use Airspace in the Study Area includes the following:

- Restricted Airspace: Areas where aircraft are subject to restriction due to the existence of unusual (often invisible) hazards to aircraft (e.g., release of ordnance). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies.
- Military Operations Area: Areas typically below 18,000 feet (ft.) used to separate certain nonhazardous military flight activities from instrument flight rules traffic and to identify visual flight rules traffic where these activities are conducted.
- Warning Area: Areas of defined dimensions, extending from 3 nm outward from the coast of the United States, that serve to warn nonparticipating aircraft of potential danger.
- Air Traffic Controlled Assigned Airspace: Airspace that is Federal Aviation Administration-defined and is not over an existing operating area. This airspace is used to contain specified activities, such as military flight training, that are segregated from other instrument flight rules air traffic.

Notices to Airmen are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route to or at a specific location. The Federal Aviation Administration issues Notices to Airmen to disseminate information on upcoming or ongoing military exercises with resulting airspace restrictions. Civilian aircraft operators are responsible for being aware of restricted areas in airspace and any Notices to Airmen in effect. Pilots have a duty to abide by aviation rules as administered by the Federal Aviation Administration.

Weather conditions will dictate whether an aircraft (general aviation, commercial, or military) can fly under visual flight rules or instrument flight rules. Under visual flight rules, the weather is favorable and the pilot is required to remain clear of clouds by specified distances to ensure separation from other aircraft under the concept of see and avoid. Pilots flying under visual flight rules must be able to see outside of the cockpit, control the aircraft's attitude, navigate, and avoid obstacles and other aircraft based on visual cues. Pilots flying under visual flight rules assume responsibility for their separation from all other aircraft and are generally not assigned routes or altitudes by air traffic control.

During unfavorable weather, pilots must follow instrument flight rules. Factors such as visibility, cloud distance, cloud ceilings, and weather phenomena cause visual conditions to drop below the minimum required to operate by visual flight referencing. Instrument flight rules represent the regulations and restrictions a pilot must comply with when flying in weather conditions that restrict visibility. Pilots can

fly under instrument flight rules in visual flight rules weather conditions; however, pilots cannot fly under visual flight rules in instrument flight rules weather conditions.

3.12.2.2 Safety and Inspection Procedures

During training and testing, it is Navy policy to ensure the safety and health of personnel and the general public (U.S. Department of the Navy 2011c). The Navy achieves these conditions by considering a location when planning activities, scheduling and notifying potential users of an area, and making sure an area is clear of nonparticipants. The Navy also has a proactive and comprehensive program of compliance with applicable standards and implementation of safety management systems.

As previously stated, the greatest potential for a training or testing activity to affect the public is in coastal areas because of the concentration of public activities. When planning a training or testing event, the Navy considers proximity of the activity to public areas in choosing a location. Important factors considered include the ability to control access to an area; schedule (time of day, day of week); frequency, duration, and intensity of activities; range safety procedures; operational control of activities or events; and safety history.

The Navy's Fleet Area Control and Surveillance Facilities provide active management of assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. Fleet Forces Command units. The Navy schedules activities through the Fleet Area Control and Surveillance Facilities who will coordinate air and surface use of the operating areas (OPAREAs) with the Federal Aviation Administration and the U.S. Coast Guard, which will issue Notices to Airmen and Notices to Mariners, respectively.

During training and testing activities in the Study Area, the Navy ensures that the appropriate safety zone is clear of nonparticipants before engaging in certain activities such as weapon firing. Inability to obtain a "clear range" could result in the delay, cancelation, or relocation of an event. This approach ensures public safety during Navy activities that otherwise could harm nonparticipants. Current Navy practices employ the use of sensors and other devices (e.g., radar and big-eye binoculars) to ensure public health and safety while conducting training and testing activities. The following subsections outline the current requirements and practices for human safety as they pertain to range safety procedures, range inspection procedures, exercise planning, and scheduling and coordinating procedures for the Navy.

Training activities comply with the Fleet Area Control and Surveillance Facility procedures. Fleet Area Control and Surveillance Facilities Virginia Capes (VACAPES) and Jacksonville (JAX) have published safety procedures for activities on the offshore and nearshore areas (U.S. Department of the Navy 2011a, b). These guidelines (and others) apply to range users as follows:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities. The coordination also applies to towed sonar arrays and torpedo decoys.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.

- Aircraft carrying ordnance to or from ranges shall avoid populated areas to the maximum extent possible.
- Strict on-scene procedures include the use of ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data to confirm the firing range and target area are clear of civilian vessels, aircraft, or other nonparticipants.

Testing activities have their own comprehensive safety planning instructions (U.S. Department of the Navy 2008b, 2009). These instructions provide guidance on how to identify the hazards, assess the potential risk, analyze risk control measures, implement risk controls, and review safety procedures. They apply to all testing activities, including ground, waterborne, and airborne testing activities involving personnel, aircraft, inert minefields, equipment, and airspace. The guidance applies to system program managers, program engineers, test engineers, test directors, and aircrews that are responsible for incorporating safety planning and review when conducting test programs.

The following safety and inspection procedures are implemented, and the commanding officer is responsible for implementing safety and inspection procedures, for activities conducted inside and outside testing or training ranges. In the absence of specific guidance on matters of safety, the Navy follows the most prudent course of action. The following subsections contain information on the Navy's program of compliance with applicable standards and implementation of safety management systems.

3.12.2.2.1 Aviation Safety

The Navy procedures regarding planning and management of Special Use Airspace are provided in the Chief of Naval Operations Instruction 3770.2K, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy 2007). Scheduling and planning procedures for air operations on range complexes (including testing activities in the Northeast Range Complexes) are issued through the Navy's Fleet Area Control and Surveillance Facilities VACAPES and JAX (U.S. Department of the Navy 2011b). Testing ranges have their own procedures for aviation safety, like the Naval Surface Warfare Center, Panama City Division Instruction (U.S. Department of the Navy 2008b) and Naval Undersea Warfare Center Division, Newport Instruction (U.S. Department of Defense 2009).

Aircrews involved in a training or testing exercise must be aware that nonparticipating aircraft and ships are not precluded from entering the area and may not comply with Notices to Airmen or Notices to Mariners. Aircrews are required to maintain a continuous lookout for nonparticipating aircraft while operating in warning areas under visual flight rules. In general, aircraft carrying ordnance are not allowed to fly over surface vessels.

3.12.2.2.2 Submarine Navigation Safety

Submarine crews use various methods to avoid collisions while they are surfaced, including visual and radar scanning, acoustic depth finders, and state-of-the-art satellite navigational systems. When transiting submerged, submarines use all available ocean navigation tools, including inertial navigation charts that calculate position based on the submerged movements of the submarine. Areas with surface vessels can then be avoided to protect both the submarines and surface vessels.

3.12.2.2.3 Surface Vessel Navigation Safety

The Navy practices the fundamentals of safe navigation. While in transit, Navy surface vessel operators are alert at all times, use extreme caution, use state-of-the-art satellite navigational systems, and are trained to take proper action if there is potential risk. Surface vessels are also equipped with trained and

qualified Navy lookouts. Individuals trained as lookouts have the necessary skills to detect objects or activity in the water that could potentially be a risk for the vessel.

For specific testing activities, like unmanned surface vehicle testing, a support boat will be used in the vicinity of the testing to ensure safe navigation. Before firing or launching a weapon or radiating a non-eyesafe laser, Navy surface vessels are required to determine that all safety criteria have been satisfied. When applicable, the surface vessel will use aircraft and other boats to aid in navigation. In accordance with Navy instructions presented in this chapter, safety and inspection procedures ensure public health and safety.

3.12.2.2.4 Sonar Safety

Surface vessels and submarines may use active sonar in the pierside locations listed in Chapter 2 (Description of Proposed Action and Alternatives) and during transit to the training or testing exercise location. To ensure safe and effective sonar use, the Navy applies the same safety procedures for pierside sonar use as described under Section 3.12.2.2 (Safety and Inspection Procedures).

Naval Sea Systems Command Instruction 3150.2, Appendix 1A, *Safe Diving Distances from Transmitting Sonar*, is the Navy's governing document for protection of divers during active sonar use (U.S. Department of the Navy 1999). This instruction provides procedures for calculating safe distances from active sonar. These procedures are derived from experimental and theoretical research conducted at the Naval Submarine Medical Research Laboratory and the Navy Experimental Diving Unit. Safety distances vary based on conditions that include diver dress, type of sonar, and duration of time in the water. Some safety procedures include measurements to be taken during testing activities to identify an exclusion area for nonparticipating swimmers and divers.

3.12.2.2.5 Electromagnetic Energy Safety

All frequencies (or wavelengths) of electromagnetic energy are referred to as the electromagnetic spectrum and include electromagnetic radiation and radio frequency radiation. Communications and electronic devices such as radar, electronic warfare devices, navigational aids, two-way radios, cell phones, and other radio transmitters produce electromagnetic radiation. While such equipment emits electromagnetic energy, some of these systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations. Radio waves and microwaves emitted by transmitting antennas are another form of electromagnetic energy, collectively referred to as radio frequency radiation. Radio frequency energy includes frequencies ranging from 0 to 3,000 gigahertz. Exposure to radio frequency energy of sufficient intensity at frequencies between 3 kilohertz and 300 gigahertz can adversely affect people, ordnance, and fuel.

To avoid excessive exposures from electromagnetic energy, military aircraft are operated in accordance with standard operating procedures that establish minimum separation distances between electromagnetic energy emitters and people, ordnance, and fuels (U.S. Department of Defense 2009). Thresholds for determining hazardous levels of electromagnetic energy to humans, ordnance, and fuel have been determined for electromagnetic energy sources based on frequency and power output, and current practices are in place to protect the public from electromagnetic radiation hazards (U.S. Department of Defense 2002, 2009). These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, activating warning lights when radar systems are operational, and not operating some platforms that emit electromagnetic energy within 15 nm of shore. Safety planning instructions provide clearance procedures for nonparticipants in operational areas before conducting training

(U.S. Department of the Navy 2011a, b) and testing (U.S. Department of the Navy 2008b, 2009) activities that involve underwater electromagnetic energy (e.g., mine warfare).

Mine warfare devices are analyzed under other resources in this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) because they emit electromagnetic energy. The electromagnetic effects from mine warfare devices are extremely localized, unlike radars and radios. Measures to avoid public interaction with mine warfare devices are effective at protecting the public from these effects.

3.12.2.2.6 Laser Safety

Lasers produce light energy. The Navy uses tactical lasers for precision range finding, as target designation/illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures. Testing activities would also include high energy laser weapons tests to evaluate the specifications, integration, and performance of an aircraft-mounted, high energy laser. The high energy laser would be used as a weapon to disable small surface vessels. Laser safety procedures for aircraft require an initial pass over the target before laser activation to ensure that target areas are clear. The Navy observes strict precautions and has written instructions in place for laser users to ensure that nonparticipants are not exposed to intense light energy. During actual laser use, aircraft run-in headings are restricted to avoid unintentional contact with personnel or nonparticipants. Personnel participating in laser training activities are required to complete a laser safety course (U.S. Department of the Navy 2008a).

3.12.2.2.7 High-Explosive Ordnance Detonation Safety

Pressure waves from underwater detonations can pose a physical hazard in surrounding waters. Before conducting an underwater training or testing activity, Navy personnel establish an appropriately sized exclusion zone to avoid exposure of nonparticipants to the harmful intensities of pressure. Naval Sea Systems Command Instruction 3150.2, Chapter 2, *Safe Diving Distances from Transmitting Sonar*, provides procedures for determining safe distances from underwater explosions (U.S. Department of the Navy 1999). In accordance with training and testing procedures for safety planning related to detonations (Section 3.12.2.2.8, Weapons Firing and Ordnance Expenditure Safety), the Navy uses the following general and underwater detonation procedures:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer or Test Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Detonation activities will be conducted during daylight hours.

3.12.2.2.8 Weapons Firing and Ordnance Expenditure Safety

In accordance with safety and inspection procedures (U.S. Department of the Navy 2011b), any unit conducting firing and ordnance expenditure shall ensure that all possible safety precautions are taken to prevent accidental injury or property damage. The Officer Conducting the Exercise shall permit firing or jettisoning of aerial targets only when the area is confirmed to be clear of nonparticipating units, both civilian and military.

Safety is a primary consideration for all training and testing activities. The range must be able to safely contain the hazard area of the weapons and equipment employed. The hazard area is based on the size and net explosive weight of the weapon, and it includes a safety buffer around the target to account for items going off range or malfunctioning. The size of the buffer zone is determined by the type of activity. For activities with a large hazard area, special sea and air surveillance measures are implemented to make sure the area is clear before the activities commence. Before aircraft can drop ordnance, they are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other nonparticipants. Aircraft carrying ordnance are not allowed to fly over surface vessels.

Training and testing activities are delayed, moved, or cancelled if there is any question about the safety of the public. Target areas must be clear of nonparticipants before conducting training and testing. When using ordnance with flight termination systems (which terminate the flight of airborne missiles or launch vehicles when they veer from their targeted path), the Navy is required to follow standard operating procedures to ensure public health and safety. In those cases where a weapons system does not have a flight termination system, the size of the target area that needs to be clear of nonparticipants is based on the flight distance of the weapon plus an additional distance beyond the system's performance capability.

3.12.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact public health and safety. Table 2.8-1 through 2.8-3 present the baseline and proposed training and testing activity locations for each alternative (including the number of events and ordnance expended). Each public health and safety stressor is introduced, analyzed by alternative, and analyzed for training and testing activities. Table F-1 in Appendix F shows the warfare areas and associated stressors that were considered for analysis of public health and safety. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to public health and safety are the following:

- underwater energy
- in-air energy
- physical interactions

Alternatives 1 and 2 include the expansion of the Study Area boundary to the north Atlantic Ocean, the southern part of the Gulf of Mexico, and in shipyards. While Alternatives 1 and 2 would adjust locations and tempo of training and testing activities, existing safety procedures and standard operating procedures would be employed such that no new or additional impacts to public health and safety would occur. Therefore, the expansion of the Study Area boundary will not be addressed in the analysis below.

The potential for impacts on public health and safety were evaluated assuming the continued implementation of the Navy's current safety procedures for each training and testing activity or group of similar activities. Generally, the greatest potential for the proposed activities to be co-located with public activities would be in coastal areas because most commercial and recreational activities occur close to the shore.

Training and testing activities in the Study Area are conducted in accordance with guidance provided in Fleet Area Control and Surveillance Facility Instructions (U.S. Department of the Navy 2011a, b) and Test and Safety Planning Instructions (U.S. Department of the Navy 2008b, 2009). These instructions provide

operational and safety procedures for all normal range events. They also provide information to range users that is necessary to operate safely and avoid affecting nonmilitary activities such as shipping, recreational boating, diving, and commercial or recreational fishing. Ranges are managed in accordance with standard operating procedures that ensure public health and safety. Current requirements and practices (e.g., standard operating procedures) designed to prevent public health and safety impacts are identified in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

3.12.3.1 Underwater Energy

Underwater energy can come from acoustic sources or electromagnetic devices. Active sonar, underwater explosions, airguns, and vessel movements produce underwater acoustic energy. Sound will travel from air to water during aircraft overflights. Electromagnetic energy can enter the water from mine warfare training devices and unmanned underwater systems. The potential for the public to be exposed to these stressors would be limited to individuals, such as recreational swimmers or self-contained underwater breathing apparatus (SCUBA) divers, that are underwater and within unsafe proximity of a training or testing event.

Underwater acoustic energy is generated from many of the proposed activities; however, not all rise to the level of consideration in this EIS/OEIS. The public might intermittently hear noise from ships if they are in the general vicinity of a training or testing event, but there would be no impact on public health and safety because of the infrequency and duration of events. Pierside integrated swimmer defense testing with underwater airguns is conducted during swimmer defense and diver deterrent training and testing activities; public health and safety would be ensured for these localized activities because access to pierside locations by nonparticipants is controlled for safety and security reasons. Because of the infrequency and short duration of the events, underwater acoustic energy from vessel movements, aircraft overflights, and airguns is not analyzed in further detail. Active sonar and underwater explosions are the only sources of underwater acoustic energy evaluated for potential impacts on public health and safety.

The proposed activities that would result in underwater acoustic energy include activities such as amphibious warfare, anti-surface warfare, anti-submarine warfare, mine warfare, civilian port defense, surface warfare testing, littoral combat ship testing, sonar maintenance, pierside sonar testing, and unmanned vehicle testing. A limited amount of active sonar would be used during transit between range complexes and training and testing locations.

The effect of active sonar on humans varies with the frequency of sonar involved. Of the four types of sonar (very high-, high-, mid-, and low-frequency), mid-frequency and low-frequency sonar have the greatest potential to impact humans due to the range of human hearing. Underwater explosives cause a physical shock front that compresses the explosive material, and the pressure wave then passes into the surrounding water. Generally, the pressure wave would be the primary cause of injury. The effects of an underwater explosion depend on several factors, including the size, type, and depth of the explosive charge and where it is in the water column.

Electromagnetic energy is associated with systems like the Organic Airborne and Surface Influence Sweep, which emit an electromagnetic field and sound to simulate the presence of a ship. It can also be used to cause nearby mines to explode. Unmanned underwater vehicles, some unmanned surface vehicles, and towed devices use electromagnetic energy. Electronic warfare activities involve aircraft, surface ship, and submarine crews attempting to control portions of the electromagnetic spectrum to degrade or deny the enemy's ability to take defensive actions. Electromagnetic signals dissipate quickly

with distance from the source. There is a lack of evidence in the literature to infer any adverse health effects from most levels of electromagnetic energy, which is why no federal standards have been set for occupational exposures to this type of energy. Because standard operating procedures require an area to be clear of participants, platforms emitting higher energy levels are not operated within 15 nm of shore and the public would not be exposed to electromagnetic energy the way a worker could experience long-term, occupational exposures. In the unlikely event that an exposure did occur, the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health and safety risk to the public. Therefore, the use of electromagnetic devices was eliminated as a potential underwater energy stressor on public health and safety.

As previously stated, the potential for the public to be exposed to these stressors would be limited to individuals who are underwater and within unsafe proximity to an event. SCUBA diving is a popular recreational activity that is typically concentrated around known dive attractions such as reefs and shipwrecks. The Professional Association of Diving Instructors (one of several scuba diving instruction organizations) suggests that certified open-water divers limit their dives to 60 ft. (18 meters [m]). More experienced divers are generally limited to 100 ft. (30.5 m); in general, no recreational diver should exceed 130 ft. (40 m) (Professional Association of Diving Instructors 2011). These depths typically limit this activity's distance from shore. Therefore, training and testing activities closest to shore have the greatest potential to co-occur with the public.

Swimmers and recreational SCUBA divers are not expected to be near Navy pierside locations (which include shipyards) because access to these areas is controlled for safety and security reasons. Locations of popular offshore diving spots are well documented, and dive boats (typically well marked) and diver-down flags would be visible from the ships conducting the training and testing. Therefore, co-occurrence of recreational divers and Navy activities is unlikely. Swimmers and recreational divers are not expected to be near training and testing locations where active sonar, underwater explosions, and electromagnetic activities would occur because of the strict procedures for clearance of nonparticipants before conducting activities.

The U.S. Navy Dive Manual (U.S. Department of the Navy 1999) prescribes safe distances from active sonar sources and underwater explosions. Safety precautions regarding use of electromagnetic energy are specified in DoD Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields* (U.S. Department of Defense 2002, 2009) and Military Standard 464A, *Electromagnetic Environmental Effects: Requirements for Systems* (U.S. Department of Defense 2002). These distances would be used as the standard safety buffers for underwater energy to protect public health and safety. If any unauthorized personnel are detected within the exercise area, the activity would be temporarily halted until the area is again cleared and secured.

3.12.3.1.1 No Action Alternative

3.12.3.1.1.1 Training

Under the No Action Alternative, active sonar training activities such as anti-submarine warfare, mine warfare, and sonar maintenance would continue at current levels and at current locations including the Northeast, VACAPES, Navy Cherry Point, JAX, and Gulf of Mexico (GOMEX) Range Complexes. Activities involving underwater explosions, such as anti-surface warfare and mine warfare, would also continue at current levels and at current locations. Current locations for underwater explosions include specific training areas in VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes, and the Sinking Exercise Boxes outside of the range complexes.

The analysis indicates that there would be no impact on public health and safety from training activities using underwater energy, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving underwater energy. Because of the Navy's safety procedures, the potential for training activities using underwater energy to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.1.1.2 Testing

Under the No Action Alternative, active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned vehicle testing, and sonar maintenance would continue at current levels and in current locations, including areas such as the Naval Undersea Warfare Center Division, Newport Testing Range; Narragansett Bay; CGULL OPAREA; Naval Surface Warfare Center, Panama City Division Testing Range; and the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Pierside testing of active sonar would continue to occur in Little Creek, Virginia; King's Bay, Georgia; and Port Canaveral, Florida. Testing activities involving underwater explosions, such as anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and surface combatant sea trials would also continue at current levels and at current locations. Current locations for underwater explosions include specific training areas in VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; Naval Surface Warfare Center, Panama City Division Testing Range; and the CGULL OPAREA.

The analysis indicates that there would be no impact on public health and safety from testing activities using underwater energy, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing testing activities involving underwater energy. Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.1.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.1.2.1 Training

Active sonar training events would continue to occur at current locations under Alternative 1; however, in many circumstances, the potential areas for these activities are expanded (see tables in Chapter 2). Locations for active sonar training include the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and Other AFTT Areas. While Alternative 1 would adjust locations and tempo of active sonar training activities, the Navy would continue implementation of standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Activities involving underwater explosions, such as anti-surface warfare, mine warfare, and civilian port defense, would also continue at current locations. The proposed locations include the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes, and the Sinking Exercise Boxes outside the range complexes. While Alternative 1 would adjust locations and tempo of underwater explosions training activities, the Navy would continue implementation of standard operating and safety procedures;

therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Because of the Navy's safety procedures, the potential for training activities to impact public health and safety under Alternative 1 would be unlikely.

3.12.3.1.2.2 Testing

Locations and tempo of active sonar testing activities would increase over the No Action Alternative. Alternative 1 also includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the testing required for these systems.

Under Alternative 1, there would be an increase in active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned vehicle testing, sonar maintenance, and sonobuoy lot acceptance testing. These activities would continue to occur in areas such as Narragansett Bay; South Florida Ocean Measurement Facility Testing Range; Naval Surface Warfare Center, Panama City Division Testing Range; Key West OPAREA; and the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Pierside testing of active sonar would continue to occur in Little Creek, Virginia; King's Bay, Georgia; and Port Canaveral, Florida; however, additional testing would occur pierside in places like Bath, Maine; Groton, Connecticut; Norfolk and Newport News, Virginia; and Pascagoula, Mississippi. While Alternative 1 would adjust locations and tempo of active sonar testing activities, the Navy would continue implementation of standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Testing activities involving underwater explosions—such as anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, surface combatant sea trials, littoral combat ship testing, ship shock trials, combat ship qualifications, at-sea explosive testing, and sonobuoy lot acceptance testing—would occur in the Key West OPAREA; Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes; Naval Surface Warfare Center, Panama City Division Testing Range; and the South Florida Ocean Measurement Facility Testing Range. While Alternative 1 would adjust locations and tempo of testing activities involving underwater explosions, the Navy would continue implementation of standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under the Alternative 1 would be unlikely.

3.12.3.1.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.1.3.1 Training

Alternative 2 is identical to Alternative 1 in the increase in active sonar and underwater explosions over the No Action Alternative. Alternative 2 is also identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Because of the

Navy's safety procedures, the potential for underwater training activities to impact public health and safety under Alternative 2 would be unlikely.

3.12.3.1.3.2 Testing

Alternative 2 would adjust locations and tempo of testing activities of active sonar and underwater explosions over the No Action Alternative. Similar to the analysis under Alternative 1, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Because of the Navy's safety procedures, the potential for underwater testing activities to impact public health and safety under Alternative 2 would be unlikely.

3.12.3.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy and lasers. The sources of electromagnetic energy include radar, navigational aids, and electronic warfare systems. These systems operate similarly to other navigational aids and radars at local airports and television weather stations throughout the United States. Electronic warfare systems emit electromagnetic energy similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. Current practices are in place to protect Navy personnel and the public from electromagnetic energy hazards. These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct human exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Procedures also are in place to limit public and participant exposure from electromagnetic energy emitted by military aircraft.

As described in Section 3.0.5.3.2.2 (Lasers), two types of lasers are used under the Proposed Action. Low energy lasers are used to illuminate or designate targets, to guide weapons, and to detect or classify mines. High energy lasers are used as weapons to disable surface targets. The Navy would operate high energy laser equipment in accordance with procedures defined in Operational Naval Instruction 5100.23G, *Navy Safety and Occupational Health Program Manual* (U.S. Department of the Navy 2011c). These high energy light sources can cause eye injuries. A comprehensive safety program exists for the use of lasers. Current Navy practices protect individuals from the hazard of severe eye injury caused by laser energy. Laser safety requirements for aircraft require verification that target areas are clear before commencement of the exercise. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

Training and testing activities involving electromagnetic energy include electronic warfare activities that use airborne and surface electronic jamming devices to defeat tracking and communications systems. Training activities involving low energy lasers include anti-surface warfare, mine warfare, and civil port defense; there are no training activities that use high energy lasers. Testing activities involving low energy lasers include surface warfare; air operations at Naval Surface Warfare Center, Panama City Division Testing Range; and mine warfare testing. High energy laser weapon testing activities are the only testing activities using high energy laser weapons and will occur only in the VACAPES Range Complex.

3.12.3.2.1 No Action Alternative

3.12.3.2.1.1 Training

Under the No Action Alternative, electronic warfare training activities involving electromagnetic energy sources would continue at current levels and in current locations, including the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Laser targeting activities and mine detection activities using

lasers would also continue at current levels within the VACAPES, Navy Cherry Point, and JAX Range Complexes.

It is unlikely that the public would be exposed to electromagnetic energy sources or lasers under the No Action Alternative. Based on the Navy's strict safety procedures for use of lasers and electronic warfare, it is unlikely these activities would be conducted close enough to the public to pose an increased risk. Because of the Navy's safety procedures, the potential for these training activities to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.2.1.2 Testing

Under the No Action Alternative, electronic warfare testing activities involving electromagnetic energy sources would continue at current levels and in current locations, including the specific areas of the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes and the Naval Surface Warfare Center Panama City Division Testing Range. Laser targeting activities and mine detection activities using lasers would continue at current levels and within current ranges and locations, including the VACAPES and JAX Range Complexes and the Naval Surface Warfare Center, Panama City Division Testing Range. No high energy lasers would be used under this alternative.

It is unlikely that the public would be exposed to electromagnetic energy sources or lasers from testing activities under the No Action Alternative. Because of the Navy's strict safety procedures for use of lasers and electronic warfare, it is unlikely these activities would be conducted close enough to the public to pose an increased risk, and the potential for these testing activities to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.2.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.2.2.1 Training

Under Alternative 1, the number of training activities that use electromagnetic energy would increase and would occur within the VACAPES, Navy Cherry Point, JAX, Key West, and GOMEX Range Complexes. Laser targeting activities and mine detection activities using lasers would increase within the VACAPES, Navy Cherry Point, and JAX Range Complexes.

While Alternative 1 would adjust locations and tempo of training activities involving electromagnetic energy and lasers, the Navy would continue implementation of standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.2.2.2 Testing

Under Alternative 1, the number of testing activities that use electromagnetic energy would increase and would occur in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Laser targeting activities and mine detection activities using lasers would increase and would occur in the VACAPES and JAX Range Complexes. High energy laser equipment has undergone Navy review and approval and is designed to incorporate safety precautions and engineering controls to prevent mishaps. Alternative 1

also includes the use of high energy lasers in the VACAPES Range Complex as an adjustment to baseline activities.

While Alternative 1 would adjust locations and tempo of testing activities involving electromagnetic energy and lasers, the Navy would continue implementation of standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.2.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.2.3.1 Training

Alternative 2 is identical to Alternative 1 in the increase and of activities over the No Action Alternative. As concluded under Alternative 1, impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.2.3.2 Testing

Similar to the analysis under Alternative 1, Alternative 2 would involve an increase in electromagnetic energy and laser testing activities. Electromagnetic energy activities would occur in the Northeast, VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Laser targeting activities, including high energy laser testing activities, would occur in the VACAPES and JAX Range Complexes. While Alternative 2 would adjust locations and tempo of testing activities involving electromagnetic energy and lasers, the Navy would continue implementation of standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.3 Physical Interactions

Public health and safety could be impacted by direct physical interactions with Navy activities. As described in Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors), Navy aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials could have a direct physical encounter with recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers.

Both Navy and public aircraft operate under visual flight rules requiring them to observe and avoid other aircraft. In addition, Notices to Airmen advise pilots about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures would minimize the potential for adverse interactions between Navy and nonparticipant aircraft. Because of standard operating procedures, private and commercial aircraft traversing the Study Area during training or testing activities are not subject to interactions with Navy aircraft, ordnance, and aerial targets.

Private and commercial vessels traversing the Study Area during training or testing activities are subject to interactions with Navy vessels, ordnance, and surface targets. Both Navy and public vessels operate

under maritime navigational rules requiring them to observe and avoid other vessels. In addition, Notices to Mariners advise vessel operators about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures minimize the potential for adverse interactions between Navy and nonparticipant vessels.

Recreational diving within the Study Area takes place primarily at known diving sites such as shipwrecks and reefs. The locations of these popular dive sites are well documented, dive boats are typically well-marked, and diver-down flags are visible from a distance. As a result, dive sites would be easily avoided by ships conducting training or testing activities. Interactions between training and testing activities and recreational divers thus would be minimized, reducing the potential for collisions or ship strikes. Similar knowledge and avoidance of popular fishing areas would minimize interactions between training and testing activities and recreational fishing.

Commercial and recreational fishing activities could encounter military expended materials that could entangle fishing gear and could pose a safety risk. The Navy would continue to recover targets at or near the surface used during training or testing to ensure they would not pose a collision risk. Unrecoverable pieces of military expended materials are typically small (such as sonobuoys), constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function was completed, so they would not pose a collision risk to civilian vessels or equipment. Thus, these targets do not pose a safety risk to individuals using the area for recreation because the public would not likely be exposed to these items before they sank to the seafloor.

As discussed in Section 3.1 (Sediments and Water Quality), a west coast study categorized types of marine debris pulled up by a trawler during a groundfish survey. Military expended materials categorized as plastic, metal, fabric and fiber, and rubber accounted for 7.4, 6.2, 13.2, and 4.7 percent of the total count of items collected, respectively. The footprint of military expended materials in the Study Area is discussed in Section 3.3.3.2.1 (Impacts from Military Expended Materials) of Marine Habitats. Tables 3.3-14 and 3.3-15 illustrate the very small percentage of marine substrate (much less than 1 percent of the total area of documented soft bottom or hard bottom in their respective training or testing areas). Given the small footprint of military expended materials estimated here, it is unlikely the public would encounter military expended materials during recreational or commercial fishing activities.

Section 3.1 (Sediments and Water Quality) also discussed the low failure rate of munitions, which indicates that most munitions operate as intended. While fishing activities may encounter undetonated ordnance, it would be unlikely because of the low density of munitions within the large size of the Study Area. The Army Corps of Engineers prescribes the following if military munitions are encountered: recognize when you may have encountered a munition, retreat from the area without touching or disturbing the item, and report the item to local law enforcement by calling 911 or the U.S. Coast Guard.

The analysis focuses on the potential for a direct physical interaction with aircraft, vessels, targets, or other expended materials. Virtually all proposed activities have potential for a direct physical interaction that could pose a risk to public health and safety, so the following analysis is not activity-specific. While some of the activities themselves may not pose potential for a direct physical interaction (like pierside sonar testing), the platforms associated with the activity (aircraft, vessels, and towed devices) have potential for a direct physical interaction that could pose a risk. The greatest potential for a physical interaction would be along the coast because of the concentration of public activities.

3.12.3.3.1 No Action Alternative

3.12.3.3.1.1 Training

Under the No Action Alternative, training activities would continue at current levels and within current locations. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would not change from the baseline. The Navy implements strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities.

The analysis indicates that there would be no impact on public health and safety from physical interactions with training activities, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving physical interactions. Because of the Navy's safety procedures, the potential for training activities to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.3.1.2 Testing

Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under the No Action Alternative. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under the No Action Alternative would be unlikely.

3.12.3.3.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.3.2.1 Training

Under Alternative 1, the number of training activities would increase. However, the increased number of aircraft and vessel movements or use of targets and expended materials would be conducted under the same safety and inspection procedures as under the No Action Alternative. While Alternative 1 would adjust locations and tempo of training activities, the Navy would continue implementation of standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.3.2.2 Testing

Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under Alternative 1. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely.

3.12.3.3.3 Alternative 2 (Preferred Alternative)

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets) requirements, new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems.

3.12.3.3.3.1 Training

Under Alternative 2, the number of training activities would increase. However, the increased number of aircraft and vessel movements or use of targets and expended materials would be conducted under the same safety and inspection procedures as under the No Action Alternative. While Alternative 2 would adjust locations and tempo of training activities, the Navy would continue implementation of standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.3.3.2 Testing

Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under Alternative 2. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 2 would be unlikely.

3.12.4 Summary of Potential Impacts

3.12.4.1 Indirect Impacts

Public health and safety could be impacted if there were changes to sediment or water quality. Section 3.1 (Sediments and Water Quality) considers the impacts on marine sediments and water quality from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that neither state nor federal standards or guidelines would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because these standards and guidelines are structured to protect human health, and the proposed activities do not violate them, there would be no indirect impacts on public health and safety from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

3.12.4.2 Combined Impact of All Stressors

Activities described in this EIS/OEIS that have potential to impact public health and safety include those that release underwater energy, in-air energy, or physical interactions, or that have indirect impacts from changes to sediments and water quality. Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the Study Area. Such activities also are dispersed temporally (i.e., few stressors would be present at the same time). For these reasons, no greater effects from the combined operation of more than one stressor are expected. The aggregate effect on public health and safety would not observably differ from existing conditions.

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4 CUMULATIVE IMPACTS

4.1 INTRODUCTION

Analysis of cumulative impacts (or cumulative effects)[1] presented in this section follows the requirements of the National Environmental Policy Act (NEPA) and Council on Environmental Quality guidance (Council on Environmental Quality 1997). The Council on Environmental Quality regulations (40 Code of Federal Regulations [C.F.R.] Parts 1500-1508) provide the implementing regulations for NEPA. The regulations define cumulative impacts as

> "…the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 C.F.R. § 1508.7)."

While a single project may have minor impacts, overall impacts may be collectively significant when the project is considered together with other projects on a regional scale. A cumulative impact is the additive effect of all projects in the geographic area. The Council on Environmental Quality provides guidance on cumulative impacts analysis in *Considering Cumulative Impacts under the National Environmental Policy Act* (Council on Environmental Quality 1997). This guidance further identifies cumulative impacts as those environmental impacts resulting "from spatial and temporal crowding of environmental perturbations. The impacts of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the impacts of the first perturbation." This guidance observes that "no universally accepted framework for cumulative impacts analysis exists" while noting that certain general principles have gained acceptance. The Council on Environmental Quality provides guidance on the extent to which agencies of the federal government are required to analyze the environmental impacts of past actions when they describe the cumulative environmental effect of an action. This guidance provides that an analysis of cumulative impacts might encompass geographic boundaries beyond the immediate area of an action and a timeframe that includes past actions and foreseeable future actions. Thus, the Council on Environmental Quality guidelines observe, "[it] is not practical to analyze cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful."

4.2 APPROACH TO ANALYSIS

4.2.1 OVERVIEW

Cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) in combination with past, present, and reasonably foreseeable future actions. The cumulative impacts analysis included the following steps, described in more detail below:

1. Identify appropriate level of analysis for each resource.
2. Define the geographic boundaries and timeframe for the cumulative impacts analysis.
3. Describe current resource conditions and trends.
4. Identify potential impacts of each alternative that might contribute to cumulative impacts.

[1] Council on Environmental Quality Regulations provides that the terms "cumulative effects" and "cumulative impacts" are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably by various sources, but the term "cumulative impacts" is used in this document except for quotations, for continuity.

5. Identify past, present, and other reasonably foreseeable future actions that affect each resource.
6. Analyze potential cumulative impacts.

4.2.2 IDENTIFY APPROPRIATE LEVEL OF ANALYSIS FOR EACH RESOURCE

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 1997), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The rationale for the level of analysis applied to each resource is described in Section 4.4 (Resource-Specific Cumulative Impacts).

4.2.3 DEFINE THE GEOGRAPHIC BOUNDARIES AND TIMEFRAME FOR ANALYSIS

The geographic boundaries for the cumulative impacts analysis included the entire Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) (Figure 2.1-1). The geographic boundaries for marine mammals and sea turtles were expanded to include activities that might impact migratory marine mammals and sea turtles. Primary considerations from outside the Study Area include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

Determining the timeframe for the cumulative impacts analysis requires estimating the length of time the impacts of the Proposed Action would last (Council on Environmental Quality 1997) and considering the specific resource in terms of its history of degradation. The Proposed Action includes ongoing and anticipated future training and testing activities. While Navy training and testing requirements change over time in response to world events and several other factors, the general types of activities addressed by this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) are expected to continue indefinitely, and the associated impacts could occur indefinitely. Likewise, some reasonably foreseeable future actions and other environmental considerations addressed in the cumulative impacts analysis are expected to continue indefinitely (e.g., oil and gas production, maritime traffic, commercial fishing). Therefore, the cumulative impacts analysis is not bounded by a specific future timeframe. For past actions, the cumulative impacts analysis only considers those actions or activities that have ongoing impacts.

While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the indefinite future. Navy environmental planning and compliance for training and testing activities is an ongoing process. The Navy submitted applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act (MMPA) authorizations supported by this EIS/OEIS. The anticipated effective date for these MMPA authorizations would be in December 2013. The Navy anticipates preparing new or supplemental environmental planning documents covering changes in training and testing activities in the Study Area as necessary. These future environmental planning documents would include cumulative impacts analysis based on information available at that time.

4.2.4 DESCRIBE CURRENT RESOURCE CONDITIONS AND TRENDS

The Affected Environment sections of Chapter 3 describe current resource conditions and trends, and they discuss how past and present human activities influence each resource. The current aggregate impacts of past and present actions are reflected in the baseline information presented in Chapter 3

(Affected Environment and Environmental Consequences). This information is used in the cumulative impacts analysis to understand how past and present actions are currently impacting each resource and to provide the context for the cumulative impacts analysis.

4.2.5 IDENTIFY POTENTIAL IMPACTS OF THE ALTERNATIVES THAT MIGHT CONTRIBUTE TO CUMULATIVE IMPACTS

Direct and indirect impacts of the alternatives, presented in Chapter 3 (Affected Environment and Environmental Consequences), were reviewed to identify impacts relevant to the cumulative impacts analysis. Key factors considered included the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts for each stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. For example, for biological resources, population-level impacts were considered more likely to contribute to cumulative impacts than were individual-level impacts. Negligible impacts were not considered further in the cumulative impacts analysis. For marine mammals, any stressor that is expected to result in Level A harassment or Level B harassment, as defined by MMPA, was considered in the cumulative impacts analysis. For Endangered Species Act (ESA)-listed species, any stressor that may affect and is likely to adversely affect the species was considered in the cumulative impacts analysis. Stressors that were determined by the Navy to have no effect or that may affect but are not likely to adversely affect ESA-listed species were not analyzed in detail in the cumulative impacts analysis. A determination of may affect, not likely to adversely affect indicates that the impacts would be discountable (extremely unlikely) or insignificant.

4.2.6 IDENTIFY OTHER ACTIONS AND OTHER ENVIRONMENTAL CONSIDERATIONS THAT AFFECT EACH RESOURCE

A list of other actions was compiled for the Study Area and surrounding areas based on information obtained during the scoping process (Appendix E, Public Comments and Responses), communications with other agencies, a review of other military activities, literature review, previous NEPA analyses for some of the other actions, and other available information. Identified future actions were reviewed to determine if they should be considered further in the cumulative impacts analysis. Factors considered when identifying other actions to be included in the cumulative impacts analysis included the following:

- Whether the other action is likely or probable (i.e., reasonably foreseeable), rather than merely possible or speculative.
- The timing and location of the other action in relationship to proposed training and testing activities.
- Whether the other action and each alternative would affect the same resources.
- The current conditions, trends, and vulnerability of resources affected by the other action.
- The duration and intensity of the impacts of the other action.
- Whether the impacts have been truly meaningful, historically significant, or identified previously as a cumulative impact concern.

In addition to identifying reasonably foreseeable future actions, other environmental considerations for the cumulative impacts analysis were identified and described. These other considerations include major environmental stressors or issues (e.g., ocean pollution, ocean noise, coastal development, etc.) that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. Including these other environmental considerations allows an analysis of the current aggregate impacts of past and present actions, as well as reasonably foreseeable actions.

4.2.7 ANALYZE POTENTIAL CUMULATIVE IMPACTS

The current impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions were characterized and summarized. The incremental impacts of each alternative were then added to the combined impacts of all other actions to describe the cumulative impacts that could result if the No Action Alternative, Alternative 1, or Alternative 2 were implemented. The cumulative impacts analysis considered additive, synergistic, and antagonistic impacts. A qualitative analysis was conducted in most cases based on the available information. The analysis in Chapter 3 (Affected Environment and Environmental Consequences) indicates that the direct and indirect impacts of the No Action Alternative, Alternative 1, and Alternative 2 would be similar for many of the stressors. Therefore, much of the cumulative impacts discussion applies to all three alternatives. Specific differences between the alternatives are discussed when appropriate.

4.3 OTHER ACTIONS ANALYZED IN THE CUMULATIVE IMPACTS ANALYSIS

4.3.1 OVERVIEW

Table 4.3-1 lists the other actions and other environmental considerations identified for the cumulative impacts analysis. Descriptions of each action and environmental consideration carried forward for analysis are provided in the following sections.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Oil and Natural Gas Exploration, Extraction, and Production					
1	Outer Continental Shelf Oil and Gas Leasing Program	Bureau of Ocean Energy Management	Gulf of Mexico LME	Past, present, and future	Retained
2	Seismic Surveys	Bureau of Ocean Energy Management, oil and gas industry, National Science Foundation, and academic institutions	Entire Study Area, all LMEs, and open ocean areas	Past, present, and future	Retained
3	Installation of Floating, Production, Storage, and Offloading Systems	Bureau of Ocean Energy Management	Gulf of Mexico LME	Past, present, and future	Retained
4	Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf	Bureau of Ocean Energy Management	Gulf of Mexico LME	Past, present, and future	Retained
5	Liquefied Natural Gas Terminals	Federal Energy Regulatory Commission, Maritime Administration, and U.S. Coast Guard	Northeast U.S. Continental Shelf LME, Southeast U.S. Continental Shelf LME, and Gulf of Mexico LME	Past, present, and future	Retained
6	Commercial Wind Lease Issuance and Site Assessment Activities	Bureau of Ocean Energy Management	Northeast U.S. Continental Shelf LME and Southeast U.S. Continental Shelf LME	Future	Retained
7	Cape Wind Energy Project	Bureau of Ocean Energy Management Cape Wind Associates, LLC	Northeast U.S. Continental Shelf LME	Future	Retained

LME: large marine ecosystem

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (Continued)

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Offshore Power Generation					
8	Fishermen's Atlantic City Wind Farm	New Jersey State Agencies, U.S. Army Corps of Engineers, Fishermen's Wind Energy of New Jersey	Northeast U.S. Continental Shelf LME	Future	Retained
9	Interim Policy Leases on the Atlantic Outer Continental Shelf – Fisherman's Energy of New Jersey, Bluewater Delaware, and Bluewater Wind New Jersey Energy	Bureau of Ocean Energy Management, Fisherman's Energy of New Jersey, Bluewater Delaware, and Bluewater Wind New Jersey Energy	Northeast U.S. Continental Shelf LME	Future	Retained
10	Electrical Transmission Lines	Bureau of Ocean Energy Management, Atlantic Grid Holdings	Northeast U.S. Continental Shelf LME	Future	Retained
11	Wave and Tidal Energy Plants	Bureau of Ocean Energy Management	Northeast U.S. Continental Shelf LME, Southeast U.S. Continental Shelf LME, and Gulf of Mexico LME	Future	Dismissed because action is speculative
Dredge Disposal, Beach Nourishment, and Mining					
12	Offshore Dredge Disposal Program	U.S. Army Corps of Engineers	All LMEs	Past, present, and future	Retained
13	Beach Nourishment Programs	U.S. Army Corps of Engineers	All LMEs	Past, present, and future	Retained
14	Sand and Gravel Mining	Bureau of Ocean Energy Management	All LMEs	Past, present, and future	Retained

LME: large marine ecosystem.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (Continued)

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Other Military Activities					
15	Construction of the Undersea Warfare Training Range	U.S. Navy	Southeast U.S. Continental Shelf LME	Future (start construction fiscal year 2014)	Retained
16	Military Training at Eglin Air Force Base and Eglin Gulf Test and Training Range	U.S. Navy and U.S. Air Force	Gulf of Mexico LME	Present and future	Retained
17	Surveillance Towed Array Sensor System Low Frequency Active Sonar	U.S. Navy	All LMEs	Future	Retained
18	Air-to-Surface Training at Long Shoal Naval Ordnance Area	U.S. Navy	Inshore water of Pamlico Sound, North Carolina	Past, present, and future	Dismissed. Training would be outside the Study Area and would not involve the use of high explosive ordnance. Use of the target would be intermittent and potential impacts to marine animals would be short-term, local, and negligible to minor. Proposed training may affect, but is not likely to adversely affect ESA-listed species.
19	Joint Logistics Over-the-Shore Training	U.S. Navy, Marine Corps, and Army	Northeast and Southeast U.S. Continental Shelf LMEs	Future	Retained. Training activities associated with elevated causeway set up and break down are addressed under Alternatives 1 and 2 of this EIS/OEIS. Land-based training, including potential impacts to nesting sea turtles, will be addressed in separate NEPA documents by the other services.
20	Littoral Combat Ship Homeporting	U.S. Navy	Northeast and Southeast U.S. Continental Shelf LMEs	Future	Dismissed. Littoral Combat Ship training is considered under Alternatives 1 and 2 of this EIS/OEIS. While NEPA has not been completed and a decision has not been made, the Navy's envisaged homeporting locations for the Atlantic Fleet Littoral Combat Ships are Naval Station Mayport (primary) and Naval Station Norfolk (tertiary). No in water construction is anticipated for either of these ports; therefore, the potential for cumulative impacts from homeporting are negligible.

EIS: Environmental Impact Statement; ESA: Endangered Species Act; LME: large marine ecosystem; NEPA: National Environmental Impact Statement; OEIS: Overseas Environmental Impact Statement.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (Continued)

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Other Military Activities (Continued)					
21	Nuclear-Powered Aircraft Carrier Homeporting at Naval Station Mayport	U.S. Navy	Southeast U.S. Continental Shelf LME	Future	Retained for potential impacts associated with development activities to accommodate the carrier at Naval Air Station Mayport (e.g., dredging, increases in vessel traffic, underwater noise, etc.). Training activities are part of the Proposed Action for this EIS/OEIS.
22	Tactical Air Crew Combat Training System Tower Removal	U.S. Navy	Northeast and Southeast U.S. Continental Shelf LMEs	Future	Dismissed. Impacts associated with removing these communication towers from at-sea ranges are expected to be temporary, local, and negligible to minor.
23	U.S. Navy Climate Change Roadmap	U.S. Navy	All LMEs	Present and future	Retained
24	U.S. Marine Corps Grow the Force at Marine Corps Base Camp Lejeune, Marine Corps Air Station New River, and Marine Corps Air Station Cherry Point, North Carolina	U.S. Marine Corps	Southeast U.S. Continental Shelf LME	Present and future	Dismissed. The action includes relocation of Marines and associated construction on land. No impacts on marine resources were identified in the EIS.
25	U.S. Marine Corps training at Camp Lejeune and Marine Corps Air Station Cherry Point	U.S. Marine Corps	Southeast U.S. Continental Shelf LME	Past, present, and future	Dismissed. Most activities would occur on land. The Environmental Assessments for these actions concluded that impacts of in-water activities on marine resources would be negligible to minor and that in-water activities may affect but are not likely to adversely affect ESA-listed species.
26	U.S. Marine Corps Joint Strike Fighter	U.S. Marine Corps	All LMEs	Future	Dismissed. Homebasing activities such as new construction and personnel relocation are not expected to impact marine resources. Joint Strike Fighter training activities are addressed under Alternatives 1 and 2.
27	U.S. Air Force Aircraft Training from Langley Air Force Base	U.S. Air Force	Northeast U.S. Continental Shelf LME	Past, present, and future	Dismissed. Over-water activities are limited to aircraft overflights.

EIS: Environmental Impact Statement; ESA: Endangered Species Act; LME: large marine ecosystem; OEIS: Overseas Environmental Impact Statement.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (Continued)

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Other Military Activities (Continued)					
28	Training Conducted by U.S. Army Vessels from Fort Eustis	U.S. Army	Northeast U.S. Continental Shelf LME	Past, present, and future	Retained
29	Homeporting of U.S. Coast Guard National Security Cutter and Other Ships at Naval Air Station Mayport	U.S. Coast Guard and U.S. Navy	Southeast U.S. Continental Shelf LME	Future	Retained
30	U.S. Coast Guard Training Conducted from Various Coast Guard Stations along the East Coast, Caribbean, and Gulf of Mexico	U.S. Coast Guard	All LMEs	Past, present, and future	Retained
Environmental Regulations and Planning					
31	Expansion of North Atlantic Right Whale Critical Habitat – National Marine Fisheries Service	National Marine Fisheries Service	Northeast U.S. Continental Shelf LME and Southeast U.S. Continental Shelf LME	Future	Retained
32	Coastal and Marine Spatial Planning	Regional Planning Bodies	All LMEs	Future	Dismissed because action involves only planning and policy-related activities; specific future actions are speculative.
33	Marine Mammal Protection Act Incidental Take Authorizations	National Marine Fisheries Service	All LMEs	Past, present, and future	Retained

LME: large marine ecosystem.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (Continued)

#	Name of Action	Lead Agency or Proponent	Location	Timeframe	Retained for Further Analysis?
Other Environmental Considerations					
34	Commercial Fishing and Fishery Management Plans	National Marine Fisheries Service and private industry	All LMEs and open ocean areas	Past, present, and future	Retained
35	Maritime Traffic (including Panama Canal Widening and U.S. Coast Guard Atlantic Coast Port	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained
36	Maritime Traffic – Panama Canal Widening	Panama Canal Authority	All LMEs	Future	Retained
37	Maritime Traffic – U.S. Coast Guard Atlantic Coast Port Access Route Study	U.S. Coast Guard	All LMEs	Future	Retained
38	Ocean Noise	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained
39	Ocean Pollution (including Marine Debris, Nonpoint Source Pollution, and Cruise Ship Discharges)	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained
40	Commercial and General Aviation	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained for greenhouse gas emission analysis

LME: large marine ecosystem.

4.3.2 Oil and Natural Gas Exploration, Extraction, and Production

4.3.2.1 Outer Continental Shelf Oil and Gas Leasing Programs

The Bureau of Ocean Energy Management administers Outer Continental Shelf Oil and Gas Leasing Programs. As of 1 April 2011, there were 6,323 active oil and gas leases totaling 33,905,799 acres in the Gulf of Mexico Continental Shelf Oil Region (Western Planning Area, 1,403 leases and 7,889,290 acres leased; Central Planning Area, 4,805 leases and 25,397,566 acres leased; and Eastern Planning Area, 115 leases and 618,944 acres leased) (Bureau of Ocean Energy Management 2011c). Oil and gas exploration and production may occur in these areas.

On 1 December 2010, Secretary of the Interior Ken Salazar announced an updated oil and gas leasing strategy for the Outer Continental Shelf. Based on lessons learned from the *Deepwater Horizon* oil spill, the United States (U.S.) Department of the Interior increased the requirements in the drilling and production stages for equipment, safety, environmental safeguards, and oversight. To implement these reforms efficiently and effectively, critical agency resources will be focused on planning areas that currently have leases for potential future development. As a result, areas in the eastern Gulf of Mexico subject to the congressional moratorium on oil and gas exploration and production activities will not be considered for potential leasing before 2017. In addition, the Mid- and South Atlantic Planning Areas are no longer under consideration for potential development through 2017. The western Gulf of Mexico, the central Gulf of Mexico, the Cook Inlet, and the Chukchi and Beaufort Seas in the Arctic will continue to be considered for potential leasing before 2017 (U.S. Department of the Interior 2010).

4.3.2.2 Seismic Surveys

Seismic surveys are typically accomplished by towing a sound source such as an airgun array that emits acoustic energy in timed intervals behind a research vessel. The transmitted acoustic energy is reflected and received by an array of hydrophones. This acoustic information is processed to provide information about geological structure below the seafloor. The oil and gas industry uses seismic surveys to search for new hydrocarbon deposits. In addition, academic geologists use them to study plate tectonics and other topics. For example, *Research Vessel Marcus G. Langseth* is owned by the National Science Foundation and operated by the Lamont-Doherty Earth Observatory at Columbia University for use by academic researchers from universities around the world. The underwater sound produced by these surveys could affect marine life, including marine mammals. For example, the potential exists to expose some animals to sound levels exceeding 180 decibels (dB) referenced to (re) 1 micropascal (µPa) (root mean square), which would in turn potentially cause temporary or permanent loss of hearing (Bureau of Ocean Energy Management 2011a).

Seismic surveys conducted by the oil and gas industry on the Outer Continental Shelf are regulated and permitted by the Bureau of Ocean Energy Management. Its *Programmatic Environmental Assessment for Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf* was completed in 2004, and the *Draft Programmatic Environmental Impact Statement for Atlantic Outer Continental Shelf Proposed Geological and Geophysical Activities in the Mid-Atlantic and South Atlantic Planning Areas* was released in March 2012 (Bureau of Ocean Energy Management 2012a). All seismic surveys conducted by U.S. vessels are subject to the MMPA authorization process administered by the NMFS, as well as the NEPA process associated with issuing MMPA authorizations.

From 1968 through 2003, approximately 997,901 line miles (mi.) of two-dimensional seismic data were collected in the Gulf of Mexico region, and 212,967 line mi. were collected in the Atlantic region (Minerals Management Service 2005a). As of April 2011, the Bureau of Ocean Energy Management had

received nine applications for Atlantic Outer Continental Shelf seismic survey activities totaling 317,494 line mi.

4.3.2.3 Installation of Floating, Production, Storage, and Offloading Systems

The U.S. Department of the Interior, Minerals Management Service (now named the Bureau of Ocean Energy Management), prepared an EIS to evaluate potential environmental impacts of the proposed use of floating production, storage, and offloading systems in the deepwater portions (depths greater than 200 meters [m]) of the Western and Central Planning Areas of the Gulf of Mexico Outer Continental Shelf. Floating production systems would store crude oil in tanks in the hulls of vessels and would periodically offload the crude to shuttle tankers or ocean-going barges for transport to shore. The Record of Decision was signed 13 December 2001. The general concept of these systems was approved, although no specific installation was authorized in the planning document.

On 17 March 2011, the Bureau of Ocean Energy Management provided final approval necessary for Petrobras America, Inc. to begin oil and natural gas production at its Cascade-Chinook project in the Walker Ridge area of the Gulf of Mexico. The project started production in September 2012 (Offshore Energy Today 2012). Located approximately 165 mi. (265.5 kilometers [km]) from Louisiana in approximately 2,500 m of water, the project is the first deepwater floating production storage offloading facility approved in the United States. The facility has the capability to process oil and natural gas, store the crude oil in tanks in the facility's hull, and offload the crude to shuttle tankers for transportation to shore. Natural gas processed by the facility will be transported to shore by pipeline (Bureau of Ocean Energy Management 2011b).

4.3.2.4 Liquefied Natural Gas Terminals

In recent years, liquefied natural gas terminals have been proposed at several locations throughout the Atlantic coast and nearshore waters of the Gulf of Mexico in response to the quickly escalating domestic demand for natural gas. Table 4.3-2 provides a summary of existing and proposed offshore terminals in the Study Area. Several existing terminals are in coastal waters near the Study Area, and others are proposed (Federal Energy Regulatory Commission 2011).

Table 4.3-2: Existing and Proposed Offshore Liquefied Natural Gas Terminals in the Atlantic Fleet Training and Testing Study Area

Facility Name	Location	Status
Gulf Gateway Energy Bridge	Gulf of Mexico, 116 miles offshore of Louisiana	Operational since 2005
Louisiana Offshore Oil Port	Gulf of Mexico, 16 miles southeast of Port Fourchon, Louisiana	Operational since 1981
Neptune Liquefied Natural Gas	Massachusetts Bay, 10 miles south of Gloucester, Massachusetts	Operational since 2010
Northeast Gateway	Massachusetts Bay, 13 miles south-southeast of Gloucester, Massachusetts	Operational since 2008
Port Dolphin	Gulf of Mexico, 28 miles offshore of the Tampa Bay area of Florida	Proposed. License issued in 2010. Construction could start in 2013, pending federal and state authorizations and permits for construction and operation.

Sources: Maritime Administration 2011, 2013

Potential environmental impacts include those associated with additional ship traffic, underwater noise from construction and operation, seawater intakes and discharges, and potential releases of liquefied natural gas. Releases of liquefied natural gas can result from equipment leaks or spills during operations. Releases can be accidental (e.g., ship collision) or intentional (e.g., sabotage or terrorist acts).

4.3.2.5 Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf

The former Minerals Management Service (now named the Bureau of Ocean Energy Management) prepared a Programmatic Environmental Assessment to determine the potential impacts that may result from decommissioning activities related to the explosive and non-explosive severing of seafloor obstructions (i.e., wellheads, caissons, casing strings, platforms, mooring devices, etc.) and the subsequent salvage and site-clearance operations that may occur. Decommissioning operations generally occur after lease expiration, when the well or facility is deemed economically unviable, or when the physical condition of the structure becomes unsafe or a navigation hindrance (Minerals Management Service 2005b).

4.3.3 OFFSHORE WIND ENERGY

4.3.3.1 Commercial Wind Lease Issuance and Site Assessment Activities

A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States was prepared in 2011 to support development of a world-class offshore wind industry in the United States (U.S. Department of Energy and U.S. Department of Interior 2011). This strategy details an initiative to achieve a scenario of 54 gigawatts of deployed offshore wind-generating capacity by 2030, with an interim scenario of 10 gigawatts of capacity deployed by 2020. In 2007, the Minerals Management Service prepared a final programmatic EIS in support of the establishment of its program for authorizing alternative energy and alternate use activities on the Outer Continental Shelf (Minerals Management Service 2007). The programmatic EIS examined the potential environmental effects of the program and identified policies and best management practices that may be adopted for the program. The Bureau of Ocean Energy Management developed a regulatory framework to review proposed offshore wind projects in federal waters and launched the "Smart from the Start" initiative to facilitate siting, leasing, and construction of new projects. In general, this process includes the following steps:

- Wind energy areas that appear most suitable for wind energy development are identified.
- Requests for interest and calls for information are issued for new wind energy areas to support lease sale environmental assessments.
- Environmental assessments are completed for the wind energy areas, allowing the lease sale process to move forward.
- A lease sale is held. Issuance of a commercial lease gives the lessee the exclusive right to subsequently seek Bureau of Ocean Energy Management approval for development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the leased area to gather resource and site characterization information and develop plans, which must be approved by the Bureau of Ocean Energy Management before the lessee can move on to the next stage of the process.
- Project-specific NEPA review (typically an EIS) is conducted, and construction and operation plans are approved before beginning construction of individual wind power facilities.

Table 4.3-3 summarizes the status of offshore wind energy siting, leasing, and proposed construction in the Study Area as of March 2013. Two wind energy projects, Cape Wind Energy and Fishermen's Atlantic City Windfarm, have been approved within the Study Area, but construction had not started as of March 2013.

Table 4.3-3: Status of Offshore Wind Energy Siting, Leasing, and Construction in the Study Area as of March 2013

State	Status
Maine	• Statoil North America Inc. submitted an unsolicited request for a commercial lease. • Potential commercial leasing request for interest published August 2012. • Notice of intent to prepare an EIS published August 2012.
Massachusetts	• Environmental assessment for wind energy area prepared November 2012. • The Cape Wind Energy project calls for 130 wind turbine generators, each with a maximum blade height of 440 ft. (134 m), to be arranged in a grid pattern on the Outer Continental Shelf in Nantucket Sound, offshore of Cape Cod, Martha's Vineyard, and Nantucket Island. The Bureau of Ocean Energy Management approved a construction and operations plan for the project on 19 April 2011 (U.S. Department of the Interior 2011).
Rhode Island	• Environmental assessment for wind energy area prepared July 2012. • Proposed lease sale notice issued November 2012.
New Jersey	• Four interim policy leases issued November 2009 to Deepwater Wind, Fishermen's Energy of New Jersey, and Bluewater Wind New Jersey Energy. The Bluewater Wind Energy of New Jersey lease was relinquished effective October 2012. • The Fishermen's Atlantic City Windfarm, which is proposed in state waters 2.8 miles offshore of Atlantic City, was approved by the New Jersey Department of Environmental Protection in 2011 (Fisherman's Energy of New Jersey 2011). The U.S. Army Corps of Engineers issued a permit in July 2012. Target date to start construction is 2013 (Fisherman's Energy of New Jersey 2012).
Delaware	• A lease with Bluewater Wind Delaware was executed November 2012.
Maryland	• Call for information and nominations published February 2012.
Virginia	• Proposed lease sale notice published December 2012.
North Carolina	• Call for information and nominations published December 2012.
Georgia	• Southern Company submitted an interim policy lease application April 2011. • Notice of intent to prepare an environmental assessment published December 2012.
Florida	• Environmental assessment for interim policy lease prepared April 2012.

Source: Bureau of Ocean Energy Management 2013, unless otherwise noted.
EIS: Environmental Impact Statement; ft.: feet

With the exception of the two approved projects, most activities over the next five years are expected to include site characterization and assessment. Site characterization activities would include high-resolution geophysical surveys for the collection of data about shallow hazards, archaeological resources, and bathymetry; sub-bottom sampling; and biological surveys. Site assessment activities would include installation of meteorological towers and meteorological buoys, data collection, and decommissioning of the towers and buoys. Potential impacts include intermittent underwater noise associated with geophysical surveys, subbottom sampling, and construction and decommissioning of the meteorological towers and buoys; bottom disturbance associated with tower construction and decommissioning; and increased vessel traffic. The Bureau of Ocean Energy Management would require leases to conduct site characterization and assessment activities in accordance with mandatory project design criteria to eliminate or minimize potential impacts on marine mammals and sea turtles. Informal ESA consultations were conducted with NMFS and the U.S. Fish and Wildlife Service. The agencies concurred that the proposed activities may affect but are not likely to adversely affect ESA-listed species

if mandatory project design criteria are implemented. Lessees would be required to obtain MMPA authorizations from NMFS before starting certain site characterization and assessment activities. The MMPA authorizations may require additional measures to protect marine mammals (Bureau of Ocean Energy Management 2012b).

4.3.3.2 Electrical Transmission Lines

In March 2011, the Bureau of Ocean Energy Management received an unsolicited right-of-way grant application from Atlantic Grid Holdings for a subsea backbone transmission system (referred to as the Atlantic Wind Connection project) in state waters and on the Outer Continental Shelf offshore of New York, New Jersey, Delaware, Maryland, and Virginia. The purpose of the project is to transmit electricity generated by future offshore commercial wind facilities to onshore markets. The project would include nine offshore electrical converter platforms and 756 mi. of cabling, with 650 mi. on the Outer Continental Shelf, 38 mi. in state waters, and 67 mi. on shore. Atlantic Grid Holdings estimates construction would occur over approximately 10 years, and the entire system could be operational by 2021 (Bureau of Ocean Energy Management 2012b).

4.3.4 OTHER MILITARY ACTIONS

4.3.4.1 Construction of the Undersea Warfare Training Range

On 5 August 2009, the Navy published its Record of Decision regarding the construction of an undersea warfare training range in the Jacksonville Operating Area (OPAREA) (U.S. Department of the Navy 2009). Construction is anticipated to start in fiscal year 2014, and initial operational capability is anticipated in fiscal year 2019. Potential impacts of constructing the range are considered in the cumulative impacts analysis. Training activities on the range are included in Alternatives 1 and 2 and are analyzed as part of the Proposed Action.

4.3.4.2 Training Activities at Eglin Gulf Test and Training Range

The U.S. Air Force Eglin Gulf Test and Training Range consists of 124,642 square miles ($mi.^2$) of special use airspace over the Gulf of Mexico, which supports a variety of military readiness activities. The range is east of the Navy's Gulf of Mexico (GOMEX) Range Complex and north of the Key West Range Complex. Current and future testing and training activities expected to have impacts relevant to this cumulative impacts analysis include the following:

- U.S. Air Force air-to-surface gunnery exercises, which include the use of explosive rounds. An incidental harassment authorization issued by NMFS for these activities on 26 September 2011 is valid through 25 September 2012. Mitigation measures are required, and incidental taking by Level B harassment is authorized for dwarf sperm whale, pygmy sperm whale, Atlantic bottlenose dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, and spinner dolphin.
- Precision strike weapon testing missions involve air-to-surface impacts of the Joint Air-to-Surface Stand-off Missile and the small-diameter bomb. These result in air and underwater detonations of up to 300 pounds (lb.) and 96 lb. of net explosive weight, respectively. Up to two high-explosive and four non-explosive missiles per year may be launched from an aircraft and as many as 6 high-explosive and 12 non-explosive small-diameter bombs can be dropped on targets annually. Detonation of the Joint Air-to-Surface Stand-off Missile and the small-diameter bomb has the potential for causing harassment, injury, or mortality to four species of marine mammals: Atlantic bottlenose dolphins, Atlantic spotted dolphins, dwarf sperm whales, and pygmy sperm whales. However, because of implementation of mitigation and monitoring measures, takings are expected to be limited to Level B harassment in the form of a temporary

change in the hearing threshold in the dolphin and whale species that might be in the vicinity of the detonations.

- Surf zone, amphibious vehicle, and weapons testing/training on Santa Rosa Island off the Florida coast include detonation of high-explosives in shallow water. Impacts on marine mammals are expected to be limited to Level B harassment. On 25 July 2008, NMFS issued an incidental harassment authorization to Eglin Air Force Base to conduct surf zone testing/training and amphibious and weapons testing/training from Santa Rosa Island for one year.
- Naval Explosive Ordnance Disposal School training includes underwater detonations of small (5 to 10 lb. net explosive weight) high-explosive charges. NMFS published a proposed rule for the incidental taking of marine mammals associated with these activities on 1 October 2010.

4.3.4.3 Surveillance Towed Array Sensor System Low Frequency Active Sonar

In August 2012, the Navy released a Record of Decision for the Final Supplemental EIS/Supplemental OEIS that evaluated the potential environmental impacts of employing the Surveillance Towed Array Sensor System Low Frequency Active Sonar. The Navy currently plans to operate up to four Surveillance Towed Array Sensor System Low Frequency Active Sonar systems for routine training, testing, and military operations. Based on current Navy national security and operational requirements, routine training, testing, and military operations using these sonar systems could occur in the Pacific Ocean, Atlantic Ocean (including the Study Area), Indian Ocean, and Mediterranean Sea.

4.3.4.4 Joint Logistics Over-the-Shore Training

Joint Logistics Over-The-Shore training consists of loading/unloading ships without fixed port facilities. This training may be conducted jointly by the Navy, Marine Corps, and Army at Joint Base Little Creek-Fort Story, Virginia or at Camp Lejeune, North Carolina, and includes in-water and land-based activities. Training activities associated with elevated causeway set up and break down are addressed under Alternatives 1 and 2 of this EIS/OEIS. Land-based training, including potential impacts to nesting sea turtles, will be addressed in separate NEPA documents by the other services.

4.3.4.5 Nuclear-Powered Aircraft Carrier Homeporting at Naval Station Mayport

In a Record of Decision dated 14 January 2009, the Navy announced it wants to establish a second Atlantic Fleet nuclear-powered aircraft carrier (CVN) home port by homeporting a CVN at Naval Station Mayport, Florida. Later that month, following the change in administrations, Obama Administration officials testified they would review the proposal. On 10 April 2009, the Department of Defense announced it had decided to delay a final decision on whether to propose transferring a CVN to Mayport until it reviewed the issue as part of its 2010 Quadrennial Defense Review. The Department of Defense's final report on the 2010 Quadrennial Defense Review, released 1 February 2010, endorsed the Navy's desire to establish a second Atlantic Fleet CVN home port by homeporting a CVN at Mayport (O'Rourke 2012).

The proposal requires certain facility upgrades to make Naval Station Mayport capable of homeporting a CVN, including dredging and construction of nuclear propulsion plant maintenance facilities. Potential cumulative impact issues associated with the homeporting action include increased vessel traffic and noise during construction and dredging. Training activities to be conducted by the relocated CVN are part of the Proposed Action for this EIS/OEIS.

Navy plans called for having Mayport ready to homeport a CVN in 2019. However, the current schedule is uncertain because the Navy's proposed fiscal year 2013 budget defers the Navy's plan to homeport a

CVN at Naval Station Mayport. The Navy's proposed fiscal year 2013 budget and the fiscal year 2013 to fiscal year 2017 Future Years Defense Plan contain no funding for Military Construction projects required to homeport a CVN at Mayport.

4.3.4.6 Training Conducted by U.S. Army Vessels from Fort Eustis

The Army conducts approximately 10 surface-to-surface gunnery training events per year in the Virginia Capes Range Complex (Warning Area 50). A representative training event includes firing approximately 2,400 rounds (.50 caliber) from a Landing Craft Utility vessel at floating, plastic drum targets, which are recovered after use. As discussed for the Proposed Action, modeling results indicate a high level of certainty that marine mammals or sea turtles would not be struck by military expended materials during Navy training activities.

4.3.4.7 Homeporting of U.S. Coast Guard National Security Cutter and Other Ships at Naval Station Mayport

The Coast Guard is proposing to homeport the U.S. Coast Guard Cutter VALIANT at Naval Station Mayport, Florida, possibly starting in summer 2013. VALIANT is a multi-mission, medium endurance cutter currently homeported in Miami Beach, Florida. VALIANT operates in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico for Commander, Coast Guard Atlantic Area. Missions include search and rescue, maritime law enforcement, marine environmental protection, and national defense operations. In November 2011, the Coast Guard also requested assistance from the Navy in determining the feasibility of homeporting several ship classes at Naval Station Mayport, including all or some of the following: two National Security Cutters and four additional medium endurance cutters. Potential cumulative impacts issues associated with these possible actions include a slight increase in vessel traffic and increases in training activities. While specific training activities associated with the homeporting are not yet identified, it is possible that surface-to-surface gunnery training would be conducted by Coast Guard vessels in the Jacksonville Range Complex. As discussed for the Proposed Action, modeling results indicate a high level of certainty that marine mammals or sea turtles would not be struck by military expended materials during Navy training activities.

4.3.4.8 U.S. Coast Guard Training Conducted from Various Coast Guard Stations Along the East Coast, Caribbean, and Gulf of Mexico

The U.S. Coast Guard provides maritime humanitarian, law enforcement, and safety services to the people of the United States. These services are performed in estuarine, coastal, and offshore waters throughout the Study Area, which includes Coast Guard District 1 (Maine to New York), District 5 (New Jersey to North Carolina), District 7 (South Carolina to Florida, including the Caribbean), and District 8 (Louisiana to Texas). Numerous Coast Guard stations are located in each district. U.S. Coast Guard training activities conducted in the Study Area include boat and ship exercises that contribute to vessel noise and could result in collisions with marine mammals and sea turtles; fixed-wing aircraft and helicopter activities that contribute noise; and gunnery training that contributes military expended materials to the benthic environment and is a potential strike risk to marine life. Other expendables such as signal flares and marine markers are also used during U.S. Coast Guard training.

4.3.5 EXPANSION OF NORTH ATLANTIC RIGHT WHALE CRITICAL HABITAT

NMFS announced a determination that it is timely and appropriate to revise the 1994 designation of critical habitat for North Atlantic right whales (6 October 2010). As of March 2013, NMFS had not yet published a proposed rule in the Federal Register for expansion of North Atlantic right whale critical habitat.

4.3.6 COMMERCIAL FISHING

Commercial fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Commercial fishing can adversely affect fish populations, other species, and habitats. Potential impacts of commercial fishing include overfishing of targeted species and bycatch, both of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidental to normal fishing operations. Use of mobile fishing gear, such as bottom trawls, disturbs the seafloor and reduces structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats.

Commercial fishing can have a profound influence on individual fish populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, Jackson et al. (2001) concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several groups of marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al. 2010).

4.3.7 MARITIME TRAFFIC

4.3.7.1 General

The east coast of the United States is heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports near Navy OPAREAs. The United States has grown increasingly dependent on international trade over the past 50 years. As a result, the number of active ports in the Study Area increased, ship traffic increased, and ships are larger. The first container ships appeared in U.S. ports less than 50 years ago and are now the fastest-growing shipping segment. Container ship calls to U.S. Atlantic ports are expected to increase 4 percent per year through 2020, and vessel calls to U.S. Atlantic coast ports are forecast to rise from approximately 47,200 calls in 2000 to 93,500 calls in 2020 (Ward-Geiger et al. 2005). Sections 3.4.3.3.1 (Impact from Vessels) and 3.11.2.3 (Commercial Transportation and Shipping) provide additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals and sea turtles and underwater sound from ships and other vessels.

4.3.7.2 Panama Canal Expansion

A project to widen and expand the capacity of the Panama Canal was started in 2007. Completion of the Panama Canal widening project in 2014 will double the Canal's tonnage volume by 2025 and allow larger vessels access to the east coast ports of the United States (Panama Canal Authority 2012).

4.3.7.3 Atlantic Coast Port Access Route Study

In May 2011, the U.S. Coast Guard announced that it will prepare the Atlantic Coast Port Access Route Study. The goal of the Atlantic Coast Port Access Route Study is to enhance navigational safety by examining existing shipping routes and waterway uses, and, to the extent practicable, reconcile the paramount right of navigation within designated port access routes with other reasonable waterway

uses, such as the leasing of Outer Continental Shelf blocks for construction and operation of offshore renewable energy facilities. The Atlantic Coast Port Access Route Study will focus on the coastwise shipping routes and near coastal users between western Atlantic coastal ports, approaches to coastal ports, and future uses of those ports (including impacts of the widening of the Panama Canal) (U.S. Coast Guard 2011). An interim report was issued in July 2012 (U.S. Coast Guard 2012).

4.3.8 DEVELOPMENT OF COASTAL LANDS

Coastal land development adjacent to the Study Area is both intensive and extensive. Development continues to impact coastal resources through point and nonpoint source pollution, concentrated recreational use, and intensive ship traffic using major port facilities. The Study Area coastline also includes extensive coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities).

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, marine habitat, and air quality. Coastal development is regulated by states that border the Atlantic Ocean and Gulf of Mexico through the Coastal Zone Management Act and associated state and local programs. New development in the coastal zone requires a permit from the state or local government to which permitting authority has been delegated.

4.3.9 OCEAN NOISE

Ambient noise is the collection of ever-present sounds of both natural and human origin. Ambient noise in the ocean comprises sound generated by natural physical, natural biological, and anthropogenic (human-generated) sources (Figure 3.0-17). Pre-industrial physical and biological noise sources in marine environments were often not high enough to interfere with the hearing and communication of marine animals (Richardson et al. 1995); however, the increase in anthropogenic noise sources in recent times is a concern (Clark et al. 2009).

In addition to sounds generated during Navy training and testing, anthropogenic sound is introduced into the ocean by a number of sources, including vessel traffic, industrial operations onshore (pile driving), seismic profiling for oil exploration, oil drilling, and underwater explosions. Noise levels resulting from human activities in coastal and offshore areas are increasing; however, there are few historical records of ambient noise data to substantiate the level of increase.

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 dB in the frequency ranges of 20 to 80 hertz (Hz) and 200 to 300 Hz, and about 3 dB at 100 Hz over a 33-year period. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004a). Within the Study Area, the east coast of the United States and the Gulf of Mexico are heavily traveled by marine vessels, with the highest concentrations of vessels occurring near several commercial ports (Figure 3.11-3). Hildebrand (2004b) found that the most energetic regularly operated sound sources are seismic airgun arrays from approximately 90 vessels with typically 12 to 48 individual guns per array, firing about every 10 seconds(Hildebrand 2004a). From 1968 through 2003, approximately 997,901 line mi. of two-dimensional seismic data were collected in the Gulf of Mexico region and 212,967 line mi. were collected in the Atlantic region (Minerals Management Service 2005a). The amount of seismic survey

work conducted in the Atlantic region will likely increase in the near future (Sections 4.3.2.2 [Seismic Surveys] and 4.3.3 [Offshore Wind Energy]).

Section 3.0.4 (Acoustic and Explosives Primer) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. Section 3.0.5.7.1 (Conceptual Framework for Assessing Effects from Sound-Producing Activities) describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal to more severe impacts that may have lasting consequences. The major categories of potential impacts are behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.3.10 OCEAN POLLUTION

4.3.10.1 Overview

Pollution is the introduction of harmful contaminants that are outside the norm for a given ecosystem. Ocean pollution has and will continue to have serious impacts on marine ecosystems. Common ocean pollutants include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from nonpoint sources (e.g., stormwater runoff from watersheds), point sources (e.g., wastewater treatment plant discharges), other land-based sources (e.g., windblown debris), spills, dumping, vessels, and atmospheric deposition.

4.3.10.2 Nonpoint Sources, Point Sources, and Atmospheric Deposition

Hypoxia (low dissolved oxygen concentration) is a major impact associated with point and nonpoint sources of pollution. Hypoxia occurs when waters become overloaded with nutrients such as nitrogen and phosphorus, which enter oceans from nonpoint source runoff, point sources, and atmospheric deposition. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are decomposed by bacteria. The bacteria use oxygen from the surrounding water during decomposition, which causes dissolved oxygen in the water to decline to the point where marine life that depend on oxygen can no longer survive (Boesch et al. 1997). The Gulf of Mexico has a seasonal hypoxic or dead zone that has averaged about 5,800 $mi.^2$ (roughly the size of Lake Ontario or New Jersey) over the past five years (Texas A&M University 2011).

Elevated nutrient loading has also been identified as a cause of harmful algal blooms. Harmful algal blooms are proliferations of marine and freshwater algae (including cyanobacteria and nonphotosynthetic algae-like organisms) that can produce toxins, causing human illness and massive animal mortalities. They also can accumulate in sufficient numbers to alter ecosystems in detrimental ways. These blooms are increasingly frequent in coastal waters around the world. Impacts include fish, bird, and marine mammal mortality (Anderson et al. 2002; Sellner et al. 2003). For example, in Florida, the deaths of 34 manatees in 2002 and 107 bottlenose dolphins in 2004 were linked to harmful algal blooms (Flewelling et al. 2005).

Nonpoint sources, point sources, and atmospheric deposition also contribute toxic pollutants such as metals, pesticides, and other organic compounds to the marine environment. Toxic pollutants may

cause lethal or sublethal effects if present in high concentrations, and they can build up in tissues over time and suppress immune system function, resulting in disease and death.

4.3.10.3 Marine Debris

Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment (National Marine Fisheries Service 2006). Approximately 80 percent of debris originates onshore and 20 percent from offshore sources. Common types of marine debris include various forms of plastic and abandoned fishing gear. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service 2006). Plastic debris is a major concern because it degrades slowly and many plastics float, allowing the debris to be transported by currents throughout the oceans.

Marine debris has been discovered to be accumulating in gyres throughout the oceans. Law et al. (2010) presented a time series of plastic content at the surface of the western North Atlantic Ocean and Caribbean Sea from 1986 to 2008. More than 60 percent of 6,136 surface plankton net tows collected small, buoyant plastic pieces. The data identified an accumulation zone east of Bermuda that is similar in size to the accumulation zone in the Pacific Ocean.

4.3.10.4 Major Pollution Events

Oil and other chemical spills have negative effects on many marine species. In April 2010, the *Deepwater Horizon* offshore drill rig, 41 mi. (66 km) southeast of the Louisiana coast, exploded and sank during exploratory well drilling, causing the largest accidental marine oil spill in U.S. history (National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). The impacts of this disaster are just beginning to be studied, and it will likely be many years before impacts are understood. Impacts include those arising from direct exposure of marine life to oil and dispersants, habitat degradation, and disturbances caused by cleanup activities. A variety of indirect impacts such as changes in prey abundance and long-term disruption of other ecological processes could result from spills of this magnitude. Impacts of the *Deepwater Horizon* spill to specific resources are discussed in the Affected Environment sections of Chapter 3 (Affected Environment and Environmental Consequences).

The National Oceanic and Atmospheric Administration is managing restoration efforts in the aftermath of the spill and is preparing a Programmatic EIS to develop a framework for restoration. Considering the complexity and far-reaching potential impacts of the spill, it is important to conceptualize restoration at a broad scale to help identify how to best restore resources across the region. The emphasis of a Programmatic EIS is on developing a broad environmental program and a plan that would apply to future projects, the details and locations of which are yet unknown. The Programmatic EIS will also serve as the foundation for future analyses required by NEPA. The Notice of Intent to prepare the Programmatic EIS was published on 2 February 2011, and public release of the Draft Programmatic EIS is anticipated in 2013 (National Oceanic and Atmospheric Administration 2012). Restoration efforts could result in temporary adverse impacts, followed by long-term benefits.

4.3.11 CLIMATE CHANGE

Section 4.5 (Climate Change and Greenhouse Gas Emissions) provides background information and an analysis of the cumulative impacts of climate change and greenhouse gas emissions for the Proposed Action. Climate change is also considered in the overall cumulative impacts analysis as another environmental consideration. The Intergovernmental Panel on Climate Change (2007) reports that physical and biological systems on all continents and in most oceans are already being affected by recent climate changes. Global-scale assessment of observed changes shows that it is likely that

anthropogenic warming over the last three decades has had a discernible influence on many physical and biological systems. Some of the major potential concerns for the marine environment include

- Sea temperature rise
- Melting of polar ice
- Rising sea levels
- Changes to major ocean current systems
- Ocean acidification

4.4 RESOURCE-SPECIFIC CUMULATIVE IMPACTS

4.4.1 SEDIMENTS AND WATER QUALITY

The analysis in Section 3.1 (Sediments and Water Quality) indicates that the alternatives could result in local, short- and long-term changes in sediment and water quality. However, chemical, physical, or biological changes to sediments or water quality would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses (Section 3.1.1.2, Methods, lists applicable standards, regulations, and guidelines). The short-term impacts could arise from explosions and the byproducts of explosions and combusted propellants. It is unlikely these short-term impacts would overlap in time and space with other future actions that produce similar constituents. For example, training and testing with explosives would not be expected to occur near an oil rig structure-removal operation that could use explosives. Therefore, the short-term impacts described in Section 3.1 (Sediments and Water Quality) are not expected to contribute to cumulative impacts.

The long-term impacts could arise from unexploded ordnance, noncombusted propellant, metals, and other materials. Long-term impacts of each alternative could be cumulative with other actions that cause increases in similar constituents. However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to long-term cumulative impacts would be negligible because

- Most training and testing activities are widely dispersed in space and time;
- Most components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign; and
- Potential areas of impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives.

Furthermore, none of the alternatives would result in long-term and widespread changes in environmental conditions, such as nutrient loading, turbidity, salinity, or pH (a measure of the degree to which a solution is either acidic [pH less than 7.0] or basic [pH greater than 7.0]).

4.4.2 AIR QUALITY

As detailed in Section 3.2 (Air Quality), training and testing activities conducted under the alternatives would result in criteria pollutant emissions and hazardous air pollutant emissions throughout the Study Area. Emissions of these pollutants would increase under Alternative 1 or Alternative 2. Sources of the emissions would include vessels and aircraft and, to a lesser extent, munitions. Potential impacts include localized and temporarily elevated pollutant concentrations. Recovery would occur quickly as emissions

disperse. The impacts of the No Action Alternative, Alternative 1, or Alternative 2 could be cumulative with other actions that involve criteria air pollutant and hazardous air pollutant emissions. However, the incremental contribution of each alternative to cumulative impacts would be low for the following reasons:

- Prevailing winds along the Atlantic coast generally trend west to east, reducing the likelihood that offshore emissions would impact air quality control regions ashore.
- Most of the proposed activities (approximately 70 percent) would occur at latitudes consistent with air quality control regions in attainment of the National Ambient Air Quality Standards for all criteria air pollutants.
- For those proposed activities occurring at latitudes consistent with air quality control region nonattainment or maintenance areas, most training and testing-related emissions (over 85 percent) are projected to occur at distances greater than 12 nm from shore.

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be negligible. An analysis of greenhouse gas emissions and climate change is provided in Section 4.5 (Climate Change and Greenhouse Gas Emissions).

4.4.3 MARINE HABITATS

The analysis presented in Section 3.3 (Marine Habitats) indicates that marine habitats could be affected by acoustic stressors (underwater detonations) and physical disturbance or strikes (interactions with military expended materials or seafloor devices). Potential impacts include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short term, and impacts on hard bottom would be long term. The impacts of each alternative could be cumulative with other actions that cause similar disturbances. However, the incremental contribution of each alternative to cumulative impacts would be low for the following reasons:

- The area of hard bottom potentially impacted represents a negligible percentage of the total hard bottom habitat in the Study Area.
- Impacts would be confined to a limited area, and recovery of soft bottom habitats would occur quickly.

Based on the analysis presented in Section 3.3 (Marine Habitats) and the reasons summarized above, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be negligible.

4.4.4 MARINE MAMMALS

4.4.4.1 Impacts of the Alternatives that Might Contribute to Cumulative Impacts

4.4.4.1.1 Overview

The analysis presented in Section 3.4 (Marine Mammals) concluded that some stressors associated with the No Action Alternative, Alternative 1, and Alternative 2 could impact individuals of certain marine mammal species, but impacts are not expected to decrease the overall fitness of any marine mammal population. From a cumulative perspective, potential impacts on ESA-listed species are of particular concern. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures,

Mitigation, and Monitoring). Impacts of the alternatives that may contribute to cumulative impacts on marine mammals can be generally categorized as mortality, injury (Level A harassment under MMPA), and behavioral responses and temporary threshold shift (TTS) (Level B harassment under MMPA). As summarized below, these impacts would be associated with certain acoustic and physical strike stressors:

- The use of sonar, other active sources, and explosives may result in Level A harassment or Level B harassment of certain marine mammals (Tables 3.4-15 through 3.4-18 discuss sonar and other active acoustic sources, and Tables 3.4-26 through 3.4-33 discuss explosives). Explosives could also result in mortality of certain marine mammals. Sonar and other active acoustic sources may affect and are likely to adversely affect the ESA-listed North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee (Table 3.4-37). Explosives may affect and are likely to adversely affect the ESA-listed North Atlantic right whale (training activities only), sei whale, fin whale, and sperm whale (Table 3.4-37).
- Pile driving is not expected to result in mortality of any marine mammal species but may result in Level A and Level B harassment of bottlenose dolphins (Tables 3.4-34 and 3.4-35). Pile driving would have no effect or may affect, but it is not likely to adversely affect ESA-listed marine mammals (Table 3.4-37).
- The use of vessels is not expected to result in Level B harassment of any marine mammal species but may result in Level A harassment or mortality by vessel strikes in fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species. Vessel strikes may affect and are likely to adversely affect the ESA-listed humpback whale, sei whale, fin whale, blue whale, and sperm whale. The Navy does not anticipate it will strike a North Atlantic right whale because of the extensive measures in place to reduce the risk of a strike to that species. The Navy does not anticipate it will strike a manatee as they only occur in a very limited portion of the Study Area, primarily in the coastal waters off the southeastern United States and the Gulf coast of Florida where vessel use is limited to only a few activities. The likelihood of a strike is very low around Jacksonville, Florida because of the low probability of vessel co-occurrence and the use of mitigation measures (Section 3.4.3.3, Physical Disturbance and Strike Stressors).

The remaining acoustic stressors (noise from airguns, weapons firing/launch/impact, aircraft, and vessels), energy stressors (electromagnetic and high energy lasers), physical disturbance and strike stressors (in-water devices, military expended materials, and seafloor devices), entanglement stressors (cables, wires, and parachutes), ingestion stressors (munitions and military expended materials other than munitions), and secondary stressors are not expected to result in Level A harassment, Level B harassment, or mortality of marine mammals under any of the alternatives. Furthermore, these stressors would have no effect or may affect but are not likely to adversely affect ESA-listed marine mammals (Table 3.4-37). For these reasons, the incremental contribution of these remaining stressors to cumulative impacts on marine mammals would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on North Atlantic right whale or West Indian manatee critical habitat. Therefore, marine mammal critical habitat is not considered further in the cumulative impacts analysis.

4.4.4.1.2 Level B Harassment

As presented in Tables 3.4-15 through 3.4-18 for sonar and other active acoustic sources and Tables 3.4-26 through 3.4-33 for explosives, the acoustic analysis predicts that most marine mammal

species, including ESA-listed species, which occur in the Study Area would be exposed to underwater sound levels that could result in behavioral responses or TTS (Level B harassment). Individual animals exposed to underwater sound levels that represent Level B harassment may alert, ignore the stimulus, avoid the area by swimming away or diving, or display aggressive behavior. Long-term consequences for individuals or populations would not be expected. Animals that do experience TTS may have reduced ability to detect relevant sounds such as predators, prey, or social vocalizations until their hearing recovers. Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days depending on the severity of the initial shift. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's ability to hear biologically relevant sounds. Furthermore, mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would further reduce the predicted impacts. Considering these factors and the low number of overall predicted impacts, long-term consequences for individuals or populations would not be expected.

4.4.4.1.3 Level A Harassment

As presented in Tables 3.4-15 through 3.4-18 for sonar and other active acoustic sources and Tables 3.4-26 through 3.4-33 for explosives, the acoustic analysis predicts that 30 marine mammal species could be exposed to underwater sound levels that could result injury or permanent threshold shift (PTS) (Level A harassment). Species most likely to be exposed to underwater sound levels that represent Level A harassment are those that are most abundant in the Study Area, primarily delphinid species (dolphins and small whales) that have stocks with tens of thousands of animals. ESA-listed marine mammals that could be exposed to underwater sound levels that represent Level A harassment include fin whale, humpback whale, sei whale, and sperm whale. Long-term consequences to populations would not be expected.

4.4.4.1.4 Mortality

Use of sonar and other active acoustic sources under the No Action Alternative, Alternative 1, and Alternative 2 is not expected to result in marine mammal mortality. Mitigation measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) are designed to avoid potential impacts of explosives, especially higher-order impacts such as injury and death. However, the acoustic analysis indicates that certain marine mammal species could be exposed to underwater sound pressure levels from explosive detonations that represent onset mortality (Tables 3.4-26 through 3.4-33). The protections afforded by mitigation measures cannot be fully quantified. Therefore, mortality from explosions could occur in isolated instances.

Abundant species including the common dolphin, Atlantic spotted dolphin, striped dolphin, bottlenose dolphin, clymene dolphin, harbor porpoise, Atlantic white-sided dolphin, Risso's dolphin, pantropical spotted dolphin, and pilot whale could have the highest chance of being killed by an explosion. The acoustic analysis also suggests that small numbers (three or less) of minke whales, melon-headed whales, white-beaked dolphins, spinner dolphins, and the ESA-listed sperm whale could be exposed to sound pressure levels from explosive detonations that represent onset mortality (Tables 3.4-22 through 3.4-29). Potentially lethal impacts were not predicted for other ESA-listed marine mammals.

Aircraft carrier ship shock trials occurring once per five-year period and guided missile destroyer/littoral combat ship shock trials occurring three times per five-year period represent the greatest risk for marine mammal mortality based on the high net explosive weight charges used during these testing activities (up to 58,000 lb. net explosive weight). These testing events may occur in either the Virginia Capes OPAREA or the Jacksonville OPAREA in waters deeper than 650 ft. Specific mitigation measures

discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would be applied during shock trials and would greatly lower the likelihood of killing or injuring any marine mammals. If mortality were to occur, it is likely that the affected individuals would be from delphinid stocks or populations that number in the tens of thousands of animals. Based on conservativeness of the onset mortality criteria and impulse modeling, and past observations of no marine mammal mortalities associated with ship shock trials, the mortalities predicted for the aircraft carrier ship shock trial are considered overestimates and highly unlikely to occur. Therefore, the Navy conservatively estimates that 10 small odontocete mortalities could occur during the aircraft carrier ship shock trial. Measureable long-term consequences to populations are unlikely.

Vessel strikes could also result in mortality of certain marine mammal species under the No Action Alternative, Alternative 1, and Alternative 2. Based on historical records and the analysis presented in Section 3.4.3.3 (Physical Disturbance and Strike Stressors), the Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year, with a maximum of three in any given year. While the species involved in a strike cannot be quantifiably predicted, the affected animals could be a combination of the following species: fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species. Of the ESA-listed species in the Study Area, the Navy anticipates no more than three humpback whales, two fin whales, one sei whale, one blue whale, and one sperm whale could be struck over a five-year period based on the percentages that those species have been involved in vessel collisions. The Navy does not anticipate it would strike a North Atlantic right whale or West Indian manatee.

4.4.4.2 Impacts of Other Actions

4.4.4.2.1 Overview

Potential impacts of other actions relevant to the cumulative impacts analysis for marine mammals include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, and entanglement in fishing and other gear.
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound.
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise.
- Reduced animal fitness associated with water pollution.

Most of the other actions and considerations retained for analysis in Table 4.3-1 include the operation of marine vessels. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis include vessel strikes and underwater noise. Many of the actions could also result in underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in the maritime traffic and ocean noise subsections. Similarly, many of the actions could result in water pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section. Bycatch and entanglement are associated with commercial fishing; therefore, these stressors are discussed below in the commercial fishing section.

4.4.4.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Potential impacts on marine mammals from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations include (1) nonauditory injury; (2) permanent loss of hearing; (3) temporary loss of hearing; (4) behavioral change; and (5) masking. The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of marine mammals from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar with monitoring and mitigation would result in no mortality. The likelihood of low-frequency active sonar transmissions causing marine mammals to strand is negligible (U.S. Department of the Navy 2011).

4.4.4.2.3 Maritime Traffic and Vessel Strikes

As discussed in Section 4.3.7 (Maritime Traffic), maritime traffic has increased over the past 50 years, and continued increases are expected in the future. Vessel strikes are, and will continue to be, a cause of marine mammal mortality and injury throughout the Study Area. A review of the impacts of vessel strikes on marine mammals is in Section 3.4.3.3.1 (Impact from Vessels). The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2003). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). National Marine Fisheries Service records for the Study Area (unpublished data 1995–2011) indicate the following percentage of strikes by species: North Atlantic right whale (19 percent), humpback whale (28 percent), minke whale (5 percent), Bryde's whale (2 percent), sei whale (6 percent), fin whale (17 percent), sperm whale (2 percent), Cuvier's beaked whale (3 percent), Blainville's beaked whale (1 percent), Gervais' beaked whale (1 percent), and unknown species (16 percent). West Indian manatees are also highly susceptible to boat strikes, but the data were not readily available to calculate a comparable percentage. The literature review by Laist et al. (2001) concluded that vessel strikes likely have a negligible impact on the status of most whale populations, but that for small populations, such as the North Atlantic right whale, vessel strikes may have considerable population-level impacts. The abundance of the species struck would in large part determine whether the injury would have population-level impacts on that species (Laist et al. 2001). Vessel strike data for selected marine mammal stocks for 2004-2008 are provided in Table 4.4-1.

4.4.4.2.4 Ocean Noise

As summarized by the National Academies of Science, the possibility that anthropogenic sound could harm marine mammals or significantly interfere with their normal activities is an issue of concern (National Research Council 2005). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, and communicating with other individuals. Noise can cause behavioral disturbances, mask other sounds (including their own vocalizations), result in injury, and in some cases, even lead to death (Tyack 2009; Würsig and Richardson 2008). Human-caused noises in the marine environment come from shipping, seismic and geologic exploration, military training, and other types of pulses produced by government, commercial, industry, and private sources. In addition, noise from whale-watching vessels near marine mammals has received a great deal of attention (Wartzok 2009).

Table 4.4-1: Summary of the Confirmed Human-Caused Mortality and Serious Injury Events Involving Baleen Whale Stocks Along the Gulf of Mexico Coast, United States East Coast and Adjacent Canadian Maritimes, 2004–2008, with Number of Events Attributed to Entanglements or Vessel Collisions by Year

Stock	Mean Annual Mortality and Serious Injury Rate	Entanglements			Vessel Collisions		
		Annual Rate (U.S. Waters/Canadian Waters)	Confirmed Mortalities (2004, 2005, 2006, 2007, 2008)	Confirmed Serious Injuries (2004, 2005, 2006, 2007, 2008)	Annual Rate (U.S. Waters/ Canadian Waters)	Confirmed Mortalities (2004, 2005, 2006, 2007, 2008)	Confirmed Serious Injuries (2004, 2005, 2006, 2007, 2008)
Western North Atlantic Right Whale	2.8	0.8 (0.6/0.2)	(1, 0, 1, 1, 0)	(0, 0, 0, 0, 1)	2.0 (1.6/0.4)	(2, 2, 4, 0, 0)	(0, 1, 1, 0, 0)
Gulf of Maine Humpback Whale[1]	4.6	3.0 (2.6/0.4)	(1, 0, 1, 1, 2)	(1, 0, 3, 2, 4)	1.6 (1.6/0)	(1, 0, 3, 3, 1)	0
Western North Atlantic Fin Whale	3.2	1.2 (1.0/0.2)	(1, 0, 0, 2, 0)	(1, 0, 1, 1, 0)	2.0 (1.4/0.6)	(2, 5, 0, 2, 1)	0
Nova Scotian Sei Whale	1.0	0.6 (0.4/0.2)	(0, 0, 0, 0, 1)	(0, 0, 1, 0, 1)	0.4 (0.4/0)	(0, 0, 1, 1, 0)	0
Western North Atlantic Blue Whale	0	0	0	0	0	0	0
Canadian East Coast Minke Whale[2]	3.2	2.8 (1.6/1.2)	(4, 1, 1, 1, 6)	(0, 0, 0, 1, 0)	0.4 (0.4/0)	(1, 1, 0, 0, 0)	0
Western North Atlantic Bryde's Whale	0	0	0	0	0	0	0

Source: Waring et al. 2011

[1] Excludes events involving confirmed members of a stock other than the Gulf of Maine feeding stock.

[2] Includes three records from the Northeast Fisheries Observer Program.

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present near the sound, and the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council 2003, 2005), there are many unknowns in assessing the specific effects and significance of responses by marine mammals to sound exposures such as what activity the animal is engaged in at the time of the exposure (Nowacek et al. 2007; Southall et al. 2007). Potential impacts on marine mammals from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.4.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on marine mammals.

4.4.4.2.5 Ocean Pollution

As discussed in Section 4.3.10 (Ocean Pollution), multiple pollutants from multiple sources are present in, and continue to be released into, the oceans. Long-term exposure to pollutants poses potential risks to the health of marine mammals, although for the most part, the impacts are just starting to be understood (Reijnders et al. 2008). Concern about the possible effects of exposure to pollutants has increased in recent years because disease outbreaks involving marine mammals with high concentrations of organochlorines in tissues appear to have occurred with increasing frequency. In addition, experimental and other evidence has shown that persistent contaminants often found in the tissues of marine mammals have deleterious effects on reproduction and the immune system (O'Shea et al. 1999). Section 3.4.2.4 (General Threats to Marine Mammals) provides an overview of these potential impacts, which include morbidity and mortality from acute toxicity (although mortality has not yet specifically been shown in marine mammals); disruption of endocrine cycles and developmental processes causing reproductive failures or birth defects; suppression of immune system function; and metabolic disorders resulting in cancer or genetic abnormalities (Reijnders et al. 2008).

If the health of an individual marine mammal were compromised by long-term exposure to pollutants, it is possible this condition could alter the animal's expected response to stressors associated with the alternatives. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by various factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, and social position. Synergistic impacts are also possible. For example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter 2005). While the response of a previously stressed animal might be different from the response of an unstressed animal, no data available at this time accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with the No Action Alternative, Alternative 1, or Alternative 2.

4.4.4.2.6 Commercial Fishing

Several commercial fisheries operate in the Study Area. Potential impacts from these activities include marine mammal injury and mortality from bycatch and entanglement. The operations of fisheries also results in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals.

Between 1990 and 1999, the annual bycatch of marine mammals in the United States was more than 6,000 animals, and most of these were killed in gill-net fisheries (Read et al. 2006). The impacts of bycatch on marine mammal populations vary based on removal rates, population size, and reproductive rates. Small populations with relatively low reproductive rates are most susceptible. Bycatch rates for

about 12 percent of United States marine mammal stocks (almost all cetaceans) exceed their potential biological removal levels (Read 2008). The potential biological removal level is the number of animals that can be removed each year without preventing a stock from reaching or maintaining its optimal sustainable population-level.

As discussed in Section 3.4.2.4 (General Threats), entanglement in fishing gear is another major threat to marine mammals in the Study Area, including North Atlantic right and humpback whales. Entanglement records from 1990 through 2009 maintained by the NMFS Northeast Regional Office included 85 confirmed right whale entanglements, including right whales in weirs, gillnets, and trailing line and buoys (National Marine Fisheries Service 2011). Of 20 dead humpback whales (principally in the mid-Atlantic, where decomposition did not preclude examination for human impacts), Wiley et al. (1995) reported that five (25 percent) had injuries consistent with possible entanglement in fishing gear.

The number of North Atlantic right whales killed or injured annually by ship strikes (all vessel types) and in entanglements has increased slightly since 1999. From 1999 to 2003, an average of 2.6 right whales were killed per year; from 2000 to 2004, an average of 2.8 right whales were killed per year; from 2001 to 2005, an average of 3.2 right whales were killed per year (Waring et al. 2010). The most recent estimate of anthropogenic mortality and serious injury available shows a rate of 3.8 right whales per year from 2002 to 2006. Of these, 2.4 were attributed to ship strikes and 1.4 were attributed to entanglements (Glass et al. 2008). Of the current threats to North Atlantic right whales, entanglement in commercial fishing gear and ship strikes currently pose the greatest threats (National Oceanic and Atmospheric Administration 2010). These threats are expected to continue into the foreseeable future.

In addition, overfishing of many fish stocks results in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 1998). These ecological changes may have important, and likely adverse, consequences for populations of marine mammals (DeMaster et al. 2001). For instance, depletion of preferred prey could lead to a less nutritional diet and decreased reproductive success.

In summary, future commercial fishing activities in the Study Area are expected to result in significant impacts on some marine mammal species based on the injury and mortality rates associated with bycatch and entanglement. This mortality could result in or contribute to population declines for some species, including ESA-listed species such as the North Atlantic right whale. Ecological changes brought about by commercial fishing are also expected to adversely impact marine mammals in the Study Area.

4.4.4.2.7 Environmental Regulation and Planning

As of March 2013, NMFS was continuing the rulemaking process for designating additional critical habitat for the North Atlantic right whale. Eventual publication of a final rule designating additional critical habitat is reasonably foreseeable, but a specific timeline was not available as of March 2013. Federal agencies would be required to ensure that actions they fund, authorize, or carry out are not likely to result in the destruction or adverse modification of critical habitat. This future action is expected to benefit the North Atlantic right whale by reducing impacts on habitat important to the survival of this species. However, this action is not expected to reduce primary threats of vessel strikes and entanglement. The overall benefits of this action to the species are uncertain at this time.

4.4.4.3 Cumulative Impacts on Marine Mammals

Of the 48 species of marine mammals known to exist within the Study Area, 10 are listed as endangered under ESA and classified as strategic stocks under MMPA (North Atlantic right whale, bowhead whale,

humpback whale, minke whale, Bryde's whale, sei whale, fin whale, blue whale, sperm whale, and West Indian manatee), one is listed as threatened under ESA (polar bear), and one is proposed for listing under ESA (Arctic subspecies of ringed seal). In addition, the pygmy sperm whale and some bottlenose dolphin stocks are classified as strategic stocks. These ESA listings and MMPA classifications provide a clear indication that the current aggregate impacts of past human activities are significant for some marine mammal species in the Study Area. Many of the past activities such as commercial fishing that have current impacts are also present actions and reasonably foreseeable future actions.

Direct, human-caused mortality of marine mammals is one of the primary issues of concern for this cumulative impacts analysis. Bycatch, vessel strikes, and entanglement are leading causes of direct mortality to marine mammals and will continue to cause mortality in the future. Read et al. (2006) noted that marine mammal bycatch declined from 1990 to 1999 after the implementation of take reduction measures in the latter half of the decade. While new management practices could result in future reductions, bycatch is expected to remain a leading cause of mortality for the reasonably foreseeable future. Vessel traffic is expected to continue to increase in the Study Area in response to continued economic globalization, widening of the Panama Canal, and increases in energy development and other offshore activities. While increased risks come with increased vessel traffic, risks of vessel strikes could be minimized by ongoing and future education and awareness, marine mammal reporting, ship speed reduction measures, and maritime traffic planning and management.

Each alternative could also result in injury and mortality to individuals of some marine mammal species from underwater explosions and vessel strikes. Implementation of measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would reduce but not eliminate potential impacts. Injury and mortality that might occur under the No Action Alternative, Alternative 1, or Alternative 2 could be additive to injury and mortality associated with other actions, but the relative contribution would be low. Each alternative has the potential for a few mortalities per year, compared to more than 1,000 per year for other actions. For example, the mean annual bycatch of marine mammals in U.S. fisheries between 1990 and 1999 was 6,215, consisting of 3,029 cetaceans and 3,187 pinnipeds (Read et al. 2006). A substantial proportion of these mortalities likely occurred in the Study Area or affected individuals that used the Study Area seasonally. The estimated mean annual bycatch mortality of western North Atlantic cetaceans in U.S. observed fisheries for 2004–2008 was about 1,500 (Waring et al. 2010). Table 4.4-2 provides a general comparison of estimated cetacean mortalities and serious injuries from various causes.

Ocean noise associated with other actions (Section 4.4.4.2.4, Ocean Noise) and acoustic stressors (underwater explosions and sonar) associated with each alternative could also result in additive impacts on marine mammals. Other future actions such as construction and operation of liquefied natural gas terminals, construction of the Cape Wind Energy project, seismic surveys, wind energy site characterization, and construction and removal of oil and gas facilities, could result in underwater sound levels that could cause MMPA Level B harassment and, to a lesser extent, Level A harassment or mortality. With the possible exception of other actions that involve the use of explosives, the potential for direct marine mammal mortality from other actions is very low. Sounds from many of these sources travel over long distances and it is possible that some would overlap in time and space with sounds from underwater explosions or sonar use. However, these activities are widely dispersed, the sound sources are intermittent, and mitigation measures are often required under MMPA to minimize exposure. For these reasons it is unlikely that an individual would be simultaneously exposed to sound levels from multiple actions that could cause Level B harassment or Level A harassment. Furthermore, safety,

security, and operational considerations would preclude some training and testing activities in the immediate vicinity of other actions, further reducing the likelihood of exposure.

Table 4.4-2: Comparison of Cetacean Mortality from Various Activities

Activity	Approximate Mortalities and Serious Injuries	References
Commercial Fishing Bycatch: Worldwide	308,000 annual mortalities and serious injuries	Read et al. (2006)
"Scientific Research"/Commercial Harvest: Japan and Iceland	1,500 mortalities per year	International Whaling Commission (2008)
Commercial Fishing Bycatch: U.S. Observed Fisheries	1,500 mean annual mortalities of western North Atlantic cetaceans for 2004–2008	Waring et al. (2011)
Entanglements: Gulf of Mexico Coast, U.S. East Coast, and Adjacent Canadian Maritimes	8.4 mean annual mortalities and serious injuries of baleen whales for 2004–2008	Waring et al. (2011)
Ship Strikes: Gulf of Mexico Coast, U.S. East Coast, And Adjacent Canadian Maritimes	6.4 mean annual mortalities and serious injuries of baleen whales for 2004–2008	Waring et al. (2011)
U.S. Navy Sonar: Worldwide	40 total known, scientifically verifiable mortalities among cetaceans, consisting mostly of beaked whales	International Council for the Exploration of the Sea (2005a, b)

It is likely that distant shipping noise (which is more widespread and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. It is not known whether the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals. However, as the International Council for the Exploration of the Sea (2005a) noted, taken in context of marine mammal populations in general, sonar is neither a major threat nor a significant portion of the overall ocean noise budget. This has also been demonstrated by monitoring in areas where the Navy operates (Bassett et al. 2010; Baumann-Pickering et al. 2010; McDonald et al. 2006).

As discussed in Section 4.4.4.2.2 (Ocean Pollution), the potential also exists for the impacts of ocean pollution and acoustic stressors associated with each alternative to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, no data indicate that a marine mammal affected by ocean pollution would be more susceptible to stressors associated with the No Action Alternative, Alternative 1, or Alternative 2.

In summary, the aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 could contribute to cumulative impacts, but the relative contribution would be low compared to other actions. In comparison to potential mortality, strandings, or injury resulting from Navy training and testing activities, marine mammal mortality and injury from bycatch, commercial vessel ship strikes, entanglement, and ocean pollution are estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals) (Culik 2004; International Council for the Exploration of the Sea 2005b; Read et al. 2006).

4.4.5 SEA TURTLES AND OTHER MARINE REPTILES

4.4.5.1 Impacts of the Alternatives That Might Contribute to Cumulative Impacts

Impacts of the alternatives on the American crocodile and American alligator would be negligible. Therefore, the cumulative impacts analysis is limited to green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles, all of which are ESA-listed. The analysis presented in Section 3.5 (Sea Turtles and Other Marine Reptiles) concludes that some stressors associated with the No Action Alternative, Alternative 1, and Alternative 2 could impact individuals of certain sea turtle species, but impacts are not expected to decrease the overall fitness of any sea turtle populations. From a cumulative perspective, potential impacts on ESA-listed species are of particular concern. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). Impacts of the alternatives that may contribute to cumulative impacts on sea turtles can be generally categorized as behavioral responses, TTS, PTS, injury (modeled as slight lung injury), and mortality. As summarized below, these impacts would be associated with certain acoustic and physical strike stressors:

- The use of sonar and other active sources may result in behavioral responses, TTS, and PTS in sea turtles (Tables 3.5-6 through 3.5-8). Sonar and other activities' acoustic sources may affect and are likely to adversely affect ESA-listed sea turtles (Table 3.5-18).
- Explosives may result in behavioral responses, TTS, PTS, injury, and mortality in sea turtles (Tables 3.5-10 through 3.5-16). Explosives may affect and are likely to adversely affect ESA-listed sea turtles (Table 3.5-18).
- Vessel strikes may cause injury or mortality in sea turtles. Vessel strikes may affect and are likely to adversely affect ESA-listed sea turtles (Section 3.5.3.3.1, Impacts from Vessels).

The remaining acoustic stressors (noise from airguns, weapons firing/launch/impact, aircraft, and vessels), energy stressors (electromagnetic and high energy lasers), physical disturbance and strike stressors (in-water devices, military expended materials, and seafloor devices), entanglement stressors (cables, wires, and parachutes), ingestion stressors (munitions and military expended materials other than munitions), and secondary stressors are not expected to result in TTS, PTS, injury, or mortality of sea turtles under any of the alternatives. Furthermore, these stressors would have no effect or may affect but are not likely to adversely affect ESA-listed sea turtles (Table 3.5-18). For these reasons, the incremental contribution of these remaining stressors to cumulative impacts on sea turtles would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis.

Although sea turtles could be exposed to sound and energy from explosive detonations throughout the Study Area, the estimated impacts on individual sea turtles are unlikely to impact populations. Injured sea turtles could suffer reduced fitness and long-term survival. Sea turtles that experience TTS or PTS may have reduced ability to detect relevant sounds such as predators or prey, although some TTS would recover quickly, possibly in a matter of minutes. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would have long-term consequences for that individual because the sea turtle hearing range is already limited. Any significant behavioral reactions to acoustic stimuli could lead to a sea turtle expending energy and missing opportunities to secure resources. However, most individuals are not likely to experience long-term consequences from behavioral reactions because exposures would be intermittent and widely spaced, allowing exposed individuals to recover. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.

4.4.5.2 Impacts of Other Actions

4.4.5.2.1 Overview

The potential impacts of other actions relevant to the cumulative impacts analysis for sea turtles include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, entanglement, ingestion of marine debris, illegal harvest, and stressors associated with coastal development and human use of coastal environments (e.g., beach vehicular driving, power plant entrainment, etc.)
- Injury associated with vessel strikes, bycatch, entanglement, ingestion of marine debris, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with prey and habitat degradation caused by water pollution or other causes
- Habitat loss related to coastal development

Most other actions and considerations retained for analysis in Table 4.3-1 include operation of marine vessels. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis include vessel strikes and underwater noise. Many of the actions could also result in underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in Sections 4.4.5.2.3 (Maritime Traffic and Vessel Strikes) and 4.4.5.2.4 (Ocean Noise). Similarly, many of the actions could result in water pollution. The aggregate impacts of water pollution are addressed in Section 4.4.4.2.5 (Ocean Pollution). Bycatch and entanglement are associated with commercial fishing, discussed in Section 4.4.5.2.6 (Commercial Fishing).

4.4.5.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Sea turtles could be affected if they are inside the mitigation zone (180-dB sound field) during a Surveillance Towed Array Sensor System Low Frequency Active Sonar transmission. However, because received levels from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations would be below 180 dB re 1 µPa (root mean square) sound pressure level within 12 nm or greater distance of any coastlines and offshore biologically important areas, effects on a sea turtle stock could occur only if a significant portion of the stock encountered the Surveillance Towed Array Sensor System Low Frequency Active Sonar vessel in the open ocean. The potential for Surveillance Towed Array Sensor System Low Frequency Active Sonar operations to expose sea turtle stocks to injurious (nonauditory or PTS) sound levels or to cause TTS or behavioral changes is considered negligible because (U.S. Department of the Navy 2011):

- Most sea turtle species inhabit the earth's oceanic temperate zones, where sound propagation is predominantly characterized by downward refraction (higher transmission loss, shorter range), rather than ducting (lower transmission loss, longer range), which is usually found in cold-water regimes.
- Sea turtle distribution and density are generally low at ranges greater than 12 nm from the coast.
- The Surveillance Towed Array Sensor System Low Frequency Active Sonar signal has a narrow bandwidth (approximately 30 Hz).

- The ship is always moving, and the system has a low duty cycle (estimated 7.5 percent), which means sea turtles would have less opportunity to be in the mitigation zone during a transmission.
- Visual monitoring mitigation is incorporated into the alternatives.

4.4.5.2.3 Maritime Traffic and Vessel Strikes

As discussed in Section 4.3.7 (Maritime Traffic), maritime traffic has increased over the past 50 years, and continued increases are expected in the future. For example, container ship calls to U.S. Atlantic ports are expected to increase 4 percent per year through 2020 (Ward-Geiger et al. 2005). Vessel strikes have been and will continue to be a cause of sea turtle mortality and injury throughout portions of the Study Area where sea turtles regularly occur.

Some vessel strikes could cause temporary impacts, such as diverting the turtle from its previous activity or causing minor injury. Major strikes could cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals a period of time after a strike. Numerous living sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls (Hazel et al. 2007; Lutcavage et al. 1997), suggesting that not all vessel strikes are lethal. Conversely, fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data. A National Research Council report qualitatively ranked the relative importance of various mortality factors for sea turtles. Vessel strikes were ranked 10th, behind leading factors of shrimp trawling and other fisheries (National Research Council 1990).

4.4.5.2.4 Ocean Noise

In general, the potential concerns associated with ocean noise and sea turtles are not as well defined as those for marine mammals. While it is well known that many species of marine mammals use sound as a primary sense for navigating, finding prey, and communicating with other individuals, little is known about how sea turtles use sound in their environment. Based on knowledge of their sensory biology (Bartol and Ketten 2006; Bartol and Musick 2003; Ketten and Bartol 2006; Levenson et al. 2004), sea turtles may be able to detect objects within the water column (e.g., vessels, prey, predators) via some combination of auditory and visual cues. However, research examining the ability of sea turtles to avoid collisions with vessels shows they may rely more on their vision than auditory cues (Hazel et al. 2007). Similarly, while sea turtles may rely on acoustic cues from breaking waves to identify nesting beaches, they also appear to rely on other nonacoustic cues for navigation, such as magnetic fields (Lohmann and Lohmann 1992; Lohmann and Lohmann 1996) and light (Avens and Lohmann 2003). Additionally, sea turtles are not known to produce sounds underwater for communication. As a result, sound may play a limited role in a sea turtle's environment.

Nonetheless, as discussed in Section 3.5.3.1 (Acoustic Stressors), sea turtles could experience a range of impacts from ocean noise, depending on the sound source. The impacts could include permanent or temporary hearing loss, changes in behavior, physiological stress, and auditory masking. In addition, potential impacts from use of explosives could range from physical discomfort to nonlethal and lethal injuries.

4.4.5.2.5 Ocean Pollution

Oil and gas exploration and development in the Gulf of Mexico are a particular threat to Kemp's ridley turtles because most of the population occurs there. Kemp's ridley turtles covered in crude oil have been documented to strand on beaches in Mexico, and most of the turtles found injured and dead following the *Deepwater Horizon* oil spill were Kemp's ridley turtles (National Marine Fisheries Service 2010, 2011).

Marine debris can also be a problem for sea turtles through entanglement or ingestion. Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherback turtles had ingested various types of plastic (Mrosovsky et al. 2009). Other marine debris, including derelict fishing gear and cargo nets, can entangle and drown turtles in all life stages.

4.4.5.2.6 Commercial Fishing

Bycatch is one of the most serious threats to the recovery and conservation of marine turtle populations (National Research Council 1990; Wallace et al. 2010). Among fisheries that incidentally capture sea turtles, certain types of trawl, gillnet, and longline fisheries generally pose the greatest threat. One comprehensive study estimated that worldwide, 447,000 turtles are killed each year from bycatch in commercial fisheries (Wallace et al. 2010). The Biological Opinion issued by NMFS in June 2009 for Navy range complexes along the Atlantic coast provided the following estimates of sea turtle bycatch for shrimp trawl fisheries (National Marine Fisheries Service 2009):

> The fisheries that have the most significant demographic effect on sea turtles are the shrimp trawl fisheries conducted off the southeast United States (from North Carolina to the Atlantic coast of Florida) and Gulf of Mexico (from the Gulf coast of Florida to Texas). Although participants in these fisheries are required to use Turtle Exclusion Devices, which are estimated to reduce the number of sea turtles trawlers capture by as much as 97 percent, each year these fisheries are expected to capture about 185,000 sea turtles and kill about 5,000 of the turtles captured. Loggerhead sea turtles account for most of this total: each of these fisheries is expected to capture about 163,000 loggerhead sea turtles, killing almost 4,000 of them. These are followed by green sea turtles: about 18,700 green sea turtles are expected to be captured each year with more than 500 of them dying as a result of their capture.

Other fisheries that result in sea turtle bycatch in the Study Area include pelagic fisheries for swordfish, tuna, shark, and billfish; purse seine fisheries for tuna; commercial and recreational rod and reel fisheries; gillnet fisheries for shark; driftnet fisheries; bottom longline fisheries; and sea scallop fisheries (National Marine Fisheries Service 2009).

4.4.5.2.7 Coastal Land Development

Coastal land development and increased human populations in coastal areas will continue to have impacts on sea turtles due to nesting beach habitat degradation, beach vehicular driving, beach lighting, power plant entrainment, habitat alteration from nearshore dredging and beach nourishment, and degradation of nearshore water quality and seagrass beds.

4.4.5.3 Cumulative Impacts on Sea Turtles and Other Marine Reptiles

The fact that all five species of sea turtles occurring in the Study Area are ESA-listed provides a clear indication that the current aggregate impacts of past human activities are significant for sea turtles.

Many of the past activities such as commercial fishing that have current impacts are also present actions and reasonably foreseeable future actions.

Direct, human-caused mortality of sea turtles is one of the primary issues of concern for this cumulative impacts analysis. Bycatch, vessel strikes, entanglement, ingestion, and nest destruction are human causes of direct mortality to sea turtles and will continue to cause mortality in the future. While new management practices could result in future reductions, bycatch is expected to remain a leading cause of mortality for the reasonably foreseeable future. Vessel traffic is expected to continue to increase in the Study Area in response to continued economic globalization, widening of the Panama Canal, and increases in energy development and other offshore activities. While increased risks come with increased vessel traffic, the risks of vessel strikes can be minimized by ongoing and future education and awareness, ship speed reduction measures (primarily aimed at protecting marine mammals), and maritime traffic planning and management.

Each alternative could also result in injury and mortality to individual sea turtles from underwater explosions and vessel strikes. Implementation of measures discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) would reduce but not eliminate potential impacts. Injury and mortality that might occur under the No Action Alternative, Alternative 1, or Alternative 2 could be additive to injury and mortality associated with other actions, but the relative contribution would be low. Each alternative has the potential for a few mortalities per year, compared to about 5,000 sea turtle mortalities per year in the shrimp trawl fishery alone (National Marine Fisheries Service 2009) and more than 1,000 per year for other actions.

Ocean noise associated with other actions (Section 4.4.4.2.4, Ocean Noise) and acoustic stressors (underwater explosions and sonar) associated with each alternative could also result in additive behavioral impacts on sea turtles. Other future actions such as construction and operation of liquefied natural gas terminals, construction of the Cape Wind Energy project, seismic surveys, and construction and removal of oil and gas facilities would be expected to result in similar impacts. However, it is unlikely these actions and underwater explosions or sonar use would overlap in time and space because all these activities are widespread and the sound sources are intermittent. Furthermore, safety, security, and operational considerations would preclude some training and testing activities in the immediate vicinity of other actions.

It is likely that distant shipping noise (which is more widespread and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on sea turtles.

As discussed in Section 4.4.4.2.2 (Ocean Pollution), the potential also exists for the impacts of ocean pollution and acoustic stressors associated with each alternative to be additive or synergistic. It is possible that the response of a previously stressed animal could be more severe than the response of an unstressed animal. However, there are no data indicating that a sea turtle affected by ocean pollution would be more susceptible to stressors associated with the No Action Alternative, Alternative 1, or Alternative 2.

In summary, the aggregate impacts of past, present, and other actions and reasonably foreseeable future actions are expected to result in significant impacts on green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles. The No Action Alternative, Alternative 1, or Alternative 2 could

contribute to cumulative impacts, but the relative contribution would be low compared to other actions such as commercial fishing.

4.4.6 BIRDS

The analysis in Section 3.6 (Birds) indicates that birds could potentially be impacted by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), energy stressors (electromagnetic, lasers), physical disturbance and strikes (aircraft, aerial targets, vessels and in-water devices, military expended materials), and ingestion (military expended materials). Potential responses could include a startle response, which includes short-term behavioral (e.g., movement) and physiological components (e.g., increased heart rate). Recovery from the impacts of most stressor exposures would occur quickly, and impacts would be localized. Some stressors, including underwater explosions, physical strikes, and ingestion of plastic military expended materials, could result in mortality. However, the number of individual birds affected is expected to be low, and no population-level impacts are expected. The impacts of each alternative could be cumulative with other actions that cause short-term behavioral and physiological impacts and mortality to birds. However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on birds would be low for the following reasons:

- Most of the proposed activities would be widely dispersed in offshore areas, where bird distribution is patchy and concentrations of individuals are often low. Therefore, the potential for interactions between birds and training and testing activities is low.
- It is unlikely that training and testing activities would influence nesting because most activities take place in water and away from nesting habitats on land. None of the alternatives would result in destruction or loss of nesting habitat.
- For most stressors, impacts would be short term and localized, and recovery would occur quickly.
- While a limited amount of mortality could occur, no population-level impacts would be expected.
- None of the alternatives are likely to adversely affect ESA-listed bird species.

Based on the analysis in Section 3.6 (Birds), and the reasons summarized above, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be negligible.

4.4.7 MARINE VEGETATION

The analysis presented in Section 3.7 (Marine Vegetation) indicates that marine vegetation could be affected by acoustic stressors (underwater explosions) and physical stressors (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance and mortality. Recovery would occur quickly, and population-level impacts are not anticipated. The impacts of each alternative could be cumulative with other actions that cause disturbance and mortality of marine vegetation. However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be low for the following reasons:

- Most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow.

- Impacts would be localized, recovery would occur quickly, and no population-level impacts would be expected.
- None of the alternatives would result in impacts that have been historically significant to marine vegetation. For example, the alternatives would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses.
- None of the alternatives would result in long-term or widespread changes in environmental conditions such as turbidity, salinity, pH, or water temperature that could impact marine vegetation.
- The Proposed Action would have no effect on ESA-listed species of marine vegetation and would not result in the destruction or adverse modification of critical habitat.

Based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized above, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be low.

4.4.8 MARINE INVERTEBRATES

The analysis presented in Section 3.8 (Marine Invertebrates) indicates that marine invertebrates could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), electromagnetic stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (cables and wires, parachutes), and ingestion (military expended materials). Potential impacts include short-term behavioral and physiological responses. Some stressors could also result in injury or mortality to a relatively small number of individuals but not to ESA-listed corals. No population-level impacts are anticipated. The No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed corals or may affect but not likely to adversely affect ESA-listed corals. The invertebrate mortality impacts of each alternative could be cumulative with other actions that cause mortality (e.g., commercial fishing). However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be negligible.

4.4.9 FISH

The analysis presented in Section 3.9 (Fish) indicates that fish could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), electromagnetic stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (cables and wires, parachutes), and ingestion (military expended materials). Potential impacts include short-term behavioral and physiological responses. Some stressors could also result in injury or mortality to a relatively small number of individuals but not to ESA-listed fish. No population-level impacts are anticipated. The No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed fishes or would be not likely to adversely affect ESA-listed fish. The fish mortality impacts of each alternative could be cumulative with other actions that cause mortality (e.g., commercial fishing). However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts would be negligible.

4.4.10 CULTURAL RESOURCES

As discussed in Section 3.10 (Cultural Resources), stressors associated with the alternatives would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these

resources. The No Action Alternative, Alternative 1, or Alternative 2 are not expected to contribute incrementally to cumulative impacts on cultural resources. Therefore, further analysis of cumulative impacts on cultural resources is not warranted.

4.4.11 SOCIOECONOMIC RESOURCES

The analysis in Section 3.11 (Socioeconomic Resources) indicates that the impacts of the alternatives on socioeconomic resources would be negligible. The No Action Alternative, Alternative 1, or Alternative 2 are not expected to contribute incrementally to cumulative socioeconomic impacts. Therefore, further analysis of cumulative impacts on socioeconomic resources is not warranted.

4.4.12 PUBLIC HEALTH AND SAFETY

The analysis presented in Section 3.12 (Public Health and Safety) indicates that the impacts of the alternatives on public health and safety would be negligible. The No Action Alternative, Alternative 1, and Alternative 2 are not expected to contribute incrementally to cumulative health and safety impacts. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

4.5.1 INTRODUCTION

Climate change is a global issue, and greenhouse gas emissions are a concern from a cumulative perspective because individual sources of greenhouse gas emissions are not large enough to have an appreciable impact on climate change. This greenhouse gas analysis considers the incremental contribution of Alternatives 1 and 2 to total estimated U.S. greenhouse emissions as compared to the No Action Alternative.

Greenhouse gases are compounds that contribute to the greenhouse effect, a natural phenomenon in which these gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating (radiative forcing) at the surface of the earth. Scientific evidence indicates a trend of increasing global temperature over the past century due to increasing greenhouse gas emissions from human activities (U.S. Environmental Protection Agency 2009). The climate change associated with this global warming is predicted to produce negative environmental, economic, and social consequences across the globe. The average global temperature since 1900 has risen by 1.5 degrees Fahrenheit (°F) (0.8 degrees centigrade [°C]) and is predicted to increase by up to 11.5°F (6.4°C) by 2100 (Karl et al. 2009).

Predictions of long-term negative environmental impacts due to global warming include sea level rise, changes in ocean pH and salinity, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems (including the potential loss of species), shrinking glaciers and sea ice, thawing permafrost, a longer growing season, and shifts in plant and animal ranges.

Climate change is likely to negatively impact the Study Area and adjacent shore regions. Since 1970, the annual average temperature in the northeast United States has increased by 2°F (1.1°C), with winter temperatures rising twice this much (Karl et al. 2009). Over the next several decades, temperatures in the northeast United States are projected to rise an additional 2.5 to 4°F (1.4 to 2.2°C) in winter and 1.5 to 3.5°F (0.8 to 1.9°C) in summer. The northeast United States is projected to face continued warming and more extensive climate-related changes, some of which could dramatically alter the region's economy, landscape, character, and quality of life (Karl et al. 2009).

In the southeastern United States, since 1970, annual average temperature has risen about 2°F (1.1°C), with the greatest seasonal increase in temperature occurring during the winter months. Climate models project continued warming in all seasons across the southeast United States and an increase in the rate of warming through the end of this century. The projected rates of warming are more than double those experienced in the southeast United States since 1975, with the greatest temperature increases projected to occur in summer. The intensity of Atlantic hurricanes is likely to increase during this century, with higher peak wind speeds, rainfall intensity, and storm surge height and strength (Karl et al. 2009).

4.5.2 REGULATORY FRAMEWORK

Federal agencies address emissions of greenhouse gases by reporting and meeting reductions mandated in laws, executive orders (EOs), and policies. The most recent of these are EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* of 5 October 2009, and EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* of 26 January 2007.

EO 13514 shifts the way the government operates by (1) establishing greenhouse gases as the integrating metric for tracking progress in federal sustainability, (2) requiring a deliberative planning process, and (3) linking budget allocations and Office of Management and Budget scorecards to ensure goal achievement.

The targets for reducing greenhouse gas emissions discussed in EO 13514 for Scope 1 (direct greenhouse gas emissions from sources that are owned or controlled by a federal agency) and Scope 2 (direct greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a federal agency) have been set for the Department of Defense at a 34 percent reduction of greenhouse gas from the 2008 baseline by 2020. Scope 3 targets (greenhouse gas emissions from sources not owned or directly controlled by a federal agency but related to agency activities such as vendor supply chains, delivery services, and employee travel and commuting) were set at a 13.5 percent reduction. EO 13514, *Strategic Sustainability Performance Plan*, submitted to the Council on Environmental Quality on 2 June 2010 contains a guide for meeting these goals.

EO 13423 established a policy that federal agencies conduct their environmental, transportation, and energy-related activities in support of their respective missions in an environmentally economic way. It included a goal of improving energy efficiency and reducing greenhouse gas emissions of the agency through reduction of energy intensity by 3 percent annually through the end of fiscal year 2015, or 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003.

The *Draft NEPA Guidance on Consideration of the Impacts of Climate Change and Greenhouse Gas Emissions* (Council on Environmental Quality 2010) states that "if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon dioxide equivalent (CO_2 Eq.) greenhouse gas emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public."

The Navy is committed to improving energy security and environmental stewardship by reducing reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the

Environmental Readiness Division is taking to implement EO 13514 (U.S. Department of the Navy 2010). The Navy's Task Force Energy is responding to the Secretary of the Navy's energy goals through energy security initiatives that reduce the Navy's carbon footprint. The Climate Change Roadmap (five-year roadmap) action items, objectives, and desired impacts are organized to focus on strategies, policies and plans; operations and training; investments; strategic communications and outreach; and environmental assessment and prediction.

4.5.3 GREENHOUSE GAS EMISSIONS IN THE UNITED STATES

Greenhouse gas emissions occur from both natural processes and human activities. The primary long-lived greenhouse gases directly emitted by human activities are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Although CO_2, CH_4, and N_2O occur naturally in the atmosphere, their concentrations have increased by 38 percent, 149 percent, and 23 percent, respectively, from the preindustrial era (1750) to 2007–2008 (U.S. Environmental Protection Agency 2009).

To estimate total greenhouse gas emissions, each greenhouse gas is assigned a global warming potential; that is, the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of 1. For example, CH_4 has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis (Intergovernmental Panel on Climate Change 2007). To simplify greenhouse gas analyses, total greenhouse gas emissions from a source are often expressed as CO_2 equivalent (Eq.). The CO_2 Eq. is calculated by multiplying the emissions of each greenhouse gas by its global warming potential and adding the results together to produce a single, combined emission rate representing all greenhouse gases. While CH_4 and N_2O have much higher global warming potentials than CO_2, CO_2 is emitted in much higher quantities, so it is the overwhelming contributor to CO_2 Eq. from both natural processes and human activities. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of teragrams (Tg) (1 million metric tons, or 1 billion kg) of carbon dioxide equivalents (Tg CO_2 Eq.).

In 2009, the United States generated an estimated 6,633.2 Tg CO_2 Eq. (U.S. Environmental Protection Agency 2011). The 2009 inventory data (U.S. Environmental Protection Agency 2011) show that CO_2, CH_4, and N_2O contributed from fossil fuel combustion processes from mobile and stationary sources (all sectors) include approximately

- 5,505.2 Tg of CO_2
- 686.3 Tg CH_4
- 295.6 Tg N_2O

The 6,633.2 Tg CO_2 Eq. generated in 2009 is a decrease from the 7,263.4 Tg CO_2 Eq. generated in 2007 (U.S. Environmental Protection Agency 2011). Among domestic transportation sources, light-duty vehicles (including passenger cars and light-duty trucks) represented 64 percent of CO_2 emissions, medium- and heavy-duty trucks 20 percent, commercial aircraft 6 percent, and other sources 9 percent. Across all categories of aviation, CO_2 emissions decreased by 21.6 percent (38.7 Tg) between 1990 and 2009. This includes a 59 percent (20.3 Tg) decrease in emissions from domestic military operations. To place military aircraft in context with other aircraft CO_2 emissions, in 2009, commercial aircraft generated 111.4 Tg CO_2 Eq., military aircraft generated 14.1 Tg CO_2 Eq., and general aviation aircraft generated 13.3 Tg CO_2 Eq. Military aircraft represent roughly 10 percent of emissions from the overall jet fuel combustion category.

4.5.4 CUMULATIVE GREENHOUSE GAS IMPACTS

Greenhouse gas emissions were calculated for ships and aircraft (Table 4.5-1 and Appendix D), which contribute the majority of emissions associated with training and testing in the Study Area. Greenhouse gas emissions from minor sources such as munitions, weapons platforms, and auxiliary equipment are considered negligible and were not calculated. Ship greenhouse gas emissions were estimated by determining annual ship fuel (typically diesel) use based on proposed activities and multiplying total annual ship fuel consumption by the corresponding emission factors for CO_2, CH_4, and N_2O. Aircraft greenhouse gas emissions were calculated by multiplying jet fuel use rates by the total operating hours, by the corresponding jet fuel emission factors for CO_2, CH_4, and N_2O, and by the total annual sorties.

Table 4.5-1: Greenhouse Gas Emissions from Ship and Aircraft Training and Testing Activities in the Atlantic Fleet Training and Testing Study Area

Alternative	Annual Emissions (Teragrams)			
	CO_2	N_2O	CH_4	CO_2 Eq.
No Action Alternative	0.89	0.00003	0.00003	0.90
Alternative 1	1.33	0.00005	0.00004	1.35
Increase in emissions for Alternative 1 compared to No Action Alternative	0.44	0.00002	0.00001	0.45
Alternative 2	1.39	0.00005	0.00004	1.37
Increase in emissions for Alternative 2 compared to No Action Alternative	0.50	0.00002	0.00001	0.47

CH_4: methane; CO_2: carbon dioxide; CO_2 Eq.: carbon dioxide equivalent; N_2O: nitrous oxide

Ship and aircraft greenhouse gas emissions are compared to U.S. 2009 greenhouse gas emissions in Table 4.5-2. The estimated CO_2 Eq. emissions from the No Action Alternative are 0.01 percent of the total CO_2 Eq. emissions generated by the United States in 2009. The estimated CO_2 Eq. emissions from Alternatives 1 and 2 would increase because of increased training and testing activities to about 0.02 percent of the total CO_2 Eq. emissions generated by the United States in 2009.

Table 4.5-2: Comparison of Ship and Aircraft Greenhouse Gas Emissions to United States 2009 Greenhouse Gas Emissions

Alternative	Annual Greenhouse Gas Emissions (Teragrams CO_2 Eq.)	Percentage of U.S. 2009 Greenhouse Gas Emissions
No Action Alternative	0.90	0.01%
Alternative 1	1.35	0.02%
Alternative 2	1.37	0.02%
U.S. 2009 greenhouse gas emissions	6,633	

Source: U.S. Environmental Protection Agency 2011
CO_2 Eq.: carbon dioxide equivalent.

4.6 SUMMARY AND CONCLUSIONS

Marine mammals and sea turtles are the primary resources of concern for cumulative impacts analysis:

- Past human activities have impacted these resources to the extent that several marine mammal species and all sea turtles species occurring in the Study Area are ESA-listed. Several marine mammal species have stocks that are classified as strategic stocks under MMPA.
- These resources would be impacted by multiple ongoing and future actions.
- Explosive detonations and vessel strikes under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill marine mammals and sea turtles.

The aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal and all sea turtle species in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 could contribute to cumulative impacts, but the relative contribution would be low compared to other actions. Compared to potential mortality, strandings, or injury resulting from Navy training and testing activities, marine mammal and sea turtle mortality and injury from bycatch, commercial vessel ship strikes, entanglement, ocean pollution, and other human causes are estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals) (Culik 2004; International Council for the Exploration of the Sea 2005b; Read et al. 2006).

The analysis presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicate that the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on sediments and water quality, air quality, marine habitats, birds, marine vegetation, marine invertebrates, fish, socioeconomic resources, and public health and safety would be negligible. When considered with other actions, the No Action Alternative, Alternative 1, or Alternative 2 might contribute to cumulative impacts on submerged prehistoric and historic resources, if such resources are present in areas where bottom-disturbing training and testing activities take place. The No Action Alternative, Alternative 1, or Alternative 2 would also make an incremental contribution to greenhouse gas emissions, representing approximately 0.01, 0.02, and 0.02 percent of U.S. 2009 greenhouse gas emissions, respectively.

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5 STANDARD OPERATING PROCEDURES, MITIGATION, AND MONITORING

This chapter describes the United States (U.S.) Department of the Navy (Navy) standard operating procedures, mitigation measures, and marine species monitoring and reporting efforts. Standard operating procedures are essential to maintaining safety and mission success, and in many cases have the added benefit of reducing potential environmental impacts. Mitigation measures are designed to help reduce or avoid potential impacts on marine resources. Marine species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve understanding of the impacts of training and testing activities on marine resources within the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area).

5.1 STANDARD OPERATING PROCEDURES

Effective training, maintenance, research, development, testing, and evaluation (hereafter referred to collectively as the Proposed Action) require that participants use their sensors and weapon systems to their optimum capabilities as required by the activity objectives. The Navy currently employs standard practices to provide for the safety of personnel and equipment, including vessels and aircraft, as well as the success of the training and testing activities. For the purpose of this document, the Navy will refer to standard practices as standard operating procedures. Because of their importance for maintaining safety and mission success, standard operating procedures have been considered as part of the Proposed Action under each alternative, and therefore are included in the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for each resource.

Navy standard operating procedures have been developed and refined over years of experience, and are broadcast via numerous naval instructions and manuals, including the following sources:

- Ship, submarine, and aircraft safety manuals
- Ship, submarine, and aircraft standard operating manuals
- Fleet Area Control and Surveillance Facility range operating instructions
- Fleet exercise publications and instructions
- Naval Sea Systems Command test range safety and standard operating instructions
- Navy instrumented range operating procedures
- Naval shipyard sea trial agendas
- Research, development, test, and evaluation plans
- Naval gunfire safety instructions
- Navy planned maintenance system instructions and requirements
- Federal Aviation Administration regulations

In many cases there are incidental environmental, socioeconomic, and cultural benefits resulting from standard operating procedures. Standard operating procedures serve the primary purpose of providing for safety and mission success, and are implemented regardless of their secondary benefits. This is what distinguishes standard operating procedures, which are a component of the Proposed Action, from mitigation measures, which are designed entirely for the purpose of reducing environmental impacts resulting from the Proposed Action. Because standard operating procedures are crucial to safety and mission success, the Navy will not modify them as a way to further reduce impacts on environmental resources. Rather, mitigation measures will be used as the tool for avoiding and reducing potential

environmental impacts. Standard operating procedures that are recognized as providing a potential secondary benefit are provided below.

5.1.1 VESSEL SAFETY

For the purposes of this chapter, the term "ship" is inclusive of surface ships and surfaced submarines. The term "vessel" is inclusive of ships and small boats (e.g., rigid-hull inflatable boats).

Ships operated by or for the Navy have personnel assigned to stand watch at all times, day and night, when moving through the water (underway). Watch personnel undertake extensive training in accordance with the U.S. Navy Lookout Training Handbook or civilian equivalent, including on-the-job instruction and a formal Personal Qualification Standard program (or equivalent program for supporting contractors or civilians), to certify that they have demonstrated all necessary skills (such as detection and reporting of floating or partially submerged objects). Watch personnel are composed of officers, enlisted men and women, and civilian equivalents. Their duties may be performed in conjunction with other job responsibilities, such as navigating the ship or supervising other personnel. While on watch, personnel employ visual search techniques, including the use of binoculars, using a scanning method in accordance with the U.S. Navy Lookout Training Handbook or civilian equivalent. After sunset and prior to sunrise, watch personnel employ night visual search techniques, which could include the use of night vision devices.

A primary duty of watch personnel is to detect and report all objects and disturbances sighted in the water that may be indicative of a threat to the ship and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per safety requirements, watch personnel also report any marine mammals sighted that have the potential to be in the direct path of the ship as a standard collision avoidance procedure. Because watch personnel are primarily posted for safety of navigation, range clearance, and man-overboard precautions, they are not normally posted while ships are moored to a pier. When anchored or moored to a buoy, a watch team is still maintained but with fewer personnel than when underway. When moored or at anchor, watch personnel may maintain security and safety of the ship by scanning the water for any indications of a threat (as described above).

While underway, Navy ships (with the exception of submarines) greater than 65 feet (ft.) (20 meters [m]) in length have at least two watch personnel; Navy ships less than 65 ft. (20 m) in length, surfaced submarines, and contractor ships have at least one watch person. While underway, watch personnel are alert at all times and have access to binoculars. Due to limited manning and space limitations, small boats do not have dedicated watch personnel, and the boat crew is responsible for maintaining the safety of the boat and surrounding environment.

All vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions.

5.1.2 AIRCRAFT SAFETY

Pilots of Navy aircraft make every attempt to avoid large flocks of birds in order to reduce the safety risk involved with a potential bird strike.

5.1.3 LASER PROCEDURES

The following procedures are applicable to lasers of sufficient intensity to cause human eye damage.

5.1.3.1 Laser Operators

Only properly trained and authorized personnel operate lasers.

5.1.3.2 Laser Activity Clearance

Prior to commencing activities involving lasers, the operator ensures that the area is clear of unprotected or unauthorized personnel in the laser impact area by performing a personnel inspection or a flyover. The operator also ensures that any personnel within the area are aware of laser activities and are properly protected.

5.1.4 WEAPONS FIRING PROCEDURES

5.1.4.1 Notice to Mariners

A Notice to Mariners is routinely issued in advance of missile firing activities. A notice is also issued in advance of explosive bombing activities when they are conducted in an area that does not already have a standing Notice to Mariners. For activities involving large-caliber gunnery, the Navy evaluates the need to publish a Notice to Mariners based on the scale, location, and timing of the activity. More information on the Notices to Mariners is found in Section 3.12.2.1.1 (Sea Space).

5.1.4.2 Weapons Firing Range Clearance

The weapons firing hazard range must be clear of non-participating vessels and aircraft before firing activities will commence. The size of the firing hazard range is based on the farthest firing range capability of the weapon being used. All missile and rocket firing activities are carefully planned in advance and conducted under strict procedures that place the ultimate responsibility for range safety on the Officer Conducting the Exercise or civilian equivalent. All weapons firing is secured when cease fire orders are received from the Range Safety Officer or when the line of fire is endangering any object other than the designated target.

Pilots of Navy aircraft are not authorized to expend ordnance, fire missiles, or drop other airborne devices through extensive cloud cover where visual clearance of the air and surface area is not possible. The two exceptions to this requirement are: (1) when operating in the open ocean, air and surface clearance through visual means or radar surveillance is acceptable, and (2) when the operational commander conducting the exercise accepts responsibility for the safeguarding of airborne and surface traffic.

During activities that involve recoverable targets (e.g., aerial drones), the Navy recovers the target and any associated parachutes to the maximum extent practicable consistent with operational requirements and personnel safety.

5.1.4.3 Target Deployment Safety

Firing exercises involving the integrated maritime portable acoustic scoring system are typically conducted in daylight hours in Beaufort number 4 conditions or better to ensure safe operating conditions during buoy deployment and recovery. The Beaufort sea state scale is a standardized measurement of the weather conditions, based primarily on wind speed. The scale is divided into levels from 0 to 12, with 12 indicating the most severe weather conditions (e.g., hurricane force winds). At Beaufort number 4, wave heights typically range from 3.5 to 5 ft. (1 to 1.5 m).

5.1.5 SWIMMER DEFENSE TESTING PROCEDURES

5.1.5.1 Notice to Mariners

A Notice to Mariners is issued in advance of all swimmer defense testing.

5.1.5.2 Swimmer Defense Testing Clearance

A daily in situ calibration of the source levels is used to establish a clearance area to the 145 decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) sound pressure level threshold for non-participant personnel safety. A hydrophone is stationed during the calibration sequences in order to confirm the clearance area. Small boats patrol the 145 dB re 1 µPa sound pressure level area during all test activities. Boat crews are equipped with binoculars and remain vigilant for non-participant divers, boats, swimmers, snorkelers, and dive flags. If a non-participating swimmer, snorkeler, or diver is observed entering into the area of the swimmer defense system, the power levels of the defense system are reduced. An additional 100 yard (yd.) (91 m) buffer is applied to the initial sighting location of the non-participant as an additional precaution. If the area cannot be maintained free of non-participating swimmers, snorkelers, and divers, testing will cease until the non-participant has moved outside the area.

5.1.6 UNMANNED AERIAL AND UNDERWATER VEHICLE PROCEDURES

For activities involving unmanned aerial and underwater vehicles, the Navy evaluates the need to publish a Notice to Airmen or Mariners based on the scale, location, and timing of the activity. Unmanned aerial vehicles and unmanned aircraft systems are operated in accordance with Federal Aviation Administration air traffic organization policy as issued in Office of the Chief of Naval Operations Instructions 3710, 3750, and 4790.

5.1.7 TOWED IN-WATER DEVICE PROCEDURES

Prior to deploying a towed device from a manned platform, there is a standard operating procedure to search the intended path of the device for any floating debris (e.g., driftwood) or other potential obstructions (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies] and animals), which have the potential to cause damage to the device.

5.1.8 SHIP SHOCK TRIAL PROCEDURES

5.1.8.1 Notice to Mariners

Notices to Mariners and Airmen are issued in advance of all ship shock trial activities.

5.1.8.2 Ship Shock Trial Clearance

A 5 nautical mile (nm) radius is established around the detonation point to exclude all non-participating vessels and aircraft for 5 to 6 hours prior to each detonation. This clearance extends for up to a total of 12 hours per detonation. This area is an electronic emissions control zone that virtually eliminates the possibility of an inadvertent detonation caused by a radio or radar induced electrical current in the explosive firing circuit. This area also provides for safe maneuvering of the explosive laden operations vessel. Since the ship being tested and the operations vessel are not stationary during the ship shock trial activities, the associated area around the detonation point moves. If a non-participating vessel or aircraft is detected within a 10 nm radius of ship shock trial activities, the non-participant is warned to alter course. This is necessary for operational security and to allow large vessels sufficient time to change course to avoid entering the clearance area. Ship shock trial testing is immediately secured when a non-participating vessel or aircraft enters or is detected within the 5 nm clearance area and cannot be

contacted. These security measures continue until the area is clear of non-participating vessels and aircraft.

5.1.8.3 Ship Shock Trial Safety

In the unlikely event a charge fails to explode, additional attempts to detonate the charge would occur. If detonation fails, the explosive would be recovered and disarmed. If the explosive cannot be detonated or disarmed, to safeguard human life, the explosive is disposed at sea in accordance with established Ammunition and Explosives Safety Afloat requirements. The location of any disposal is recorded.

5.2 INTRODUCTION TO MITIGATION

The Navy recognizes that the Proposed Action has the potential to impact the environment. Unlike standard operating procedures, which are established for reasons other than environmental benefit, mitigation measures are modifications to the Proposed Action that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. The procedures discussed in this chapter, most of which are currently or were previously implemented as a result of past environmental compliance documents, Endangered Species Act (ESA) Biological Opinions, Marine Mammal Protection Act (MMPA) Letters of Authorization, or other formal or informal consultations with regulatory agencies, have been coordinated with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service through the consultation and permitting processes.

5.2.1 REGULATORY REQUIREMENTS FOR MITIGATION

An Environmental Impact Statement (EIS) must analyze the affected environment, discuss the environmental impacts of the Proposed Action and each alternative, and assess the significance of the impacts on the environment. Mitigation measures are designed to help reduce the severity or intensity of impacts of the Proposed Action. Assessment of mitigation measures can occur early in the planning process. An agency may choose not to take the action or to move the location of the action. Mitigation measure development also occurs throughout the analysis process whenever an impact is minimized by limiting the degree or magnitude of the action or its implementation. Mitigation measures can also include actions that repair, rehabilitate, or restore the affected environment or reduce impacts over time through constant monitoring and corrective adjustments.

In accordance with the National Environmental Policy Act (NEPA) requirement, the environmental benefit of all Navy-recommended mitigation measures will apply to all alternatives analyzed in this Final EIS, and according to Navy policy, will also apply to the Final Overseas Environmental Impact Statement (OEIS) where applicable and appropriate. Additionally, the White House Council on Environmental Quality issued guidance for mitigation and monitoring on 14 January 2011. This guidance affirms that federal agencies, including the Navy, should:

- commit to mitigation in decision documents when they have based environmental analysis upon such mitigation (by including appropriate conditions on grants, permits, or other agency approvals, and making funding or approvals for implementing the Proposed Action contingent on implementation of the mitigation commitments);
- monitor the implementation and effectiveness of mitigation commitments;
- make information on mitigation and monitoring available to the public, preferably through agency web sites; and
- remedy ineffective mitigation when the federal action is not yet complete.

The Council on Environmental Quality guidance encourages federal agencies to develop internal processes for post-decision monitoring to ensure the implementation and effectiveness of the mitigation. It also states that federal agencies may use adaptive management as part of an agency's action. Adaptive management, when included in the NEPA analysis, allows for the agency to take alternate mitigation actions if mitigation commitments originally made in the planning and decision documents fail to achieve projected environmental outcomes. Adaptive management generally involves four phases: plan, act, monitor, and evaluate. This process allows the use of the results to update knowledge and adjust future management actions accordingly. Through implementation of mitigation measures from the Navy's previous planning, consultations, permits, and monitoring of those efforts, the Navy has collected data to further refine its recommended mitigation measures.

Through the planning, consultation, and permitting processes, federal regulatory agencies suggested that the Navy analyze additional mitigation measures for inclusion in this Final EIS/OEIS and associated consultation and permitting documents. Proposals for additional mitigation measures were based on the federal agency's assessment of the likelihood that such measures will contribute to a notable reduction of the environmental impact. As additional measures were identified, the effectiveness and operational assessment protocols discussed in Section 5.3 (Mitigation Assessment) were applied to determine whether the Navy would recommend the additional measures for implementation. The final suite of mitigations resulting from the ongoing planning, consultation, and permitting processes will be documented in the Navy and NMFS Records of Decision, the MMPA Letters of Authorization, and the ESA Biological Opinions.

5.2.2 Overview of Mitigation Approach

This section describes the approach the Navy took to develop its recommended mitigation measures. The Navy's overall approach to assessing potential mitigation measures was based on two principles: (1) mitigations will be effective at reducing potential impacts on the resource, and (2) from a military perspective, the mitigations are practical to implement, executable, and personnel safety and readiness will not be impacted. The assessment process involved using information directly from Chapter 3 (Affected Environment and Environmental Consequences) and assessing all existing mitigation and proposals for new or modified mitigation in order to determine if recommending a mitigation measure for implementation would be appropriate.

This document organized, and where appropriate, analyzed training and testing activities separately. This separation was needed because the training and testing communities perform activities for differing purposes, and in some cases, with different personnel and in different locations. For example, there is a fundamental difference between the testing of a new mine warfare system with civilian scientists and engineers, and the eventual training of sailors and aviators with that same system. As such, mitigations that the Navy recommends for both training and testing activities are presented together, while mitigations that are designed for and executable only by the training or testing community are presented separately.

5.2.2.1 Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements

In an effort to improve upon past processes, the Navy considered all mitigations previously implemented and adapted its mitigation assessment approach based on lessons learned from previous EISs, ESA Biological Opinions, MMPA Letters of Authorization, and other formal or informal consultations with regulatory agencies. A lesson learned from the previous analysis at test ranges is that relocation of activities to other geographic locations is not feasible. For example, the Naval Surface

Warfare Center, Panama City Division Mission Activities EIS/OEIS considered a relocation alternative but it was rejected for several reasons. Systems command field activities that are co-located with systems command test ranges provide critical infrastructure support and technical expertise necessary to conduct range testing. Logistical support of range testing can only be efficiently and effectively supported when the support is co-located with the testing activities. Test range site locations along with associated field activities were originally established to support specific Navy mission testing needs using a selection process which included but was not limited to testing requirements, cost of living, availability of personnel, and low level of crowding from industry and development. These same principles also apply to pierside and at-sea testing that must occur in proximity to naval shipyards and Navy contractor shipyards. Although some systems command field activity tests may be conducted outside of their testing ranges (e.g., to provide specific technical requirements not available on range), for the majority of tests, it is necessary that tests conducted by systems command field activities be conducted on their test ranges. Systems command field activities with test ranges included in this EIS/OEIS are Naval Surface Warfare Center, Panama City Division; Naval Undersea Warfare Center Division, Newport; and South Florida Ocean Measurement Facility Testing Range.

Similarly, during the Atlantic Fleet Active Sonar Training EIS/OEIS process, geographic alternatives were thoroughly analyzed for impacts on marine resources as well as impacts on training and testing fidelity and effectiveness. The Atlantic Fleet Active Sonar Training EIS/OEIS analyzed three geographic alternatives that would designate: (1) fixed areas for active sonar activities, (2) seasonal active sonar activity areas, or (3) areas of increased awareness where active sonar activities would not take place. Designated areas of increased awareness are defined as environmentally sensitive areas that typically indicate higher concentrations of marine species and include the following features: bathymetric features such as canyons, steep walls, and seamounts; areas of persistent oceanographic features; North Atlantic right whale critical habitat areas; river and bay mouths; areas of high marine mammal density; and designated national marine sanctuaries.

The Record of Decision for the Atlantic Fleet Active Sonar Training EIS/OEIS concluded that implementation of any of the above alternatives would result in severe limitations on access to training and testing areas with features similar to where potential threats operate and would require relocation of approximately 30 percent of the Navy's current training. Additionally, the Atlantic Fleet Active Sonar Training EIS/OEIS analysis determined that geographically restricting sonar training in areas of increased awareness did not result in a statistically significant decrease in the predicted impacts on marine mammals. It was determined that avoiding these areas of increased awareness would not necessarily result in a reduction of potential impacts.

When considering the outcome of the Atlantic Fleet Active Sonar Training EIS/OEIS analysis, the Naval Surface Warfare Center, Panama City Division EIS/OEIS analysis, the importance of the geographic flexibility required to conduct realistic training and testing, and the continued necessity for mitigation measures to effectively reduce potential environmental impacts, the Navy determined that large geographic restrictions and alternative-specific mitigation measures would not be a practical or effective mitigation scheme for the AFTT EIS/OEIS.

Navy planners, scientists, and the operational community assessed the effectiveness of a full suite of potential mitigation measures (a portion of which were specific mitigation areas) on a case-by-case basis, using lessons learned and information from the Navy's internal adaptive management process. The resulting assemblage of recommended measures is comprised of currently implemented measures, modifications of currently implemented measures, and newly proposed measures. Details on the

assessment methods are provided in Section 5.2.3, Assessment Method. The rationale for recommending, modifying, adding, or discontinuing each measure is provided in Section 5.3, Mitigation Assessment.

5.2.2.2 Protective Measures Assessment Protocol

The Protective Measures Assessment Protocol is a decision support and situational awareness software tool that the Navy uses to facilitate compliance with mitigation measures when conducting certain training and testing activities at sea. The Navy runs the Protective Measures Assessment Protocol program during the event planning process to ensure that personnel involved in the activity are aware of the mitigation requirements and to help ensure that all mitigations are implemented appropriately. In addition to providing notification of the required mitigation, the tool also provides a visual display of the activity location, unit's position in relation to the target area, and any relevant environmental data. The final suite of mitigation measures contained in the Navy and NMFS Records of Decision, the MMPA Letters of Authorization, and the ESA Biological Opinions will be integrated into the Protective Measures Assessment Protocol. Section 5.3.1.1.1.1 (United States Navy Afloat Environmental Compliance Training Series) contains information about the newly developed Protective Measures Assessment Protocol training module.

5.2.3 ASSESSMENT METHOD

As shown in Figure 5.2-1, the Navy undertook an effectiveness assessment and operational assessment for each potential mitigation measure to ensure its compatibility with Section 5.2.2 (Overview of Mitigation Approach). The Navy used information from published and readily available sources, as well as Navy after-action and monitoring reports. When available, these data were used when they represented the best available science and if they were generally accepted by the scientific community to ensure that they were applicable and contributed to the analysis.

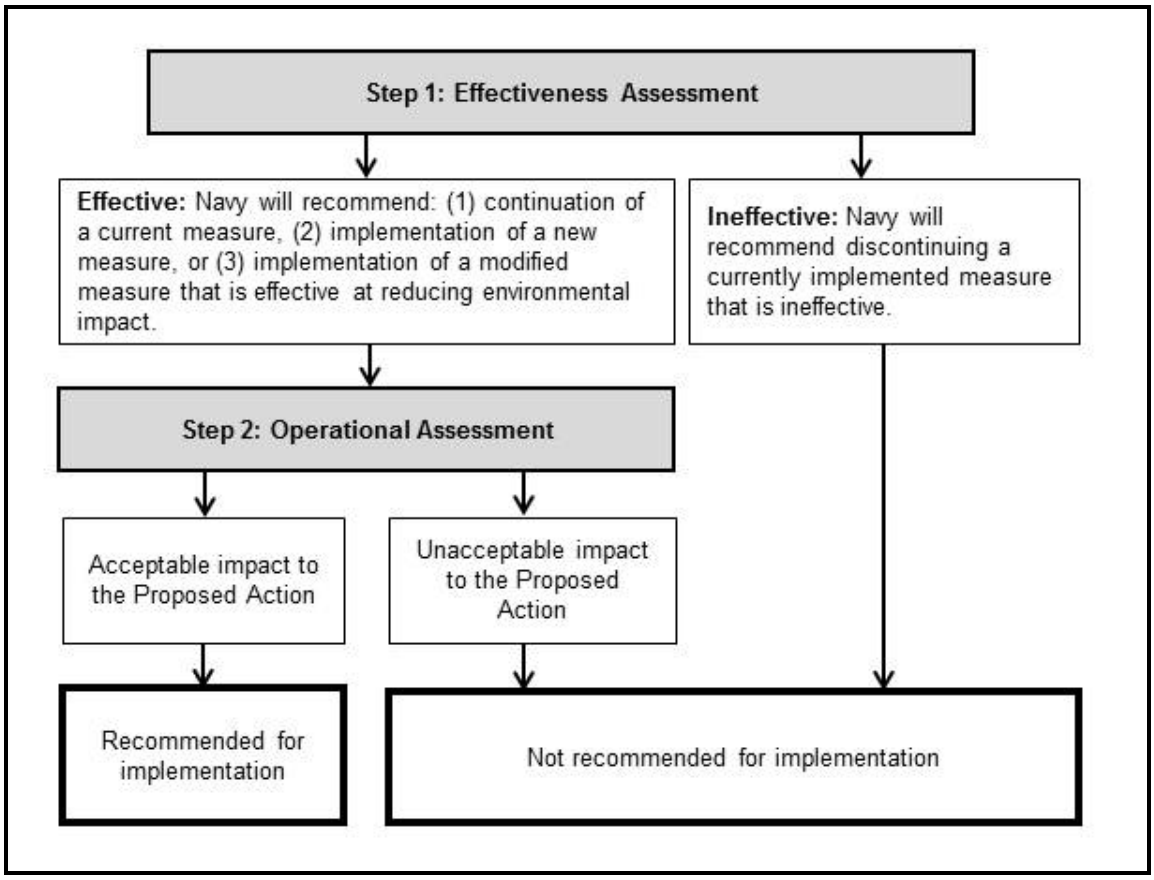

Figure 5.2-1: Flowchart of Process for Determining Recommended Mitigation Measures

5.2.3.1 Effectiveness Assessment

5.2.3.1.1 Procedural Measures

Procedural measures could involve employing techniques or technology during a training or testing activity in order to avoid or reduce a potential impact on a particular resource. For the purposes of organization, procedural measures are discussed within two subcategories: Lookouts and mitigation zones.

A proposed procedural measure was deemed effective if implementing the measure would likely result in avoidance or reduction of an impact on a resource. The level of avoidance or reduction of the impact gained from implementing a procedural measure was weighed against the potential for a shift in impacts resulting from the activity modification. For example, if predictive modeling results indicate that the use of underwater explosives could cause unacceptable impacts on a particular resource; those impacts could possibly be reduced by substituting non-explosive activities for explosive activities. However, if the increased use of non-explosive activities would consequently produce an unacceptable impact on habitats due to an associated physical disturbance or strike risk from military expended materials, the measure would not necessarily be justifiable.

A proposed procedural measure was deemed ineffective if its implementation would not result in avoidance or reduction of an impact on a resource, or if an unacceptable impact will simply be shifted from one resource to another. For ineffective procedural measures that are currently being

implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

5.2.3.1.2 Mitigation Areas

In order to avoid or reduce a potential impact on a particular resource, the Navy would either limit the time of day or duration in which a particular activity could take place, or move or relocate a particular activity outside of a specific geographic area. Within mitigation areas, the measures would only apply to the specific activity that resulted in the requirement for mitigation, and would not prevent or restrict other activities from occurring during that time or in that area.

A proposed mitigation area was deemed effective if implementing the measure would likely result in avoidance or reduction of the impact on the resource. The specific season, time of day, or geographic area must be important to the resource. In determining importance, special consideration was given to time periods or geographic areas having characteristics such as especially high overall density or percent population use, seasonal bottlenecks for a migration corridor, and identifiable key foraging and reproduction areas.

Avoidance or reduction of the impact in the specific time period or geographic area was weighed against the potential for causing new impacts in alternative time periods or geographic areas. For example, if the use of underwater explosives was predicted to cause unacceptable impacts on a particular resource in a known foraging location, those impacts could possibly be reduced by relocating those activities to a new location. However, if the use of explosives at the new location would consequently produce an unacceptable impact on the same or a different resource at the new location, the measure would not necessarily be justifiable.

A proposed mitigation area was deemed ineffective if implementing the measure would not result in avoidance or reduction of an impact on a resource, or if an unacceptable impact would simply be shifted from one time period or location to another. For ineffective mitigation areas that are currently being implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

5.2.3.2 Operational Assessment

The Navy conducted the operational assessment for procedural measures and mitigation areas using the criteria described below. The Navy deemed procedural and mitigation area measures to have acceptable operational impacts on a particular proposed activity if the following four conclusions were reached:

1. Implementation of the measure will not increase safety risks to Navy personnel and equipment.

2. Implementation of the measure is practical. Practicality was defined by the following factors:
   - The measure does not result in an unacceptable increase in resource requirements (e.g., wear and tear on equipment, additional fuel, additional personnel, increased training or testing requirements, or additional reporting requirements).
   - The measure does not result in an unacceptable increase in time away from homeport for Navy personnel.
   - The measure does not result in national security concerns. Should national security require conducting more than the designated number of activities, or a change in how the Navy conducts those activities, the Navy reserves the right to provide the regulatory federal

agency with prior notification and include the information in any associated exercise or monitoring reports.
- The measure is consistent with Navy policy. Navy policy requires that mitigation measures are developed through consultation with regulatory agencies (e.g., the MMPA and ESA processes), would likely result in avoidance or reduction of an impact on a resource as determined by the effectiveness assessment, and would not negatively impact training and testing fidelity. This policy applies to the full suite of potential mitigation measures that the Navy assessed, including measures that were considered but eliminated, and as appropriate, to currently implemented measures that the Navy is no longer recommending to implement.

3. Implementation of the measure will not result in an unacceptable impact on the effectiveness of the military readiness activity. A primary factor that was considered for all mitigation measures is that the measure must not modify the activity in a way that no longer allows the activity to meet the intended objectives, and ultimately must not interfere with the Navy meeting all of its military readiness requirements. Specifically, for mitigation area measures, the following additional factors were considered:
   - The activity is not dependent on a specific range or range support structure within the mitigation area and there are alternate areas with the necessary environmental conditions (e.g., oceanographic conditions).
   - The mitigation area does not hold any current or foreseeable future readiness value. This assessment will be revisited if Navy operations or national security interests conclude that training or testing needs to occur within the mitigation area.
   - Implementation of the measure will not prohibit conducting shipboard maintenance, repair, and testing pierside prior to at-sea operations.

4. The Navy has legal authority to implement the measure.

If all four of the conditions above can be achieved, then the Navy will recommend the mitigation measure for implementation.

5.3 MITIGATION ASSESSMENT

The effectiveness and operational assessments resulted in potential mitigation measures being organized into the following four sections:

- Section 5.3.1 (Lookout Procedural Measures) includes recommended measures specific to the use of Lookouts or trained marine species observers.
- Section 5.3.2 (Mitigation Zone Procedural Measures) includes recommended measures specific to visual observations with a mitigation zone.
- Section 5.3.3 (Mitigation Areas) includes recommended measures specific to particular locations.
- Section 5.3.4 (Mitigation Measures Considered but Eliminated) includes measures that the Navy does not recommended for implementation due to the measure being ineffective at reducing environmental impacts, having an unacceptable operational impact, or being incompatible with Section 5.2.2, Overview of Mitigation Approach.

A summary of the Navy-recommended measures is provided in Table 5.4-1.

5.3.1 LOOKOUT PROCEDURAL MEASURES

As described in Section 5.1 (Standard Operating Procedures), ships have personnel assigned to stand watch at all times while underway. Watch personnel may perform watch duties in conjunction with job responsibilities that extend beyond looking at the water or air (such as supervision of other personnel). This section will introduce Lookouts, who perform similar duties to watch personnel and whose duties satisfy safety of navigation and mitigation requirements.

The Navy will have two types of Lookouts for the purposes of conducting visual observations: (1) those positioned on ships, and (2) those positioned in aircraft or on small boats. Lookouts positioned on ships will be dedicated solely to diligent observation of the air and surface of the water. They will have multiple observation objectives, which include but are not limited to detecting the presence of biological resources and recreational or fishing boats, observing the mitigation zones described in Section 5.3.2 (Mitigation Zone Procedural Measures), and monitoring for vessel and personnel safety concerns.

Due to aircraft and small boat manning and space restrictions, Lookouts positioned in aircraft or on small boats may include the aircraft crew, pilot, or boat crew. Lookouts positioned in aircraft and small boats may be responsible for tasks in addition to observing the air or surface of the water (e.g., navigation of a helicopter or small boat). However, aircraft and small boat Lookouts will, considering personnel safety, practicality of implementation, and impact on the effectiveness of the activity, comply with the observation objectives described above for Lookouts positioned on ships.

The procedural measures described below primarily consist of having Lookouts during specific training and testing activities.

5.3.1.1 Specialized Training

5.3.1.1.1 Training for Navy Personnel and Civilian Equivalents

5.3.1.1.1.1 United States Navy Afloat Environmental Compliance Training Series

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the Marine Species Awareness Training for watch personnel and Lookouts, and to add the requirement for additional Navy personnel and civilian equivalents to complete one or more environmental training modules.

The Navy has developed the U.S. Navy Afloat Environmental Compliance Training Series to help ensure Navy-wide compliance with environmental requirements, and to help Navy personnel gain a better understanding of their personal roles and responsibilities. The training series contains four interactive multimedia training modules. Personnel will be required to complete all modules identified in their career path training plan.

The first module is the Introduction to the U.S. Navy Afloat Environmental Compliance Training Series. The introduction module provides information on environmental laws (e.g., ESA and MMPA) and responsibilities relevant to Navy training and testing activities. The material is put into context of why environmental compliance is important to the Navy, from the most junior sailor to Commanding Officers. All personnel completing the U.S. Navy Marine Species Awareness Training will also be required to take this module.

The second module is the U.S. Navy Marine Species Awareness Training. Consistent with current requirements, all bridge watch personnel, Commanding Officers, Executive Officers, maritime patrol

aircraft aircrews, anti-submarine warfare helicopter crews, civilian equivalents, and Lookouts will successfully complete the Marine Species Awareness Training prior to standing watch or serving as a Lookout. The module contained within the U.S. Navy Environmental Compliance Training Series is an update to the current Marine Species Awareness Training version 3.1. The updated training is designed to improve the effectiveness of visual observations for marine resources, including marine mammals and sea turtles. The Marine Species Awareness Training provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures.

The third module is the U.S. Navy Protective Measures Assessment Protocol. The Protective Measures Assessment Protocol is a decision support and situational awareness software tool that the Navy uses to facilitate compliance with worldwide mitigation measures during the conduct of training and testing activities at sea. The module provides instruction for generating and reviewing Protective Measures Assessment Protocol reports. Section 5.2.2.2 (Protective Measures Assessment Protocol) contains additional information on the benefits of the software tool.

The fourth module is the U.S. Navy Sonar Positional Reporting System and Marine Mammal Incident Reporting. The Navy developed the Sonar Positional Reporting System as its official record of underwater sound sources (e.g., active sonar) used under its MMPA permits. Marine mammal incidents include vessel strikes and animal strandings. The module provides instruction on the reporting requirements and procedures for both the Sonar Positional Reporting System and marine mammal incident reporting.

Effectiveness and Operational Assessment

Navy personnel undergo extensive training in order to stand watch. Standard training includes on-the-job instruction under the supervision of experienced personnel, followed by completion of the Personal Qualification Standard program. The Personal Qualification Standard program certifies that personnel have demonstrated the skills needed to stand watch, such as detecting and reporting floating or partially submerged objects.

The U.S. Navy Afloat Environmental Compliance Training Series, including the updated Marine Species Awareness Training, is a specialized multimedia training program designed to help Navy operational and test communities best avoid potentially harmful interactions with marine species. The program provides training on how to sight marine species, focusing on marine mammals. The training also includes instruction for visually identifying sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), jellyfish aggregations, and flocks of seabirds, which are often indicators of marine mammal or sea turtle presence. The Marine Species Awareness Training also addresses the role that watch personnel and Lookouts play in helping the Navy maintain compliance with environmental protection requirements, as well as supporting Navy environmental stewardship commitments.

In summary, the Navy believes that the U.S. Navy Afloat Environmental Compliance Training Series, including the updated Marine Species Awareness Training, is the best and most appropriate forum for teaching watch personnel and Lookouts about their responsibilities for helping reduce impacts on the marine environment. The Marine Species Awareness Training provides the Navy with invaluable training for a relatively large number of personnel. Constantly shifting personnel assignments presents a real challenge; however, the format and structure of the U.S. Navy Afloat Environmental Compliance Training Series will help the Navy reduce costs during fiscally constrained periods and provide constant access to training. Overall, the Marine Species Awareness Training is an effective tool for improving the potential for Lookouts to detect marine species while on duty.

Implementation of the Marine Species Awareness Training has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.1.2 Lookouts

The Navy proposes to use one or more Lookouts during the training and testing activities described below, which are organized by stressor category. A comparison of the currently implemented mitigation measures and recommended mitigation measures are provided where applicable. The effectiveness and operational assessments are discussed for all Lookout measures collectively in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts) and Section 5.3.1.2.5 (Operational Assessment for Lookouts). A number of training and testing activities involve the participation of multiple vessels and aircraft, which could ultimately increase the cumulative number of personnel standing watch per standard operating procedures or Lookouts posted in the vicinity of the activity (e.g., sinking exercises). The following sections discuss the minimum number of Lookouts the Navy will use during each activity.

5.3.1.2.1 Acoustic Stressors – Non-Impulsive Sound

5.3.1.2.1.1 Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar

Mitigation measures do not currently exist for low-frequency active sonar sources analyzed in this Final EIS/OEIS, or new platforms or systems. The Navy is proposing to (1) add mitigation measures for low-frequency active sonar and new platforms and systems, and (2) maintain the number of Lookouts currently implemented for ships using hull-mounted mid-frequency active sonar. The recommended measures are provided below.

Ships using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea (with the exception of ships less than 65 ft. [20 m] in length and ships that are minimally manned) will have two Lookouts at the forward position. For the purposes of this document, low-frequency active sonar does not include Surveillance Towed Array Sensor System (SURTASS) Low-Frequency Active (LFA) sonar.

While using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea, ships less than 65 ft. (20 m) in length and ships that are minimally manned will have one Lookout at the forward position due to space and manning restrictions.

Ships conducting active sonar activities while moored or at anchor (including pierside) will maintain one Lookout.

5.3.1.2.1.2 High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar

Mitigation measures do not currently exist for high-frequency active sonar activities associated with anti-submarine warfare and mine warfare, or for new platforms, such as the Littoral Combat Ship; therefore, the Navy is proposing to add a new measure for these activities or platforms. The Navy is proposing to continue using the number of Lookouts currently implemented for ships or aircraft conducting non-hull mounted mid-frequency active sonar, such as helicopter dipping sonar systems. The recommended measure is provided below.

The Navy will have one Lookout on ships or aircraft conducting high-frequency or non-hull mounted mid-frequency active sonar activities associated with anti-submarine warfare and mine warfare activities at sea.

5.3.1.2.2 Acoustic Stressors – Explosives and Impulsive Sound

5.3.1.2.2.1 Improved Extended Echo Ranging Sonobuoys

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout in an aircraft conducting Improved Extended Echo Ranging sonobuoy activities.

5.3.1.2.2.2 Explosive Sonobuoys Using 0.6–2.5 Pound Net Explosive Weight

Lookout measures do not currently exist for explosive sonobuoy activities using 0.6–2.5 pound (lb.) net explosive weight. The Navy is proposing to add this measure. Aircraft conducting explosive sonobuoy activities using 0.6–2.5 lb. net explosive weight will have one Lookout.

5.3.1.2.2.3 Anti-Swimmer Grenades

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the vessel conducting anti-swimmer grenade activities.

5.3.1.2.2.4 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

As background, mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver-placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation.

The Navy is proposing to modify the number of Lookouts currently implemented for general mine countermeasure and neutralization activities using positive control firing devices to account for additional categories of net explosive weights. The recommended measures are provided below.

- During general mine countermeasure and neutralization activities under positive control using up to a 500 lb. net explosive weight detonation (bin E10 and below), vessels greater than 200 ft. (61 m) will have two Lookouts, while vessels less than 200 ft. (61 m) or aircraft will have one Lookout.
- During general mine countermeasure and neutralization activities under positive control using a 501–650 lb. net explosive weight (bin E11) detonation, the Navy will have two Lookouts (one positioned in an aircraft and one in a small boat).

The Navy is proposing to (1) continue using the number of Lookouts currently implemented for mine neutralization activities using diver-placed charges up to a 20 lb. net explosive weight under positive control, and (2) extend the implementation of its current mitigation to all additional categories of net explosive weights. Mitigation measures for activities involving diver-placed charges under positive control do not currently exist for 21–100 lb. net explosive weight detonations. The recommended measures are provided below.

- During activities involving diver-placed mines under positive control, activities using up to a 100 lb. net explosive weight (bin E8) detonation will have a total of two Lookouts (one Lookout positioned on two small boats or on one boat and in one helicopter).
- All divers placing the charges on mines will support the Lookouts while performing their regular duties. The divers will report all marine mammal and sea turtle sightings to their supporting small boat or Range Safety Officer.

5.3.1.2.2.5 Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices

As background, when mine neutralization activities using diver-placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns.

Current mitigation involves the use of six Lookouts and three small boats (two Lookouts positioned in each of the three boats) for mitigation zones equal to or larger than 1,400 yd. (1,280 m), or four Lookouts and two small boats for mitigation zones smaller than 1,400 yd. (1,280 m). The Navy is proposing to modify the number of Lookouts currently used for mine neutralization activities using diver-placed time-delay firing devices because the measure is impractical to implement and is currently resulting in an unacceptable impact on military readiness. The Navy does not have the resources to maintain six Lookouts and three small boats during mine neutralization activities using diver-placed time-delay firing devices. Due to a lack of personnel and small boats available for this activity, the requirement for six Lookouts and three small boats would require reassigning personnel from other assigned duties or training activities, thus impacting the ability of the reassigned personnel to complete his or her assigned duties or other training requirements. Therefore, the Navy is currently unable to conduct the activities that require six Lookouts and three small boats, which is reducing the Navy's ability to maintain military readiness for these activities. Four Lookouts and two small boats represent the maximum level of effort that the Navy can commit to observing mitigation zones for this activity given the number of personnel and assets available. To prevent these unacceptable impacts, the Navy recommends the following measures:

During activities using up to a 20 lb. net explosive weight (bin E6) detonation, the Navy will have four Lookouts and two small boats (two Lookouts positioned in each of the two boats). In addition, when aircraft are used, the pilot or member of the aircrew will serve as an additional Lookout. All divers placing the charges on mines will support the Lookouts while performing their regular duties. The divers will report all marine mammal and sea turtle sightings to their supporting small boat or Range Safety Officer.

5.3.1.2.2.6 Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the vessel or aircraft conducting small- or medium-caliber gunnery exercises against a surface target.

5.3.1.2.2.7 Gunnery Exercises – Large-Caliber Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the ship conducting large-caliber gunnery exercises against a surface target.

5.3.1.2.2.8 Missile Exercises (Including Rockets) up to 250 Pound Net Explosive Weight Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. When aircraft are conducting missile exercises up to 250 lb. net explosive weight against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.2.9 Missile Exercises Using 251–500 Pound Net Explosive Weight Using a Surface Target

Lookout measures do not currently exist for missile exercises using 251–500 lb. net explosive weight. The Navy is proposing to add this measure. When aircraft are conducting missile exercises using 251–500 lb. net explosive weight against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.2.10 Bombing Exercises

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout positioned in an aircraft conducting bombing exercises.

5.3.1.2.2.11 Torpedo (Explosive) Testing

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout positioned in an aircraft during torpedo (explosive) testing.

5.3.1.2.2.12 Sinking Exercises

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have two Lookouts (one positioned in an aircraft and one on a vessel) during sinking exercises.

5.3.1.2.2.13 At-Sea Explosive Testing

Lookout measures do not currently exist for at-sea explosive testing. The Navy is proposing to add this measure. The Navy will have a minimum of one Lookout on each vessel supporting at-sea explosive testing.

5.3.1.2.2.14 Ordnance Testing – Line Charge Testing

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the surface vessel conducting line charge testing.

5.3.1.2.2.15 Ship Shock Trials

The Navy develops detailed ship shock trial mitigation plans approximately 1 year prior to each ship shock trial event and will continue to provide these plans to NMFS. The recommended Lookout measures specific to ship shock trials using 10,000-lb. and 40,000-lb. charges are provided below.

10,000-Pound Charges (High Blast Explosive)

The Navy is proposing to (1) continue implementing Lookout measures based on the most recently conducted ship shock trial (Mesa Verde, which used 10,000-lb. charges), (2) provide the option to use either shipboard observations or a combination of aerial and shipboard observations, and (3) allow the use of either Lookouts or trained marine species observers, or a combination of both. Trained marine species observers are different from Lookouts in that they are contracted civilians with experience in locating and identifying animals from shipboard and aerial platforms. The recommended measures are provided below.

Prior to commencing, during, and after completion of ship shock trials using up to 10,000-lb. charges, the Navy will have at least 10 Lookouts or trained marine species observers (or a combination thereof) positioned either in an aircraft or on multiple vessels (i.e., a Marine Animal Response Team boat and the test ship). If aircraft are used, there will be Lookouts or trained marine species observers positioned in an aircraft and positioned on multiple vessels. If vessels are the only platform, a sufficient number of additional Lookouts or trained marine species observers will be used to provide visual observation of the

mitigation zone comparable to that achieved by aerial surveys. Due to the manning requirement associated with ship shock trial mitigation, the Navy typically prefers to use trained marine species observers whenever possible for ship shock trials, and will use Lookouts if the use of marine species observers is not practical due to availability or other constraints. Details will be provided in the ship-specific mitigation plan.

40,000-Pound Charges (High Blast Explosive)

Lookout measures do not currently exist for this activity because it is a new activity. The Navy is proposing to add mitigation for this activity. The recommended measures are provided below.

Prior to commencing, during, and after completion of ship shock trials using up to 40,000-lb. charges, the Navy will have at least 10 Lookouts or trained marine species observers (or a combination thereof) positioned in an aircraft and on multiple vessels (i.e., a Marine Animal Response Team boat and the test ship). Details will be provided in the ship-specific mitigation plan.

5.3.1.2.2.16 Elevated Causeway System – Pile Driving

Lookout measures do not currently exist for elevated causeway system pile driving activities. The Navy is proposing to add this measure. The Navy will have one Lookout positioned on the platform (which could include the shore, an elevated causeway, or on a small boat) that will maximize the potential for sightings during pile driving and pile removal.

5.3.1.2.2.17 Weapons Firing Noise During Gunnery Exercises – Large-Caliber

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the ship conducting explosive and non-explosive large-caliber gunnery exercises. This may be the same Lookout described in Section 5.3.1.2.2.7 (Gunnery Exercises – Large-Caliber Using a Surface Target) or Section 5.3.1.2.3.3 (Non-Explosive Practice Munitions – Small-, Medium-, and Large-Caliber Gunnery Exercises Using a Surface Target) when the large-caliber gunnery exercise is conducted from a ship against a surface target.

5.3.1.2.3 Physical Disturbance and Strikes

5.3.1.2.3.1 Vessels

The Navy is proposing to continue using the mitigation measures currently implemented for this activity (including full power propulsion testing). While underway, vessels will have a minimum of one Lookout.

5.3.1.2.3.2 Towed In-Water Devices

The Navy is proposing to continue using the number of Lookouts currently implemented for activities using towed in-water devices (e.g., towed mine neutralization). The Navy will have one Lookout during activities using towed in-water devices when towed from a manned platform.

5.3.1.2.3.3 Non-Explosive Practice Munitions – Small-, Medium-, and Large-Caliber Gunnery Exercises Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. The Navy will have one Lookout during activities involving non-explosive practice munitions (e.g., small-, medium-, and large-caliber gunnery exercises) against a surface target.

5.3.1.2.3.4 Non-Explosive Practice Munitions – Bombing Exercises

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. The Navy will have one Lookout positioned in an aircraft during non-explosive bombing exercises.

5.3.1.2.3.5 Non-Explosive Practice Munitions – Missile Exercises (Including Rockets) Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. When aircraft are conducting non-explosive missile exercises (including exercises using rockets) against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.4 Effectiveness Assessment for Lookouts

Personnel standing watch in accordance with Navy standard operating procedures have multiple job responsibilities. While on duty, these standard watch personnel often conduct marine species observation in addition to their primary job duties (e.g., aiding in the navigation of a vessel). By having one or more Lookouts dedicated solely to observing the air and surface of the water during certain training and testing activities, the Navy increases the likelihood that marine species will be detected. It is also important to note that a number of training and testing activities involve multiple vessels and aircraft, thereby increasing the cumulative number of Lookouts or watch personnel who could potentially be present during a given activity.

Although using Lookouts is expected to increase the likelihood that marine species will be detected at the surface of the water, it is unlikely that using Lookouts will be able to help avoid impacts on all species entirely due to the inherent limitations of sighting marine mammals and sea turtles, as discussed in the sections below. Refer to Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures) for a quantitative discussion on the Navy's effectiveness assessment for Lookouts during sound-producing activities.

Pursuant to Phase I (e.g., Atlantic Fleet Active Sonar Training EIS/OEIS) and in cooperation with NMFS, the Navy has undertaken monitoring efforts to track compliance with take authorizations, help evaluate the effectiveness of implemented mitigation measures, and gain a better understanding of the impacts of Navy activities on marine resources. In 2010, the Navy initiated a study designed to evaluate the effectiveness of the Navy Lookout team. The University of St. Andrews, Scotland, under contract to the U.S. Navy, developed an initial data collection protocol for use during the study. Between 2010 and 2012, trained Navy marine mammal observers collected data during nine field trials as part of a "proof of concept" phase. The goal of the proof of concept phase was to develop a statistically valid protocol for quantitatively analyzing the effectiveness of Lookouts during Navy training exercises. Field trials were conducted in the Hawaii Range Complex, Southern California Range Complex, and Jacksonville (JAX) Range Complex onboard one frigate, one cruiser, and seven destroyers. Preliminary analysis of the proof of concept data is ongoing. The Navy is also working to finalize the data collection process for use during the next phase of the study. While data was collected as part of this proof of concept phase, those data are not fairly comparable because protocols were being changed and assessed, nor are those data statistically significant. Therefore, it is improper to use these data to draw any conclusions on the effectiveness of Navy lookouts.

5.3.1.2.4.1 Detection Probabilities of Marine Mammals in the Study Area

Until results of the Navy's Lookout effectiveness study are available, the Navy must rely on the best available science to determine detection probabilities of marine mammals by Navy Lookouts. To do so,

the Navy compiled results of available literature on line-transect analyses, which are typically used to estimate cetacean abundance. In line-transect analyses, the factors affecting the detection of an animal or group of animals directly on the transect line may be probabilistically quantified as g(0). As a reference, a g(0) value of 1 indicates that animals on the transect line are always detected. Table 5.3-1 provides detection probabilities for cetacean species based largely on g(0) values derived from shipboard and aerial surveys in the Study Area, which vary widely based on g(0) derivation factors (e.g., species, sighting platforms, group size, and sea state conditions). Refer to Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures) for additional background on g(0) and a discussion of how the Navy used g(0) to quantitatively assess the effectiveness of Lookouts during sound-producing activities.

Table 5.3-1: Sightability Based on Average g(0) Values for Marine Mammal Species in the Study Area

Species	Family	Vessel Sightability[1]	Aircraft Sightability[1]
Atlantic Spotted Dolphin	Delphinidae	0.665	0
Atlantic White-Sided Dolphin	Delphinidae	0.325	0.675
Beaked Whales	Ziphiidae	0.485	0.2
Blue Whale	Balaenopteridae	0.95	0.41
Bottlenose Dolphin	Delphinidae	0.805	0.675
Bryde's Whale	Balaenopteridae	0.95	0
Common Dolphin (Long-Beaked)	Delphinidae	0.735	0.675
False Killer Whale	Delphinidae	0.87	0
Fin Whale	Balaenopteridae	0.63	0.2
Fraser's Dolphin	Delphinidae	0.88	0.675
Harbor Porpoise	Phocoenidae	0.54	0.365
Humpback Whale	Balaenopteridae	0.2	0.605
Killer Whale	Delphinidae	0.9	0.965
Kogia species (Dwarf Sperm Whale, Pygmy	Kogiidae	0.42	0
Melon-Headed Whale	Delphinidae	0.87	0
Minke Whale	Balaenopteridae	0.505	0.2
North Atlantic Right Whale	Balaenidae	0.645	0.41
Pantropical Spotted Dolphin	Delphinidae	0.665[2]	0
Pilot Whale	Delphinidae	0.575	0.24
Pygmy Killer Whale	Delphinidae	0.87	0
Risso's Dolphin	Delphinidae	0.675	0.675
Rough-Toothed Dolphin	Delphinidae	0.87	0
Sei Whale	Balaenopteridae	0.92	0
Sperm Whale	Physeteridae	0.425	0.24
Spinner Dolphin	Delphinidae	0.685	0
Striped Dolphin	Delphinidae	0.485	0

[1] Values reported are averaged based on the data cited for the U.S. Atlantic coast, U.S. west coast, and Hawaii. Some g(0) values in the table above are estimates of perception bias only, some are estimates of availability bias only, and some reflect both, depending on the species and the Navy's analysis of available data (Barlow 1995; Barlow 2003; Barlow and Forney 2007; Barlow et al. 1997; Barlow and Gerrodette 1996; Barlow and Sexton 1996; Barlow and Taylor 2005; Blaylock et al. 1995; Carretta et al. 2000; Forney 2007; Forney et al. 1995; Hain et al. 1999; Mobley et al. 2001; Palka 1995a; Palka 1995b, 2005a, b, 2006).

[2] g(0) values were either determined by the source or applied by the source for abundance/density estimation analyses.

Several variables that play into how easily a marine mammal may be detected by a dedicated observer are directly related to the animal, including its external appearance and size; surface, diving, and social behavior; and life history. The following is a generalized discussion of the behavior and external appearance of the marine mammals with the potential to occur in the Study Area as these characters relate to the detectability of each species. The species are grouped loosely based on either taxonomic relatedness or commonalities in size and behavior, and include large whales, cryptic species delphinids, beluga whales, and pinnipeds. Not all statements may hold true for all species in a grouping and exceptions are mentioned where applicable. The information presented in this section may be found in Jefferson et al. (2008) and sources within unless otherwise noted.

Large Whales

Species of large whales found in the Study Area include all the baleen whales and the sperm whale. Baleen whales are generally large, with adults ranging in size from 30–89 ft. (9–27 m), often making them immediately detectable. Many species of baleen whales have a prominent blow ranging from 10 ft. (3 m) to as much as 39 ft. (12 m) above the surface. However, there are at least two species (Bryde's whale and common minke whale) that often have no visible blow. Baleen whales tend to travel singly or in small groups ranging from pairs to groups of five. The exception to this is the fin whale, which is known to travel in pods of seven or more individuals. All species of baleen whales are known to form larger-scale aggregations in areas of high localized productivity or on breeding grounds. Baleen whales may or may not fluke at the surface before they dive; some species fluke regularly (e.g., the humpback whale and North Atlantic right whale), some fluke variably (e.g., the blue whale and fin whale) and some rarely fluke (e.g., the sei whale, common minke whale, and Bryde's whale). Baleen whales may remain at the surface for extended periods of time as they forage or socialize. North Atlantic right whales are known to form surface-active groups and humpback whales are known to corral prey at the surface. Dive behavior varies amongst species. Many species will dive and remain at depth for as long as 30 minutes (min.). Some will adjust their diving behavior according to the presence of vessels (e.g., the North Atlantic right whale, humpback whale, and fin whale). Sei whales are known to sink just below the surface and remain there between breaths.

Sperm whales also belong to the large whales, with adult males reaching as much as 50 ft. (18 m) in total length. Sperm whales at the surface would likely be easy to detect. They have a prominent 16 ft. (5 m) blow, and may remain at the surface for long periods of time. They are known to raft (i.e., loll at the surface) and to form surface-active groups when socializing. Sperm whales may travel or congregate in large groups of as many as 50 individuals. Although sperm whales engage in conspicuous surface behavior such as fluking, breaching, and tail-slapping, they are long, deep divers and may remain submerged for over 1 hour.

Cryptic Species

Cryptic and deep-diving species are those not at the surface for long periods of time and are often difficult to see when they surface, which ultimately limits the ability of observers to detect them even in good sighting conditions (Barlow et al. 2006). Cryptic species include beaked whales (family Ziphiidae), dwarf and pygmy sperm whales (*Kogia* species), and harbor porpoises. Beaked whales are difficult to detect at sea. In the Study Area, beaked whales may occur in a variety of group sizes, ranging from single individuals to groups of as many as 22 individuals (MacLeod and D'Amico 2006). Beaked whale diving behavior in general consists of long, deep dives that may last for nearly 90 min. followed by a series of shallower dives and intermittent surfacings (Baird et al. 2008; Tyack et al. 2006). Some individuals remain at the surface for an extended period of time (perhaps 1 hour or more) or make shorter dives (MacLeod and D'Amico 2006). Detection of beaked whales is further complicated because beaked

whales often dive and surface in a synchronous pattern and they travel below the surface of the water (MacLeod and D'Amico 2006).

Dwarf and pygmy sperm whales (referred to broadly as *Kogia* species) are small cetaceans (10–13 ft. [3–4 m] adult length) that are not commonly seen. *Kogia* species are some of the most commonly stranded species in some areas, which suggests that sightings are not indicative of their overall abundance. This supports the idea that they are cryptic, perhaps engaging in inconspicuous surface behavior or actively avoiding vessels. When *Kogia* species are sighted, they are typically seen in groups of no more than five to six individuals. They have no visible blow, do not fluke when they dive, and are known to log (i.e., lie motionless) at the surface. When they do dive, they often will sink out of sight with no prominent behavioral display.

Harbor porpoises are difficult to detect in all but the best of conditions (i.e., no swell, no whitecaps). Harbor porpoises travel singly or in small groups of less than six individuals, but may aggregate into groups of several hundred. They are inconspicuous at the surface, rarely lifting their heads above the surface and often lying motionless. They are small and may actively avoid vessels.

Delphinids

Delphinids are some of the most likely species to be detected at sea by observers. Many species of delphinids engage in very conspicuous surface behavior, including leaping, spinning, bow riding, and traveling along the surface in large groups. Delphinid group sizes may range from 10 to 10,000 individuals, depending on the species and the geographic region. Species such as pilot whales, rough-toothed dolphins, white-beaked dolphins, white-sided dolphins, bottlenose dolphins, stenellid dolphins, common dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins and common dolphins form huge groups that travel quickly along the surface, churning up the water and making them visible from a great distance. Delphinids may dive for as little as 1 min. to more than 30 min., depending on the species.

Beluga Whales

Beluga whales can reach up to 16 ft. (5 m) in total length and individuals are often all white or gray in color. They travel in groups ranging from 15 individuals to thousands. They dive for lengths of up to 25 min. In some locations during periods of the year, aerial surveys have been successful at detecting belugas when they are concentrated along the ice edge. During portions of the year, beluga whales may not be available to be detected when swimming under the ice shelf. Vessel surveys have typically found it difficult to detect belugas in the nearshore environment with high turbidity levels (Division of Fisheries and Oceans 2013). Because of the white coloring of most individuals, belugas usually have a relatively good probability of being detected if animals are not swimming under the ice shelf or in turbid nearshore waters.

Pinnipeds

Pinnipeds (e.g., seals) are more difficult to detect at sea than cetaceans. Seals are much smaller, often solitary, and generally do not engage in conspicuous surface behavior. There is not a lot of information regarding seal behavior at sea. Pinnipeds have a low profile, no dorsal appendage, and small body size in comparison with most cetaceans, which limits accurate visual detection to sea states of less than 2 on the Beaufort scale (Carretta et al. 2000). Some species, such as harbor seals, are known to approach and observe human activities on land or on stationary vessels. Harbor seals and gray seals are solitary at sea. Harp seals appear to be an exception, traveling in large groups at the surface and churning up

whitewater like dolphins. Gray seals are known to rest vertically at the surface with only the head exposed. Gray seals may dive for as long as 30 min. and hooded seals for up to 60 min.

Manatees

The West Indian manatee is gray or gray-brown, slow-moving, and reaches a maximum length of 12.8 ft. (3.9 m). Manatees are found in coastal marine, brackish, and freshwater habitats. Manatees are not gregarious and are most often observed alone, except for large groups that aggregate around warm-water outfalls during winter months (Hartman 1979). Manatees can be difficult to detect from vessels because they can submerge for extended periods of time, and when they surface, very little of the animal is visible. They can be more easily seen from aircraft, but detectability depends on a variety of factors, one of which is water clarity.

5.3.1.2.4.2 Detection Probabilities of Sea Turtles in the Study Area

Sea turtles spend a majority of their time below the surface and are difficult to sight from a vessel until the animal is at close range (Hazel et al. 2007). Sea turtles often spend over 90 percent of their time underwater and are not visible more than 6.5 ft. (2 m) below the surface (Mansfield 2006). Sea turtles are generally much smaller than cetaceans, so while shipboard surveys designed for sighting marine mammals are adequate for detecting large sea turtles (e.g., adult leatherbacks), they are usually not adequate for detecting the smaller sized turtles (e.g., juveniles and Kemp's ridleys). Juvenile sea turtles may be especially difficult to detect. Aerial detection may be more effective in spotting sea turtles on the surface, particularly in calm seas and clear water, but it is possible that the smallest age classes are not detected even in good conditions (Marsh and Saalfeld 1989). Visual detection of sea turtles, especially small turtles, is further complicated by their startle behavior in the presence of vessels. Turtles on the surface may dive below the surface of the water in the presence of a vessel before it is detected by shipboard or aerial observers (Kenney 2005). The detection probability of sea turtles is generally lower than that of cetaceans. The use of Lookouts for visual detection of sea turtles is likely effective only at close range, and is thought to be less effective for small individuals than large individuals.

5.3.1.2.4.3 Summary of Lookout Effectiveness

Due to the various detection probabilities, levels of Lookout experience, and variability of sighting conditions, Lookouts will not always be effective at avoiding impacts on all species. However, Lookouts are expected to increase the overall likelihood that certain marine mammal species and some sea turtles will be detected at the surface of the water, when compared to the likelihood that these same species would be detected if Lookouts are not used. The Navy believes the continued use of Lookouts contributes to helping reduce potential impacts on these species from training and testing activities.

5.3.1.2.5 Operational Assessment for Lookouts

As written, implementation of the mitigation measures recommended in Section 5.3.1.2 (Lookouts) has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of military readiness activities, and Navy policy. The number of Lookouts recommended for each measure often represents the maximum Lookout capacity based on limited resources (e.g., space and manning restrictions).

5.3.2 MITIGATION ZONE PROCEDURAL MEASURES

Safety zones described in Section 5.1 (Standard Operating Procedures) are zones designed for human safety, whereas this section will introduce mitigation zones. A mitigation zone is designed solely for the

purpose of reducing potential impacts on marine mammals and sea turtles from training and testing activities. Mitigation zones are measured as the radius from a source. Unique to each activity category, each radius represents a distance that the Navy will visually observe to help reduce injury to marine species. Visual detections of applicable marine species will be communicated immediately to the appropriate watch station for information dissemination and appropriate action. If the presence of marine mammals is detected acoustically, Lookouts posted in aircraft and on vessels will increase the vigilance of their visual observation. As a reference, aerial surveys are typically made by flying at 1,500 ft. altitude or lower at the slowest safe speed.

Many of the proposed activities have mitigation measures that are currently being implemented, as required by previous environmental documents or consultations. Most of the current Phase I (e.g., Atlantic Fleet Active Sonar Training EIS/OEIS) mitigation zones for activities that involve the use of impulsive and non-impulsive sources were originally designed to reduce the potential for onset of temporary threshold shift (TTS). For the AFTT EIS/OEIS, the Navy updated the acoustic propagation modeling to incorporate updated hearing threshold metrics (i.e., upper and lower frequency limits), updated density data for marine mammals, and factors such as an animal's likely presence at various depths. An explanation of the acoustic propagation modeling process can be found in the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Marine Species Modeling Team 2013).

As a result of the updates to the acoustic propagation modeling, in some cases the ranges to onset of TTS effects are much larger than those output by previous Phase I models. Due to the ineffectiveness and unacceptable operational impacts associated with mitigating these large areas, the Navy is unable to mitigate for onset of TTS for every activity. In this AFTT analysis, the Navy developed each recommended mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, permanent threshold shift (PTS), out to the predicted maximum range. In some cases where the ranges to effects are smaller than previous models estimated, the mitigation zones were adjusted accordingly to provide consistency across the measures. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also consequently covers the predicted average range to TTS. Table 5.3-2 summarizes the predicted average range to TTS, average range to PTS, maximum range to PTS, and recommended mitigation zone for each activity category, based on the Navy's acoustic propagation modeling results.

The activity-specific mitigation zones are based on the longest range for all the functional hearing groups (based on the hearing threshold metrics described in Section 3.4 [Marine Mammals] and Section 3.5 [Sea Turtles and Other Marine Reptiles]). The mitigation zone for a majority of activities is driven by either the high-frequency cetacean or the sea turtle functional hearing groups. Therefore, the mitigation zones are even more protective for the remaining functional hearing groups (i.e., low-frequency cetaceans, mid-frequency cetaceans, and pinnipeds), and likely cover a larger portion of the potential range to onset of TTS.

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones

Activity Category	Representative Source (Bin)[1]	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Non-Impulsive Sound					
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar	SQS-53 ASW hull-mounted sonar (MF1)	3,821 yd. (3.5 km) for one ping	100 yd. (91 m) for one ping	Not Applicable	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd. (183 m)
	Low-frequency sonar[2] (LF4)	3,821 yd. (3.5 km) for one ping	100 yd. (91 m) for one ping	Not Applicable	200 yd. (183 m)[2]
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	AQS-22 ASW dipping sonar (MF4)	230 yd. (210 m) for one ping	20 yd. (18 m) for one ping	Not applicable	200 yd. (183 m)
Explosive and Impulsive Sound					
Improved Extended Echo Ranging Sonobuoys	Explosive sonobuoy (E4)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	600 yd. (549 m)
Explosive Sonobuoys Using 0.6–2.5 lb. NEW	Explosive sonobuoy (E3)	290 yd. (265 m)	113 yd. (103 m)	309 yd. (283 m)	350 yd. (320 m)
Anti-Swimmer Grenades	Up to 0.5 lb. NEW (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	NEW dependent (see Table 5.3-3)				
Mine Neutralization Diver-Placed Mines Using Time-Delay Firing Devices	Up to 20 lb. NEW (E6)	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	1,000 yd. (914 m)
Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target	40 mm projectile (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Gunnery Exercises – Large-Caliber Using a Surface Target	5 in. projectiles (E5 at the surface[3])	453 yd. (414 m)	186 yd. (170 m)	526 yd. (481 m)	600 yd. (549 m)

ASW: anti-submarine warfare; dB: decibel; in.: inches: km: kilometer; lb.: pound(s); m: meter; mm: millimeter; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift; yd.: yard

[1] This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.

[2] The representative source bin and mitigation zone applies to sources that cannot be powered down (e.g., bins LF4 and LF5).

[3] The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones (Continued)

Activity Category	Representative Source (Bin)[1]	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Missile Exercises (Including Rockets) up to 250 lb. NEW Using a Surface Target	Maverick missile (E9)	949 yd. (868 m)	398 yd. (364 m)	699 yd. (639 m)	900 yd. (823 m)
Missile Exercises Using 251–500 lb. NEW Using a Surface Target	Harpoon missile (E10)	1,832 yd. (1.7 km)	731 yd. (668 m)	1,883 yd. (1.7 km)	2,000 yd. (1.8 km)
Bombing Exercises	MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2,500 yd. (2.3 km)[2]
Torpedo (Explosive) Testing	MK-48 torpedo (E11)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km)
Sinking Exercises	Various sources up to the MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2.5 nm[2]
At-Sea Explosive Testing	Various sources of 10 lb. NEW and less (E5 at various depths[3])	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	1,600 yd. (1.4 km)[2]
Ordnance Testing – Line Charge Testing	Numerous 5-lb. charges (E4)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	900 yd. (823 m)[2]
Ship Shock Trials in JAX Range Complex	10,000-lb. charge (HBX)	5.8 nm	2.7 nm	4.8 nm	3.5 nm[4]
	40,000-lb. charge (HBX)	9.2 nm	3.6 nm	6.4 nm	3.5 nm[4]
Ship Shock Trials in VACAPES Range Complex	10,000-lb. charge (HBX)	9 nm	2 nm	4.7 nm	3.5 nm[4]
	40,000-lb. charge (HBX)	10.3 nm	3.7 nm	7.6 nm	3.5 nm[4]
Elevated Causeway System – Pile Driving	24 in. steel impact hammer	1,094 yd. (1 km)	51 yd. (46 m)	51 yd. (46 m)	60 yd. (55 m)

ASW: anti-submarine warfare; HBX: high blast explosive; JAX: Jacksonville; km: kilometer; lb.: pound; m: meter; NEW: net explosive weight; nm: nautical mile; PTS: permanent threshold shift; TTS: temporary threshold shift; VACAPES: Virginia Capes; yd.: yard

[1] This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.

[2] Recommended mitigation zones are larger than the modeled injury zones to account for multiple types of sources or charges being used.

[3] The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

[4] See Section 5.3.2.1.2.15 (Ship Shock Trials) regarding ship shock trial mitigation zones.

Table 5.3-3: Predicted Range to Effects and Recommended Mitigation Zones for Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Charge Size Net Explosive Weight (Bins)	General Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices[1]				Mine Countermeasure and Neutralization Activities Using Diver-Placed Charges Under Positive Control[2]			
	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
2.6–5 lb. (E4)	434 yd. (474 m)	197 yd. (180 m)	563 yd. (515 m)	600 yd. (549 m)	545 yd. (498 m)	169 yd. (155 m)	301 yd. (275 m)	350 yd. (320 m)
6–10 lb. (E5)	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	800 yd. (732 m)	587 yd. (537 m)	203 yd. (185 m)	464 yd. (424 m)	500 yd. (457 m)
11–20 lb. (E6)	766 yd. (700 m)	288 yd. (263 m)	648 yd. (593 m)	800 yd. (732 m)	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	500 yd. (457 m)
21–60 lb. (E7)[3]	1,670 yd. (1.5 km)	581 yd. (531 m)	964 yd. (882 m)	1,200 yd. (1.1 km)	1,532 yd. (1.4 km)	473 yd. (432 m)	789 yd. (721 m)	800 yd. (732 m)
61–100 lb. (E8)[4]	878 yd. (802 m)	383 yd. (351 m)	996 yd. (911 m)	1,600 yd. (1.4 km)	969 yd. (886 m)	438 yd. (400 m)	850 yd. (777 m)	850 yd. (777 m)
251–500 lb. (E10)	1,832 yd. (1.7 km)	731 yd. (668 m)	1,883 yd. (1.7 km)	2,000 yd. (1.8 km)				Not Applicable
501–650 lb. (E11)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km)				Not Applicable

km: kilometer; lb.: pound; m: meter; PTS: permanent threshold shift; TTS: temporary threshold shift; yd.: yard

[1] These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations specified in Tables 2.8-1 through 2.8-3.

[2] These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver-placed charges. These activities are conducted in shallow water, and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).

[3] The E7 bin was only modeled in shallow-water locations, so there is no difference for the diver-placed charges category.

[4] The E8 bin was only modeled for surface explosions, so some of the ranges are shorter than for sources modeled in the E7 bin, which occur at depth.

In some instances, the Navy recommends mitigation zones that are larger or smaller than the predicted maximum range to PTS based on the effectiveness and operational assessments. The recommended mitigation zones and their associated assessments are provided throughout the remainder of this section. The recommended measures are either currently implemented, modifications of current measures, or new measures.

For some activities specified throughout the remainder of this section, Lookouts may be required to observe for concentrations of detached floating vegetation (*Sargassum* or kelp paddies), which are indicators of potential marine mammal and sea turtle presence, within the mitigation zone. Those specified activities will not commence if the floating vegetation (*Sargassum* or kelp paddies) is observed within the mitigation zone prior to the initial start of the activity. If floating vegetation is observed prior to the initial start of the activity, the activity will be relocated to an area where no floating vegetation is observed. Training and testing will not cease as a result of floating vegetation (*Sargassum* or kelp paddies) entering the mitigation zone after activities have commenced. This measure is intended only for floating vegetation detached from the seafloor.

5.3.2.1 Acoustic Stressors

5.3.2.1.1 Non-Impulsive Sound

5.3.2.1.1.1 Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for low-frequency active sonar sources analyzed in this Final EIS/OEIS, or new platforms or systems. The Navy is proposing to (1) add mitigation measures for low-frequency active sonar, (2) continue implementing the current measures for mid-frequency active sonar, and (3) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Training and testing activities that involve the use of low-frequency and hull-mounted mid-frequency active sonar (including pierside) will use Lookouts for visual observation from a ship immediately before and during the activity. Active sonar transmission will not begin if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. With the exception of certain low-frequency sources that are not able to be powered down during the activity (e.g., low-frequency sources within bins LF4 and LF5), mitigation will involve powering down the sonar by 6 dB when a marine mammal or sea turtle (low-frequency sources only) is sighted within 1,000 yd. (914 m), and by an additional 4 dB when sighted within 500 yd. (457 m) from the source, for a total reduction of 10 dB. If the source can be turned off during the activity, active transmission will cease if a marine mammal or sea turtle (low-frequency sources only) is sighted within 200 yd. (183 m). Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 min., (4) the ship has transited more than 2,000 yd. (1.8 kilometers [km]) beyond the location of the last sighting, or (5) the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave (and there are no other marine mammal sightings within the mitigation zone). Active transmission may resume when dolphins are bow riding because they are out of the main transmission axis of the active sonar while in the shallow-wave area of the bow.

If the source is not able to be powered down during the activity (e.g., low-frequency sources within bins LF4 and LF5), mitigation will involve ceasing active transmission if a marine mammal or sea turtle is sighted within 200 yd. (183 m). Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 min., or (4) the ship has transited more than 400 yd. (366 m) beyond the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted average range to onset of PTS for low-frequency and hull-mounted mid-frequency active sonar sources is 100 yd. (91 m) for one ping. This range was determined by the high-frequency cetacean functional hearing group. The distance for all other marine mammal functional hearing groups is less than 80 yd. (73 m) for one ping, so the mitigation zone will provide further protection from injury (PTS) for these species. Therefore, implementation of the 200 yd. (183 m) shutdown zone will reduce the potential for exposure to higher levels of energy that would result in injury (PTS) and large threshold shifts that are recoverable (i.e., TTS) when individuals are sighted. Implementation of the 500 yd. (457 m) and 1,000 yd. (914 m) sonar power reductions will further reduce the potential for injury (PTS) and larger threshold shifts that would result in recovery (i.e., TTS) to occur when individual marine mammals are sighted within these zones, especially in cases where the ship and animal are approaching each other.

The mitigation zones the Navy has developed are within a range for which Lookouts can reasonably be expected to maintain situational awareness and visually observe during most conditions. Since the predicted average range to onset of TTS is 3,821 yd. (3.5 km), the entire range to TTS is not reasonably observable. By establishing mitigation zones that can be realistically maintained from ships, Lookouts will be more effective at sighting individual animals. By keeping Lookouts focused within the ranges where exposure to higher levels of energy is possible, the effectiveness at reducing potential impacts on marine mammals and sea turtles will increase. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles. Observations for sea turtles are required only during low-frequency active sonar activities because hull-mounted mid-frequency active sonars are not within the primary sea turtle hearing range.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect submarines, objects, or other exercise targets as would be required in a real world combat situation; reduce the sonar operator's situational awareness of the environment where the training or

testing is occurring; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.1.2 High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for all high-frequency and non-hull mounted mid-frequency active sonar activities (i.e., new sources or sources not previously analyzed). The Navy is proposing to (1) continue implementing the current mitigation measures for activities currently being executed, such as dipping sonar activities, (2) extend the implementation of its current mitigation to all other activities in this category, and (3) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from a vessel or aircraft (with the exception of platforms operating at high altitudes) immediately before and during active transmission within a mitigation zone of 200 yd. (183 m) from the active sonar source. For activities involving helicopter-deployed dipping sonar, visual observation will commence 10 min. before the first deployment of active dipping sonar. Helicopter dipping and sonobuoy deployment will not begin if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. If the source can be turned off during the activity, active transmission will cease if a marine mammal or sea turtle (for MF8, MF9, MF10, and MF12 only) is sighted within the mitigation zone. Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. for an aircraft-deployed source, (4) the mitigation zone has been clear from any additional sightings for a period of 30 min. for a vessel-deployed source, (5) the vessel or aircraft has repositioned itself more than 400 yd. (366 m) away from the location of the last sighting, or (6) the vessel concludes that dolphins are deliberately closing in to ride the vessel's bow wave (and there are no other marine mammal sightings within the mitigation zone).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted average range to onset of PTS for high-frequency and non-hull mounted mid-frequency active sonar sources is 20 yd. (18 m) for one ping. This range was determined by the high-frequency cetacean functional hearing group. The average range to onset of TTS across all functional hearing groups is 230 yd. (210 m) for one ping. Implementation of the 200-yd. (183-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury (PTS) and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. Lookouts often visually observe either close aboard a vessel or from directly above the source by aircraft (i.e., helicopters). Exceptions include when sonobuoys are deployed and when sources are deployed from high altitude aircraft. When sonobuoys are used, the sonobuoy field may be dispersed over a large distance. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic

marine mammals decreases at long distances. This measure should be effective at reducing risks to all marine mammals and sea turtles that are available to be observed within the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles. Observations for sea turtles are required only during non-hull mounted mid-frequency active sonar activities within bins MF8, MF9, MF10, and MF12 because high-frequency active sonars and other bins of mid-frequency sonar are not within the primary sea turtle hearing range.

The post-sighting wait periods are designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period for vessel-deployed sources more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving species. However, the analysis in Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur, with the exception of *Kogia* species. Requiring additional delay beyond 30 min. for vessel-deployed sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect submarines, objects, or other exercise targets and would be required during a real world combat situation; reduce the sonar operator's situational awareness of the environment where the training or testing is occurring; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period for aircraft-deployed sources covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period for aircraft-deployed sources is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect submarines, objects, or other exercise targets as would be required during a real world combat situation; reduce the sonar operator's situational awareness of the environment where the training or testing is occurring; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2 Explosives and Impulsive Sound

5.3.2.1.2.1 Improved Extended Echo Ranging Sonobuoys

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the marine mammal and sea turtle mitigation zone from 1,000 yd. (914 m) to 600 yd. (549 m), (2) clarify the conditions needed to recommence an activity after a sighting, and (3) adopt the marine mammal and sea turtle mitigation zone size for floating vegetation for ease of implementation. The recommended measures are provided below.

Mitigation will include pre-exercise aerial observation and passive acoustic monitoring, which will begin 30 min. before the first source/receiver pair detonation and continue throughout the duration of the

exercise within a mitigation zone of 600 yd. (549 m) around an Improved Extended Echo Ranging sonobuoy. The pre-exercise aerial observation will include the time it takes to deploy the sonobuoy pattern (deployment is conducted by aircraft dropping sonobuoys in the water). Improved Extended Echo Ranging sonobuoys will not be deployed if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone around the intended deployment location. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Passive acoustic monitoring would be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for Improved Extended Echo Ranging sonobuoys is 563 yd. (515 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 434 yd. (397 m). Implementation of the 600-yd. (549-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The sonobuoy field may be dispersed over a large distance. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. for aircraft-deployed Improved Extended Echo Ranging sonobuoys would modify the activity in a way that it would no longer meet its intended objective. The 30-min. wait period represents the maximum wait period acceptable for the type of aircraft involved in this activity

(e.g., maritime patrol aircraft) based on fuel restrictions. Any additional delay would result in an unacceptable increased risk to personnel safety, require aircraft to depart the activity location to refuel, eliminate opportunities to detect submarines as would be required in a real world combat situation; and reduce the aircrew's situational awareness of the environment where the activity is occurring; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.2 Explosive Sonobuoys Using 0.6–2.5 Pound Net Explosive Weight

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. The Navy is proposing to add the recommended measures provided below.

Mitigation will include pre-exercise aerial monitoring during deployment of the field of sonobuoy pairs (typically up to 20 min.) and continue throughout the duration of the exercise within a mitigation zone of 350 yd. (320 m) around an explosive sonobuoy. Explosive sonobuoys will not be deployed if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone (around the intended deployment location). Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min.

Passive acoustic monitoring will also be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft in order to increase vigilance of their visual observation.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for explosive sonobuoys using 0.6–2.5 lb. net explosive weight is 309 yd. (283 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 290 yd. (265 m). Implementation of the 350-yd. (320-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and large threshold shifts that are recoverable (i.e., TTS) when individuals are sighted. The sonobuoy field may be dispersed over a large distance. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period for aircraft-deployed sources is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect and track submarines or other exercise targets as would be required in a real world combat situation; reduce the sonar operator's situational awareness of the environment where the training or testing is occurring; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.3 Anti-Swimmer Grenades

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue implementing the current mitigation measures for this activity, and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from a small boat immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around an anti-swimmer grenade. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 min., or (4) the activity has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for anti-swimmer grenades is 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementation of the 200-yd. (183-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. Since the Lookout is visually observing close aboard the boat, this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed. Observation for indicators of marine

mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities for maritime security forces to detect, respond to, and defend against enemy scuba divers as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.4 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Recommended Mitigation and Comparison to Current Mitigation

As background, mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver-placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef, live hard bottom, artificial reef, and shipwreck mitigation areas.

For general mine countermeasure and neutralization activities, the Navy is proposing to (1) modify the currently implemented mitigation measures to account for additional categories of net explosive weights and to align with the modeled explosive bins, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) add a requirement to observe for floating vegetation. For comparison, the currently implemented mitigation zones for general mine countermeasure and neutralization are 378 yd. (345 m) when using less than 11 lb. net explosive weight; 1,091 yd. (997 m) when using 11–75 lb. net explosive weight; and 3,130 yd. (2.9 km) when using 76–600 lb. net explosive weight. The recommended general mine countermeasure and neutralization measures are provided below.

The Navy is proposing to use the mitigation zones outlined in Table 5.3-3 during general mine countermeasure activities using positive control firing devices. General mine countermeasure and neutralization activity mitigation will include visual observation from small boats or aircraft beginning 10 min. before, during, and 10 min. after (when helicopters are involved in the activity) or 30 min. before, during, and 30 min. after (when helicopters are not involved in the activity) the completion of the exercise within the mitigation zones around the detonation site. For activities involving explosives in

bin E11 (501–650 lb. net explosive weight), aerial observation of the mitigation zone will be conducted. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. when helicopters are involved in the activity, or (4) the mitigation zone has been clear from any additional sightings for a period of 30 min when helicopters are not involved in the activity.

For activities involving positive control diver-placed charges, the Navy is proposing to (1) add new mitigation measures for mine neutralization activities involving diver-placed charges using 21–100 lb. net explosive weight charges, (2) modify the currently implemented mitigation measures for activities involving diver-placed charges using less than or equal to 20 lb. net explosive weight charges to account for additional categories of net explosive weights and to align with the modeled explosive bins, (3) discontinue implementing the addition of a Lookout to observe for hatchling sea turtles from late July through October, (4) clarify the conditions needed to recommence an activity after a sighting, and (5) add a requirement to observe for floating vegetation. For comparison, the currently implemented mitigation zone for less than or equal to 20 lb. net explosive weight charges is 700 yd. (640 m). The recommended measures for activities involving positive control diver-placed activities are provided below.

The Navy is proposing to use the mitigation zones outlined in Table 5.3-3 during activities involving positive control diver-placed charges. Visual observation will be conducted by either two small boats or by one small boat and one helicopter. Boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius and human safety zone) and travel in a circular pattern around the detonation location. When using two boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If used, helicopters will travel in a circular pattern around the detonation location. The conditions needed to recommence an activity after a sighting and requirement to observe for floating vegetation recommended above for general mine countermeasure and neutralization activities above will also apply to activities using diver-placed charges.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. The range to effects shown in Table 5.3-3 for general mine countermeasure and neutralization activities using positive control firing devices were determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. Implementation of the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft or small boats may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation or assistance with mine countermeasure and neutralization deployment. The decrease in mitigation zone size for activities using diver-placed charges will result in no mitigation for exposure to lower levels of potential onset of TTS;

however, it will allow for a more focused survey effort over a smaller area, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement would not be likely to result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

As described in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the ability of a Lookout to detect an animal can vary greatly based on what observing platform is being used. For large ranges, aerial observation is more effective. In addition, when observing from a small boat, sea turtle and cryptic marine mammal species can be very difficult to detect beyond a few meters. However, this measure should be effective at reducing potential impacts for individuals that are sighted.

Mine neutralization activities involving diver-placed charges occur primarily close to shore and in shallow water (concentrated in the Virginia Capes [VACAPES] Range Complex) where only mid-frequency cetaceans and sea turtles are expected to occur with any regularity. The range to effects shown in Table 5.3-3 for mine neutralization activities involving diver-placed charges under positive control were determined by the sea turtle functional hearing group. The mid-frequency hearing group had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. However, mitigation would be implemented for any species observed within the mitigation zone. Implementation of the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The decrease in mitigation zone size for activities using diver-placed charges (up to 20 lb. net explosive weight) will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller area, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals.

During activities using diver-placed charges, Lookouts are visually observing from small boats or helicopters. As discussed above, aerial observation is more effective than observation from a small boat. Since small boats do not have a very elevated observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further than a few meters away from the boat. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

For activities using diver-placed charges, maintaining an additional Lookout to observe for hatchling sea turtles is impractical to implement from an operational standpoint due to the unacceptable impact on resource requirements (i.e., limited personnel resources), and does not effectively reduce the potential for impacts on sea turtles to occur due to the extreme difficulty of sighting hatchlings at sea (see Section 5.3.1.2.4, Effectiveness Assessment for Lookouts). See Section 5.3.3.3.1.2 (Sea Turtle Nesting Habitat off North Carolina) and Section 5.3.3.4.1.1 (Piping Plover Breeding Habitat in Virginia) for information on mitigation areas pertinent to these activities.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine

mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. (when helicopters are not involved in the activity) would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect, identify, evaluate, and neutralize mines as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period (when helicopters are involved in the activity) covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on helicopter fuel restrictions. Requiring additional delay beyond 10 min. for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect, identify, evaluate, and neutralize mines; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to most marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.5 Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices Recommended Mitigation and Comparison to Current Mitigation

As background, when mine neutralization activities using diver-placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns. Refer to Section 5.3.2.1.2.4 (Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices) for a general discussion of mitigation measures applicable to mine neutralization activities using diver-placed mines. This section will specify unique mitigation zones and observation methods for diver-placed mine activities that use time-delay firing devices. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef, live hard bottom, artificial reef, and shipwreck mitigation areas.

The Navy is proposing to (1) modify the mitigation zones and observation requirements currently implemented for mine countermeasure and neutralization activities using diver-placed time-delay firing devices, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) add a requirement to observe for floating vegetation. For comparison, the current mitigation zones are based on size of charge and length of time-delay, ranging from a 1,000-yd. (914-m) mitigation zone for a 5 lb. net explosive weight charge using a 5-min. time-delay to a 1,450-yd. (1,326-m) mitigation zone for a 20 lb. net explosive weight charge using a 10-min. time-delay. The current requirement is for two small boats to be used for observation in mitigation zones that are less than 1,400 yd. (1,280 m). The recommended measures for activities involving diver-placed time-delay firing devices are provided below.

The Navy recommends one mitigation zone for all net explosive weights and lengths of time-delay. Mine neutralization activities involving diver-placed charges will not include time-delay longer than 10 min. Mitigation will include visual observation from small boats commencing 30 min. before, during, and until 30 min. after the completion of the exercise within a mitigation zone of 1,000 yd. (915 m) around the detonation site. During activities using time-delay firing devices involving up to a 20 lb. net explosive weight charge, visual observation will take place using two small boats. In addition, when aircraft are involved (e.g., during deployment of divers), the pilot or member of the aircrew will serve as an additional Lookout. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. The fuse initiation will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Fuse initiation will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Survey boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius/human safety zone) and travel in a circular pattern around the detonation location. One Lookout from each boat will look inward toward the detonation site and the other Lookout will look outward away from the detonation site. Each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If participating, helicopters will travel in a circular pattern around the detonation location.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for mine neutralization diver-placed mines using time-delay firing devices is 469 yd. (429 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 647 yd. (592 m). The time-delay firing device mitigation zone was determined by including additional distance on top of the predicted maximum range to onset of PTS to account for a portion of the time that a marine mammal or sea turtle could enter the mitigation zone during the time-delay. Implementation of the 1,000-yd. (915-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

A 1,000-yd. (915-m) mitigation zone represents the maximum distance that the Lookouts on small boats can adequately observe given the number of personnel that will be involved. As discussed in Section 5.3.1.2.2.5 (Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices), the use of more than two small boats for observation during this activity presents an unacceptable impact on readiness due to limited personnel resources. Since small boats do not have an elevated observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further than a few meters away from the boat. Sighting a sea turtle is only likely if a helicopter is participating in the activity. In addition, even with the extended mitigation zone to account for as much of the time-delay as possible, there is still a remote chance that animals may swim into the area after the charge is already set. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. The 30-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect, identify, evaluate, and neutralize mines as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to most marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.6 Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue implementing the current mitigation measures for this activity, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) add a requirement to visually observe for kelp paddies. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from a vessel or aircraft immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around the intended impact location. Vessels will observe the mitigation zone from the firing position. When aircraft are firing, the aircrew will maintain visual watch of the mitigation zone during the activity. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. for a firing aircraft, (4) the mitigation zone has been clear from any additional sightings for a period of 30 min. for a firing vessel, and (5) the intended target location has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for small- and medium-caliber gunnery is 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementation of the 200-yd. (183-m)

mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

Small- and medium-caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location that may be up to 4,000 yd. (3.7 km) away, although typically much closer than this. Therefore, it is necessary for the Lookout to be able to visually observe the mitigation zone from varying distances. Large vessel or aircraft platforms would provide a more effective observation platform for Lookouts than small boats. However, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 4,000 yd. (3.7 km). However, this measure is likely effective at reducing the risk of injury to marine mammals that may be observed from the typical target distances. This measure may be ineffective at reducing the risk of injury to sea turtles at large target distances; however, it does reduce the risk for those individuals that may be observed at closer distances. In addition, it is more likely that sea turtles will be observed when exercises involve aircraft versus vessels. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period for a firing vessel more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. for a firing vessel would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period for a firing aircraft covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities and reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.7 Gunnery Exercises – Large-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the currently implemented mitigation zone for this activity, (2) clarify the conditions needed to recommence an activity after a sighting, (3) add a requirement to

visually observe for kelp paddies, (4) modify the seafloor habitat mitigation area, and (5) specifically for activities involving the integrated maritime portable acoustic scoring system, decrease the post-sighting activity recommencement wait period from 45 min. to 30 min. and remove the requirement for post-activity visual observations of the mitigation zone during buoy retrieval. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from a ship immediately before and during the exercise within a mitigation zone of 600 yd. (549 m) around the intended impact location. Ships will observe the mitigation zone from the firing position. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for large-caliber gunnery is 526 yd. (481 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 453 yd. (414 m). Implementation of the 600-yd. (549-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. Eliminating the post-activity visual observations for activities that use the integrated maritime portable acoustic scoring system will help maintain consistency between large-caliber gunnery exercises using a surface target and improve the practicality of implementation. Per the Navy's current reporting requirements, any injured or dead marine mammals or sea turtles will be reported as appropriate.

Large-caliber gunnery exercises involve the participating ship firing munitions at a target location from ranges up to 6 nm away. Therefore it is necessary for the Lookout to be able to visually observe the mitigation zone from this distance. Although the Lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-

diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.8 Missile Exercises (Including Rockets) up to 250 Pound Net Explosive Weight Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 1,800 yd. (1.6 km) to 900 yd. (823 m), (2) clarify the conditions needed to recommence an activity after a sighting, (3) adopt the marine mammal and sea turtle mitigation zone size for floating vegetation for ease of implementation**,** and (4) modify the platform of observation to eliminate the requirement to observe when ships are firing. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 900 yd. (823 m) around the deployed target. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. or 30 min. (depending on aircraft type).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise (including rockets) up to 250 lb. net explosive weight (bin E9) is 699 yd. (639 m). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 949 yd. (868 m). Implementation of the 900-yd. (823-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

Missile exercises involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because that type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Therefore, this measure is not effective at reducing the risk of injury to animals once the firing activity has begun; however, it does reduce the risk for those individuals that may be observed prior to commencement of the activity when aircraft are firing. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.9 Missile Exercises Using 251–500 Pound Net Explosive Weight Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 2,000 yd. (1.8 km) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. or 30 min. (depending on aircraft type).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise using 251–500 lb. net explosive weight (bin E10) is 1,883 yd. (1.7 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 1,832 yd. (1.7 km). Implementation of the 2,000-yd. (1.8-km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

Missile exercises involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because that type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Therefore, this measure is not effective at reducing the risk of injury to animals once the firing activity has begun; however, it does reduce the risk for those individuals that may be observed prior to commencement of the activity when aircraft are firing. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.10 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 5,100 yd. (4.7 km) to 2,500 yd. (2.3 km), (2) clarify the conditions needed to recommence an activity after a sighting, (3) add a requirement to visually observe for kelp paddies, and (4) adopt the marine mammal and sea turtle mitigation zone size for floating vegetation for ease of implementation. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 2,500 yd. (2.3 km) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Bombing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Bombing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for bombing exercises is 2,474 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. For example, the maximum range to onset of PTS to mid-frequency of cetaceans is less than 500 yd. (457 m). The average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementation of the 2,500-yd. (2.3-km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 250 yd. (229 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2,500 yd. (2.3 km) near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Similarly, Lookouts posted in aircraft during bombing activities will, by necessity, focus their attention on the water surface below and surrounding the location of bomb deployment. Due to the nature of this activity (e.g., aircraft maintaining a relatively steady altitude of approximately 1,500 ft. and approaching the intended impact location), Lookouts will be able to observe a larger area during bombing activities than other proposed activities that involve the use of Lookouts positioned in aircraft (e.g., Improved Extended Echo Ranging sonobuoy activities). However, observation of an area beyond what the Navy is proposing to implement for bombing activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on fuel restrictions (factoring in the typical activity locations) for the types of aircraft involved in this activity (e.g., F/A-18). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and deliver bombs as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.11 Torpedo (Explosive) Testing

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 5,063 yd. (4.6 km) to 2,100 yd. (1.9 km), (2) clarify the conditions needed to recommence an activity after a sighting, (3) add a requirement to visually observe for kelp paddies, and (4) remove the requirement to review remotely sensed sea surface temperature maps prior to conducting the activity. The recommended measures are provided below.

Mitigation will include visual observation by aircraft (with the exception of platforms operating at high altitudes) immediately before, during, and after the exercise within a mitigation zone of 2,100 yd. (1.9 km) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal, sea turtle, or aggregation of jellyfish is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. or 30 min. (depending on aircraft type).

In addition to visual observation, passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. Passive acoustic observation would be accomplished through the use of remote acoustic sensors, expendable sonobuoys, or via passive acoustic sensors on submarines when they participate in the Proposed Action. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to the Lookout posted in the aircraft in order to increase vigilance of the visual observation; and to the person in control of the activity for their consideration in determining when the mitigation zone is determined free of visible marine mammals.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for explosive torpedoes is 2,021 yd. (1.8 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 1,632 yd. (1.5 km). Implementation of the 2,100-yd. (1.9-km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 600 yd. (549 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2,100 yd. (1.9 km) near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement for torpedo (explosive) testing activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies] and jellyfish aggregations) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch torpedoes as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch torpedoes as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The original intent of the measure requiring the review of remotely sensed sea surface temperature maps was to help predict areas in which protected species could occur. However, while the presence of sea surface temperature fronts may indicate suitable habitat for marine species and may sometimes lead observers to pay more attention to an area of the ocean likely to be associated with a marine species, sea surface temperature fronts alone are insufficient to locate and prevent avoidance of marine species during this type of exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles,

and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.12 Sinking Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 4.5 nm to 2.5 nm, (2) clarify the conditions needed to recommence an activity after a sighting, (3) add a requirement to visually observe for kelp paddies, and (4) adopt the marine mammal and sea turtle mitigation zone size for floating vegetation and jellyfish for ease of implementation. The recommended measures are provided below.

Mitigation will include visual observation within a mitigation zone of 2.5 nm around the target ship hulk. Sinking exercises will include aerial observation beginning 90 min. before the first firing, visual observations from vessels throughout the duration of the exercise, and both aerial and vessel observation immediately after any planned or unplanned breaks in weapons firing of longer than 2 hours. Prior to conducting the exercise, the Navy will review remotely sensed sea surface temperature and sea surface height maps to aid in deciding where to release the target ship hulk.

The Navy will also monitor using passive acoustics during the exercise. Passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation. Lookouts will also increase observation vigilance before the use of torpedoes or unguided ordnance with a net explosive weight of 500 lb. or greater, or if the Beaufort sea state is a 4 or above.

The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. The exercise will cease if a marine mammal, sea turtle, or aggregation of jellyfish is sighted within the mitigation zone. The exercise will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min. Upon sinking the vessel, the Navy will conduct post-exercise visual observation of the mitigation zone for 2 hours (or until sunset, whichever comes first).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. During a sinking exercise, multiple weapons sources may be used (e.g., projectiles, missiles, bombs, and torpedoes), the largest of which is the 2,000 lb. bomb. The recommended mitigation zone is approximately double the predicted maximum range to onset of PTS of the largest weapon source and is designed to account for multiple detonations during the activity. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a bombing exercise is 2,474 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. For example, the maximum range to onset of PTS to mid-frequency of cetaceans is less than 500 yd.

(457 m). The average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementation of the 2.5-nm mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 250 yd. (229 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2.5 nm near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft or vessels may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement for sinking exercises is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles. The amount of time it takes for an aircraft to conduct line transects around a detonation point within the currently implemented 4.5-nm mitigation zone could result in animals entering the mitigation zone at one end while the aircraft completes the survey at the other end of the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies] and jellyfish aggregations) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the ship and aircrews' abilities to coordinate attack tactics on a seaborne target as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise. Although activities involving certain types of aircraft (e.g., helicopters) typically employ a 10-min. wait period due to fuel restrictions, the Navy is able to make an exception for this particular activity due to the large variation and rotation of assets that could participate in this type of exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles,

and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.13 At-Sea Explosive Testing

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for at-sea explosive testing activities. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The Navy is proposing to add the recommended measures provided below.

Mitigation during at-sea explosive testing, such as the sinking of a vessel by a sequential firing of multiple small charges (e.g., explosives in bin E5) for use as an artificial reef, will include visual observation from supporting vessels immediately before and during the activity within a mitigation zone of 1,600 yd. (1.4 km) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. During at-sea explosive testing, multiple weapons sources or charges may be used (projectiles and charges), the largest of which is a 10 lb. net explosive weight charge. The recommended mitigation zone is approximately double the predicted maximum range to onset of PTS of the largest source, and is designed to account for multiple detonations during the activity. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for at-sea explosive testing is 649 yd. (593 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 525 yd. (480 m). Implementation of the 1,600-yd. (1.4-km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 60 yd. (55 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. This measure is likely also effective at reducing the risk of injury to marine mammals and sea turtles within the maximum range to onset of PTS (649 yd. [593 m]). As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, from a vessel decreases at long distances; therefore, this measure is likely ineffective at reducing impacts on sea turtles and some species of marine mammals at distances closer to 1,600 yd. (1.4 km) near the perimeter of the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the vessel's ability to determine the pressure generated, which is used to test the feasibility of using various net explosive weight sizes for different events; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to some species of marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.14 Ordnance Testing – Line Charge Testing

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) increase the mitigation zone from 880 yd. (805 m) to 900 yd. (823 m), (2) add the requirement to cease the activity after a marine mammal or sea turtle is sighted in the mitigation zone, (3) clarify the conditions needed to recommence an activity after a sighting, (4) add a requirement to visually observe for floating vegetation, and (5) discontinue visual observations for the Gulf sturgeon. Currently, if a Gulf sturgeon is sighted close to the line charge detonation point, tests are postponed until the animal is over 0.5 mile (mi.) (0.8 km) from the detonation point. The recommended measures are provided below.

Mitigation will include visual observation from a vessel immediately before and during the exercise within a mitigation zone of 900 yd. (823 m) around the line charges. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Effectiveness and Operational Assessments

Visual observation for Gulf sturgeon (including determining if a sturgeon has moved more than 0.5 mi. [0.8 km] away from the detonation point) does not effectively reduce the potential for impacts on the species to occur due to the extreme difficulty of sighting a primarily bottom dwelling fish below the water's surface. Activity in the surf zone (e.g., deployment of the line charges) prior to commencement of the detonation will likely result in Gulf sturgeon leaving the immediate area of their own volition. Refer to Section 5.3.3.5.1.1 (Gulf Sturgeon Habitat in the Gulf of Mexico) for a discussion of mitigation measures conducted within Gulf sturgeon habitat.

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for line charge testing is 563 yd.

(515 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 434 yd. (397 m). Implementation of the 900-yd. (823-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

This activity involves launching the line charge array at the beach. Therefore it is necessary for the Lookout to be able to visually observe the mitigation zone from this distance. Very few marine mammal species would be present in the surf zone, except coastal dolphins and manatees. Although the Lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a large pod of dolphins will be seen from long distances from this vantage point. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and manatees, it does reduce the risk for those individuals that may be observed. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.9 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the vessel's ability to verify the capability to safely clear surf zone areas for sea-based expeditionary operations; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.15 Ship Shock Trials

Recommended Mitigation and Comparison to Current Mitigation

The Navy develops detailed ship shock trial mitigation plans approximately 1 year prior to each ship shock trial event and will continue to provide these plans to NMFS. The recommended mitigation zone measures specific to ship shock trials using 10,000-lb. and 40,000-lb. charges are provided below.

10,000-Pound Charges (High Blast Explosive)

The Navy is proposing to (1) continue implementing mitigation measures based on the largest mitigation zone of the most recently conducted ship shock trial (Mesa Verde, which used 10,000-lb. charges), (2) clarify the conditions needed to recommence an activity after a sighting, (3) add a requirement to visually observe for kelp paddies, (4) add an option to conduct visual observations using only vessels. The recommended measures are provided below.

Mitigation will include aerial or shipboard observation prior to, during, and after completion of the event within a mitigation zone of 3.5 nm around the shock trial location. Pre-planning will include selection of one primary and two secondary areas where marine mammal populations are expected to be the lowest during the event. The primary and secondary locations will be greater than 2 nm from the western boundary of the Gulf Stream.

The Navy will conduct aerial or shipboard visual observations of the mitigation zone at intervals of 5 hours, 3 hours, and 40 min. prior to detonation and immediately before each detonation at the primary shock trial location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. If it is determined during pre-detonation surveys that the primary area is environmentally unsuitable (e.g., observations of marine mammals or presence of concentrations of floating vegetation [*Sargassum* or kelp paddies]), the shock trial could be moved to a secondary site. Details of this process will be provided in the ship-specific mitigation plan. The detonation will cease if marine mammals, sea turtles, large schools of fish, jellyfish aggregations, or flocks of seabirds are visually observed within the mitigation zone. The detonation will recommence if any one of the following conditions is met: (1) the species is observed exiting the mitigation zone, (2) the species is thought to have exited the mitigation zone based on its course and speed, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min. The Navy will visually observe the mitigation zone immediately after each detonation for 3 hours. Mitigation will also include observation for a minimum of 2 days and no more than 7 days following a detonation. If any injured or dead marine mammals or sea turtles are detected in the mitigation zone during the post-detonation observation, the remainder of the activity will be halted until procedures for subsequent detonations can be reviewed and changed as necessary.

40,000-Pound Charges (High Blast Explosive)

Lookout measures do not currently exist for this activity because it is a new activity. The Navy is proposing to add mitigation for this activity. The recommended measures are provided below.

Mitigation will include aerial and shipboard observation prior to, during, and after completion of the event within a mitigation zone of 3.5 nm around the shock trial location. Pre-planning will include selection of one primary and two secondary areas where marine mammal populations are expected to be the lowest during the event. The primary and secondary locations will be located greater than 2 nm from the western boundary of the Gulf Stream.

The Navy will conduct shipboard and aerial visual observations of the mitigation zone at intervals of 5 hours, 3 hours, and 40 min. prior to detonation and immediately before each detonation at the primary shock trial location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. If it is determined during pre-detonation surveys that the primary area is environmentally unsuitable (e.g., observations of marine mammals or presence of concentrations of floating vegetation [*Sargassum* or kelp paddies]), the shock trial could be moved to a secondary site. Details of this process will be provided in the ship-specific mitigation plan. The detonation will cease if marine mammals, sea turtles, large schools of fish, jellyfish aggregations, or flocks of seabirds are visually observed within the mitigation zone. The detonation will recommence if any one of the following conditions is met: (1) the species is observed exiting the mitigation zone, (2) the species is thought to have exited the mitigation zone based on its course and speed, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min. The Navy will visually observe the mitigation zone immediately after each detonation for 3 hours. Mitigation will also include observation for a minimum of 2 days and no more than 7 days following a detonation. If

any injured or dead marine mammals or sea turtles are detected in the mitigation zone during the post-detonation observation, the remainder of the activity will be halted until procedures for subsequent detonations can be reviewed and changed as necessary.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. Table 5.3-2 shows the predicted maximum range to PTS based on the Navy's acoustic propagation model for all charge sizes and locations. As shown, the predicted maximum ranges to onset of PTS are larger than the recommended mitigation zone. However, for the 10,000-lb. charges, the longest average range to PTS across all functional hearing groups between the two locations is 2.7 nm. For the 40,000-lb. charges, the longest average range to PTS across all functional hearing groups between the two locations is 3.7 nm. Implementation of the 3.5-nm mitigation zone is still likely to reduce the majority of the potential for exposure to higher levels of energy that would result in injury, when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is 3,000 yd. (2.8 km) for the 10,000-lb. charge and 4,800 yd. (4.4 km) for the 40,000-lb. charge. This measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted due to the number of combination of observation platforms in use. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 3.5 nm near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone. The ability to detect indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies], jellyfish aggregations, large schools of fish, and flocks of seabirds) decreases at long distances when observing from a vessel; however, observation will further help avoid impacts on marine mammals and sea turtles.

For ship shock trials using up to 10,000-lb. charges, aerial surveys are not always operationally feasible due to resource limitations. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals from a vessel, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. However, if vessels are used as the sole observation platform, the Navy's use of a sufficient number of vessels (e.g., Marine Animal Response Team boats) will ensure that the mitigation zone is visually observed with effectiveness comparable to aerial surveys.

For ship shock trials using up to 40,000-lb. charges, the Navy estimates that 3.5 nm is the upper limit of effectiveness for aerial observation during ship shock trials based on the amount of time it takes for the aircraft to patrol the area. Larger survey areas would result in an unacceptable increase to the amount of time it would take for an aircraft to conduct line transects around the detonation point. The longer an aircraft spends transiting the survey area, the less focused the survey becomes at observing individuals that may be present close to the detonation. For instance, animals could potentially enter one end of the mitigation zone unnoticed while the aircraft conducts its survey at the opposite end of mitigation zone. The Navy believes that a more focused survey effort over a smaller survey distance will provide the most effective means for helping reduce potential impacts on marine mammals and sea turtles during ship shock trials, even if the mitigation zone is smaller than the full extent of the predicted range to PTS for some charge sizes or locations.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the Navy's opportunity to simulate shock waves at various distances from the ship's hull that would be expected during a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the test.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to some marine species, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.16 Elevated Causeway System – Pile Driving

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. The Navy is proposing to add the recommended measures provided below.

Mitigation will include visual observation from a small boat, the elevated causeway, or from shore starting 30 min. prior to and during the exercise within a mitigation zone of 60 yd. (55 m) around the pile driver. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Pile driving will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Pile driving will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for pile driving exercises is 51 yd. (46 m). This range was determined by the injury threshold of 180 dB root mean square for cetaceans. The average range to onset of TTS is 1,094 yd. (1 km). Implementation of the 60-yd. (55-m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. Since the mitigation zone is so small, this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed within the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.1.10 (Impacts from Pile Driving) shows that injury to deep-

diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the crew's ability to construct the causeway platform in a manner that would be expected during a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.17 Weapons Firing Noise During Gunnery Exercises – Large-Caliber

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the currently implemented mitigation measure to clarify that the mitigation zone is only on the firing side of the ship, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) add a requirement to visually observe for floating vegetation. The recommended measures are provided below.

For all explosive and non-explosive large-caliber gunnery exercises conducted from a ship, mitigation will include visual observation immediately before and during the exercise within a mitigation zone of 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 min., or (4) the ship has repositioned itself more than 140 yd. (128 m) away from the location of the last sighting.

Effectiveness Assessment

The mitigation zone is designed to reduce the potential for injury from weapons firing noise during large-caliber gunnery exercises conducted from a ship. The majority of the energy that an animal could be exposed to would occur on the firing side of the ship and would follow in the direction of fire. It is not operationally feasible to have Lookouts stationed on all sides of the ship to visually observe for marine mammals and sea turtles due to limited resources (e.g., manning restrictions). Since the Lookout is positioned aboard the firing ship and is visually observing a small area (70 yd. [64 m]), this measure should be effective at reducing the risk to all marine mammals and sea turtles that available to be observed. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for sea turtles. However, the analysis in Section 3.4.3.1.12 (Impacts from Weapons Firing, Launch, and Impact Noise) shows that injury to marine mammals is not expected to occur. Requiring additional delay beyond 30 min. would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities

to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2 Physical Disturbance and Strikes

5.3.2.2.1 Vessels and In-Water Devices

5.3.2.2.1.1 Vessels

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented. The recommended measures are provided below.

Vessels will avoid approaching marine mammals head on and will maneuver to maintain a mitigation zone of 500 yd. (457 m) around observed whales and 200 yd. (183 m) around all other marine mammals (except bow riding dolphins), providing it is safe to do so. For additional information on species-specific mitigations pertaining to vessel strikes within mitigation areas, see Section 5.3.3.1.1 (North Atlantic Right Whale) and Section 5.3.3.1.2 (West Indian Manatee).

Effectiveness and Operational Assessments

Since the Lookout is visually observing within a reasonable distance of the vessel (within 500 yd. [457 m]), this measure should be effective at reducing the risk to marine mammals that are available to be observed. However, as discussed above in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), large whales and pods of dolphins are more likely to be seen than other more cryptic species, such as beaked whales.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.1.2 Towed In-Water Devices

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented. The recommended measure is provided below.

The Navy will ensure that towed in-water devices being towed from manned platforms avoid coming within a mitigation zone of 250 yd. (229 m) around any observed marine mammal, providing it is safe to do so.

Effectiveness and Operational Assessments

Since the Lookout is visually observing within a reasonable distance of the vessel (250 yd. [229 m]), this measure should be effective at reducing the risk to marine mammals that are observable. However, as discussed above in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), large whales and pods of dolphins are more likely to be seen than other more cryptic species such as beaked whales.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2 Non-Explosive Practice Munitions

5.3.2.2.2.1 Non-Explosive Gunnery Exercises – Small-, Medium-, and Large-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the mitigation measures currently implemented for this activity, and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. for a firing aircraft, (4) the mitigation zone has been clear from any additional sightings for a period of 30 min. for a firing vessel, or (5) the intended target location has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive projectile. Large-caliber gunnery exercises involve the participating ship firing munitions at a target location from ranges up to 6 nm away. Small- and medium-caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from up to 2 nm away, although typically closer. Therefore it is necessary for the Lookout to be able to visually observe the mitigation zone from these distances. Although the Lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 6 nm (i.e., at the furthest target distance for large-caliber gunnery exercises) or 2 nm (i.e., at the furthest target distance for small- and medium-caliber gunnery exercises). Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-min. wait period when vessels are firing more than covers the average dive times of most marine mammal species but may not be sufficient for sea turtles. However, the analysis in Section 3.4.3.3.3 (Impacts from Military Expended Materials) shows that injury to marine mammals and sea turtles is not expected to occur. Requiring additional delay beyond 30 min. for a firing vessel would modify the activity in a way that it would no longer meet its intended objective. Any additional delay

would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period for a firing aircraft covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities and reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to some species of marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2.2 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the mitigation measures currently implemented for this activity, and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 1,000 yd. (914 m) around the intended impact location. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Bombing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Bombing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive bomb. The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., F/A-18). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and deliver bombs as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise. Observation for indicators of marine mammal and sea turtle

presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2.3 Missile Exercises (Including Rockets) Using a Surface Target

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 1,800 yd. (1.6 km) to 900 yd. (823 m), (2) clarify the conditions needed to recommence an activity after a sighting, (3) adopt the marine mammal and sea turtle mitigation zone size for floating vegetation for ease of implementation, and (4) modify the platform of observation to eliminate the requirement to observe when ships are firing. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 900 yd. (823 m) around the deployed target. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 min. or 30 min. (depending on aircraft type).

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive projectile. Activities using non-explosive missiles (including rockets) involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because that type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Observation for indicators of marine mammal and sea turtle presence (e.g., concentrations of floating vegetation [*Sargassum* or kelp paddies]) will further help avoid impacts on marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.3.3.3 (Impacts from Military Expended Materials) shows that injury to marine mammals and sea turtles is not expected to occur. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond

30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation; and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3 MITIGATION AREAS

The Navy is proposing to implement several mitigation measures within pre-defined habitat areas in the Study Area. For the purposes of this document, the Navy will refer to these areas as "mitigation areas." As described throughout this section, these recommended mitigation areas may be based off endangered species critical habitats, endangered species reproductive areas, or bottom features. The size and location of certain habitat areas, such as the critical habitats, is subject to change over time; however, the Navy's effectiveness and operational assessments and resulting mitigation recommendations are entirely dependent on the mitigation area defined in this document. Therefore, it is important to note that the Navy is recommending implementing mitigation measures only within each area as described in this document. Applying these mitigations to additional or expanded areas could potentially result in an unacceptable impact on readiness.

5.3.3.1 Marine Mammal Habitats

5.3.3.1.1 North Atlantic Right Whale

5.3.3.1.1.1 North Atlantic Right Whale Southeast Calving Habitat

Recommended Mitigation and Comparison to Current Mitigation

To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) continue implementing seasonal measures within the North Atlantic right whale mitigation area off the southeast United States, and (2) clarify the activities that are not allowed within the mitigation area. Previous documents described these measures in terms of identifying the specific activities that are allowed in the mitigation area (i.e., precision anchorage drills, swept channel exercises, helicopter dipping sonar, search and rescue, maritime security operations, object detection activities, and use of the Shipboard Electronic System Evaluation Facility range with clearance from Mayport Harbor Operations). In order to maintain consistency throughout this chapter, these measures will now be described in terms of what activities will be minimized, restricted, or avoided. The recommended measures are provided below.

The Navy will not conduct the following activities within the mitigation area:

- Low-frequency and hull-mounted mid-frequency active sonar (except as noted below)
- High-frequency and non-hull mounted mid-frequency active sonar (excluding helicopter dipping)
- Missile activities (explosive and non-explosive)
- Bombing exercises (explosive and non-explosive)
- Underwater detonations
- Improved Extended Echo Ranging sonobuoy exercises
- Torpedo exercises (explosive)
- Small-, medium- and large-caliber gunnery exercises

The Navy will minimize to the maximum extent practicable the use of the following systems within the mitigation area:

- Helicopter dipping using active sonar
- Low-frequency and hull-mounted mid-frequency active sonar used for navigation training
- Low-frequency and hull-mounted mid-frequency active sonar used for object detection exercises

The Navy will conduct several mitigation measures within pre-defined boundaries of a North Atlantic right whale mitigation area off the southeast United States during calving season between 15 November and 15 April. The southeast United States mitigation area is defined as follows (and depicted in Figure 3.4-1): a 5 nm buffer around the coastal waters between 31°15' North and 30°15' North from the coast out 15 nm; and the coastal waters between 30°15' North and 28°00' North from the coast out 5 nm.

Before transiting through or conducting any training or testing activities within the mitigation area, the Navy will initiate prior communication with the Fleet Area Control and Surveillance Facility, Jacksonville to obtain Early Warning System North Atlantic right whale sightings data. The Fleet Area Control and Surveillance Facility, Jacksonville, will advise vessels of all reported whale sightings in the vicinity of the mitigation area to help vessels and aircraft reduce potential interactions with North Atlantic right whales. Commander Submarine Force U.S. Atlantic Fleet will coordinate any submarine operations that may require approval from the Fleet Area Control and Surveillance Facility, Jacksonville.

When transiting within the mitigation area, all Navy vessels will exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. Vessels will implement speed reductions after they observe a North Atlantic right whale, if they are within 5 nm of a sighting reported within the past 12 hours, or when operating at night or during periods of poor visibility. The Navy will minimize to the maximum extent practicable north-south transits through the mitigation area. Consistent with current mitigation, the Navy may periodically travel in a north-south direction during training and testing activities due to operational requirements. If north-south directional travel is required during training or testing activities, the Navy will continue to implement the increased caution and speed reductions described above when applicable.

Effectiveness and Operational Assessments

The waters off the southeastern United States are the only known calving grounds for the North Atlantic right whale. The Early Warning System is a comprehensive aerial survey effort conducted off the southeast United States to approximately 30–35 nm offshore during the North Atlantic right whale

calving season. Sponsored collaboratively by the Navy, U.S. Coast Guard, U.S. Army Corps of Engineers, and NMFS, aerial surveys are flown daily from December 1–March 31, weather permitting. Aerial surveys are conducted to sight North Atlantic right whales and to relay the sighting information to mariners transiting within the North Atlantic right whale calving ground. The information exchange network includes the Fleet Area Control and Surveillance Facility, Jacksonville; Commander, Naval Submarine Forces, Norfolk, Virginia; and Naval Submarine Support Command.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to the North Atlantic right whale, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.1.2 North Atlantic Right Whale Northeast Foraging Habitat

Recommended Mitigation and Comparison to Current Mitigation

As background, two important North Atlantic right whale foraging habitats, the Great South Channel and Cape Cod Bay, are located off the northeast United States (Figure 3.4-1). These two areas comprise the northeast United States mitigation area, which applies year-round and is defined as follows:

- Great South Channel: The area bounded by 41°40' North / 69°45' West; 41°00' North / 69°05' West; 41°38' North / 68°13' West; and 42°10' North / 68°31' West
- Cape Cod Bay: The area bounded by 42°04.8' North / 70°10' West; 42°12' North / 70°15' West; 42°12' North / 70°30' West; 41°46.8' North / 70°30' West and on the south and east by the interior shoreline of Cape Cod, Massachusetts

To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) continue implementing year-round measures within the North Atlantic right whale mitigation area off the northeast United States, (2) clarify the torpedo (non-explosive) testing visual observation requirements, (3) clarify the conditions needed to recommence an activity after a sighting, and (4) remove the requirement for operators to submit a written request to U.S. Fleet Forces Command for permission prior to conducting hull-mounted surface and submarine active sonar training or helicopter dipping in the mitigation area (these activities are not expected to occur in the area as part of the Proposed Action). The recommended measures are provided below.

The Navy will not conduct the following activities within the boundaries of the mitigation area or within additional specified distances from the mitigation area:

- Improved Extended Echo Ranging sonobuoy exercises in or within 3 nm of the mitigation area
- Bombing exercises (explosive and non-explosive)
- Underwater detonations
- Torpedo exercises (explosive)

The Navy will minimize to the maximum extent practicable the use of the following systems within the boundaries of the mitigation area:

- Low-frequency and hull-mounted mid-frequency active sonar
- High-frequency and non-hull mounted mid-frequency active sonar, including helicopter dipping

Before transiting the mitigation area with a vessel, the Navy will conduct a prior web query or email inquiry to the National Oceanographic and Atmospheric Administration Fisheries Service Northeast United States Right Whale Sighting Advisory System in order to obtain the latest North Atlantic right whale sighting information. When transiting within the mitigation area, vessels will exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. Vessels will implement speed reductions after they observe a North Atlantic right whale, if they are within 5 nm of a sighting reported within the past week, when operating at night, or during periods of poor visibility. These additional speed reductions will be implemented per Rule 6 of International Navigational Rules.

Additional mitigation will be implemented during torpedo (non-explosive) testing: (1) ships will maintain a speed of no more than 10 knots (19 km/hour) during transit, and (2) ship speeds will range from 10 knots (19 km/hour) during normal firing; 18 knots (33.3 km/hour) during submarine target firing; and in excess of 18 knots (33.3 km/hour) during vessel target firing (speeds in excess of 18 knots will occur for a short time [e.g., 10–15 min.]). The Navy will conduct all torpedo (non-explosive) testing during daylight hours in Beaufort sea states of 3 or less to increase the probability of marine mammal detection. Mitigation will include visual observation immediately before and during the exercise within the vicinity of the activity. The Navy will have three Lookouts during torpedo (non-explosive) testing activities (one positioned on a vessel and two in an aircraft during dedicated aerial surveys). An additional Lookout will be positioned on the submarine, when surfaced. Visual observation from the vessels and aircraft will occur immediately prior to and during the activity. Current mitigation requires that aerial observation be conducted from an aircraft with an overhead wing. The Navy is proposing to modify this measure to allow for the aerial observation to be conducted from any aircraft type that would be consistent with established aerial survey protocol. The Navy is also proposing to remove the seasonal restriction and designated training areas in order to allow activities to occur year-round throughout the mitigation area. Currently there are five designated areas within and adjacent to the mitigation area where torpedo (non-explosive) activities may occur. Based on the Proposed Action, torpedo (non-explosive) testing activities will typically continue to be conducted within these established areas. The test scenario will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the vicinity of the activity. The test scenario will cease if a marine mammal is sighted within the vicinity of the activity. The test scenario will recommence if any one of the following conditions is met: (1) the animal is observed exiting the vicinity of the activity, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the vicinity of the activity has been clear from any additional sightings for a period of 30 min.

Effectiveness and Operational Assessments

Important habitats or congregation areas for North Atlantic right whales include the coastal waters of the Great South Channel, Georges Bank/Gulf of Maine, and Cape Cod and Massachusetts Bays. New England waters are an important feeding habitat for right whales due to the dense zooplankton patches, particularly during the spring, summer, and fall. The consistency with which the North Atlantic right whale occurs at its northern feeding grounds is relatively high (Waring et al. 2010). The Right Whale Sighting Advisory System is a National Oceanographic and Atmospheric Administration Fisheries program that collects sightings information off the northeastern United States from aerial surveys, shipboard surveys, whale watch vessels, and opportunistic sources, such as the U.S. Coast Guard, commercial ships, fishing vessels, and the general public.

The Navy is proposing to modify the current seasonal and geographic restrictions for torpedo (non-explosive) testing activities. The current restrictions for torpedo (non-explosive) testing activities are resulting in unacceptable impacts on military readiness because they limit the ability to test new torpedoes or modifications to existing torpedo systems when assets and testing locations are available. All torpedo testing is part of a Navy program development plan and any delay in testing results in a delay in delivery of a war fighting capability requirement to the Fleet. Inability to use assets and testing locations as they become available results in an adverse impact on readiness by (1) resulting in a significant additional annual cost (both in time and personnel associated with program development) to the testing process, (2) adding significant logistical complications, as torpedo testing is largely dependent upon Fleet asset availability, and current restrictions reduce the Navy's availability to obtain assets for testing during this short operational window, and (3) delaying the Navy's ability to complete required testing, finalize associated training materials, and complete training of relevant personnel. Ultimately, these adverse impacts are degrading readiness in that they hinder the Navy's operational platforms from operating at maximum capability against enemy threats. The Navy will continue to conduct most torpedo (non-explosive) testing activities within the currently established torpedo testing areas; however, full seasonal and geographic flexibility is needed in order to prevent unacceptable impacts on readiness.

Requiring the submission of written requests prior to conducting a training or testing activity limits the number of requests that are received, and ultimately reduces the number of activities that could occur in a particular area, such as the North Atlantic right whale foraging habitat off the northeastern United States. However, low-frequency and hull-mounted active sonar training and helicopter dipping activities are not expected to be conducted in this particular area as part of the Proposed Action. As such, the requirement to submit written requests for these activities is no longer needed.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to the North Atlantic right whale, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.1.3 North Atlantic Right Whale Mid-Atlantic Migration Corridor

Recommended Mitigation and Comparison to Current Mitigation

A North Atlantic right whale migratory route is located off the mid-Atlantic coast of the United States. To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) continue implementing additional measures within the North Atlantic right whale mid-Atlantic migration corridor, and (2) modify the definition of the geographic coordinates and dates of the currently implemented mitigation area to match the NMFS guidance for right whale ship strike reduction (National Marine Fisheries Service 2008). The recommended measures are provided below.

This mitigation area applies from November 1 through April 30 and is defined as follows:

- Block Island Sound: The area bounded by 40°51'53.7" North / 070°36'44.9" West; 41°20'14.1" North / 070°49'44.1" West
- New York and New Jersey: 20 nm seaward of the line between 40°29'42.2" North / 073°55'57.6" West
- Delaware Bay: 38°52'27.4" North / 075°01'32.1" West
- Chesapeake Bay: 37°00'36.9" North / 075°57'50.5" West

- Morehead City, North Carolina: 34°41'32.0" North / 076°40'08.3" West
- Wilmington, North Carolina, through South Carolina, and to Brunswick, Georgia: Within a continuous area 20 nm from shore and west back to shore bounded by 34°10'30" North / 077°49'12" West; 33°56'42" North / 077°31'30" West; 33°36'30" North / 077°47'06" West; 33°28'24" North / 078°32'30" West; 32°59'06" North / 078°50'18" West; 31°50'00"North / 080°33'12" West; 31°27'00" North / 080°51'36" West

When transiting within the migration corridor, the Navy will practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives.

Effectiveness and Operational Assessments

Major habitats or congregation areas for North Atlantic right whales include the coastal waters of the southeastern United States, the Great South Channel, Georges Bank/Gulf of Maine, and Cape Cod and Massachusetts Bays. Movements within and between these habitats are extensive (Waring et al. 2010). The Early Warning System and Right Whale Sighting Advisory System sightings data do not extend throughout the North Atlantic right whale migration corridor. Therefore, when transiting within the migration corridor, the Navy's increased vigilance, proceeding at the slowest speed that is consistent with safety, mission, training, and operations will likely reduce the potential for Navy vessels to interact with North Atlantic right whales during seasonal migrations in the absence of more comprehensive sightings information data.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to the North Atlantic right whale, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.2 West Indian Manatee

5.3.3.1.2.1 Manatee Habitat Near Mayport, Florida

Recommended Mitigation and Comparison to Current Mitigation

Information on protective measures pertaining to activities not conducted under the Proposed Action is contained in the Integrated Natural Resources Management Plan for Naval Station Mayport. This mitigation area is located within the basin and channels at Naval Station Mayport in Jacksonville, Florida. To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to continue implementing additional measures in this area. The recommended measures are provided below.

Within the turning basin, basin entrance channel, and all other waterways adjacent to these water bodies at Naval Station Mayport in Jacksonville, Florida, Navy vessels will comply with all federal, state, and local Manatee Protection Zones and reduce speed in accordance with established operational safety and security procedures. The Navy will ensure that small boats operating out of Naval Station Mayport will be fitted with manatee propeller guards. Pursuant to the Naval Station Mayport Integrated Natural Resource Management Plan, the Station provides training to Harbor Operations personnel to report manatee observations to other vessels in the basin and posts signs at select locations alerting personnel of the potential presence of manatees and the requirements and procedures for reporting manatee sightings.

Effectiveness and Operational Assessments

Vessel collisions are the primary cause of injury and death to West Indian manatees. The U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission Manatee Protection Zones are designed to reduce this threat by limiting speeds within designated areas, including certain basins and channels of the Study Area. The Navy's adherence to all federal, state, and local Manatee Protection Zones and participation in the manatee sighting communication system within basins and channels of the Study Area will help reduce the potential for collision with West Indian manatees.

The Navy proposes to implement the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to the manatee, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.2.2 Manatee Habitat Near Port Canaveral, Florida

Recommended Mitigation and Comparison to Current Mitigation

This mitigation area is located within the bay of Port Canaveral, Florida. To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to continue implementing additional measures in this area. The recommended measures are provided below.

The Navy will notify the Port Authority prior to the commencement of pierside sonar testing activities. Pierside sonar testing will only occur during daylight hours to ensure adequate sightability of marine mammals and sea turtles. To facilitate observations, Lookouts will be equipped with polarized sunglasses. The Navy will have a minimum of four Lookouts to conduct visual observations for marine mammals and sea turtles (bins MF8, MF9, MF10, and MF12 only) immediately prior to the start of, during, and for 30 min. after the completion of pierside sonar testing activities. Applicable mitigation zones and post-sighting activity recommencement conditions for pierside sonar testing activities are described in Section 5.3.2.1.1.1, Low-frequency and Hull-mounted Mid-frequency Active Sonar.

Effectiveness and Operational Assessments

In the Study Area, the West Indian manatee's primary range extends along both the Atlantic and gulf coasts of Florida. The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to manatees and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.2.3 Manatee Habitat Near Kings Bay, Georgia

Recommended Mitigation and Comparison to Current Mitigation

Information on protective measures pertaining to activities not conducted under the Proposed Action is contained within the Naval Submarine Base Kings Bay Integrated Natural Resources Management Plan. This mitigation area is located within Kings Bay, Georgia. To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to continue implementing additional measures in this area. The recommended measures are provided below.

When mooring pierside, the Navy will ensure proper fendering techniques (e.g., the use of buoys that keep submarines 20 ft. [6 m.] off of the quay wall) to prevent submarines from injuring a manatee. The Navy will notify the Port Authority prior to the commencement of pierside sonar testing activities. Source level reductions in pierside testing are standard protocol, and a reduction of a minimum of 36 dB

from full power for mid-frequency active sonar transmissions at Kings Bay will be implemented. Pierside sonar testing will only occur during daylight hours to ensure adequate sightability of marine mammals and sea turtles. To facilitate observations, Lookouts will be equipped with polarized sunglasses. The Navy will have a minimum of four Lookouts to conduct visual observations for marine mammals and sea turtles (bins MF8, MF9, MF10, and MF12 only) immediately prior to the start of, during, and for 30 min. after the completion of pierside sonar testing activities. Applicable mitigation zones and post-sighting activity recommencement conditions for pierside sonar testing activities are described in Section 5.3.2.1.1.1, Low-frequency and Hull-mounted Mid-frequency Active Sonar.

As part of the Early Warning Communication System, information regarding all sightings of manatees and sea turtles (e.g., information on the time and location of sighting, number and size of animals sighted, description of the tag if present, and direction of travel) will be communicated to Port Operations for information dissemination to other vessels operating in the vicinity of the sighting. This information will also be communicated to the Georgia Department of Natural Resources sightings hotline and the Base Natural Resources Manager. Port Operations will keep a sightings log of all manatee sightings.

Effectiveness and Operational Assessments

The Atlantic Coast subpopulation of manatee occurs along the Atlantic coast of Georgia and Florida. Manatees are most frequently sighted in the vicinity of Kings Bay from April through July, but have also been sighted in the winter months. The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to manatees and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.2.4 Manatee Habitat Near Camp Lejeune, North Carolina

Recommended Mitigation and Comparison to Current Mitigation

As described in Section 2.8 (Alternative 2: Includes Alternative 1 Plus Increased Tempo of Training and Testing Activities), elevated causeway system pile driving activities could occur up to once per year at either the VACAPES Range Complex (Joint Expeditionary Base, Little Creek and Fort Story) location or Cherry Point Range Complex (Camp Lejeune) location. As described in Section 5.3.1.2.2.16 (Elevated Causeway System – Pile Driving) and Section 5.3.2.1.2.16 (Elevated Causeway System – Pile Driving), the Navy is proposing to add mitigation measures for elevated causeway system pile driving activities regardless of the activity location. For reference, the recommended measures include having one Lookout (positioned on the platform that will maximize the potential for sightings, which could include the shore, an elevated causeway, or a small boat) conduct visual observations starting 30 min. prior to and during the exercise within a mitigation zone of 60 yd. (55 m) around the pile driver. The exercise will not commence if concentrations of floating vegetation (*Sargassum* or kelp paddies) are observed in the mitigation zone. Pile driving will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Pile driving will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 min.

Mitigation measures specific to manatees during elevated causeway system pile driving activities do not currently exist. To supplement the mitigation measures summarized above that apply to all marine

mammals, the Navy is proposing to add the recommended measures provided below for the purpose of further protecting manatees during this activity when conducted near Camp Lejeune, North Carolina.

Prior to elevated causeway system pile driving activities near Camp Lejeune, the Navy project manager or civilian equivalent will inform all personnel associated with the project that manatees may be present in the project area, and the need to avoid any harm to these endangered marine mammals. The Navy project manager or civilian equivalent will ensure that all construction personnel know the general appearance of the species and their behaviors, which may include being completely or partially submerged in shallow water. All construction personnel will be informed that they are responsible for observing water-related activities for the presence of manatees. The Navy project manager or civilian equivalent will advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the MMPA and the ESA.

As described in Section 5.5.2.4 (Marine Mammal Incident Reporting), the Navy will immediately report any injury to a manatee to the U.S. Fish and Wildlife Service (by calling 919.856.4520 ext. 28), NMFS (by calling 252.728.8762), and the North Carolina Wildlife Resources Commission (by calling 252.448.1546). Additionally, the Navy will maintain a log detailing all sightings and injuries to manatees during pile driving activities. Upon completion of the activity, the Navy project manager or civilian equivalent will prepare a report that summarizes all information on manatees encountered and submit the report to the U.S. Fish and Wildlife Service, Raleigh Field Office.

Effectiveness and Operational Assessments

In the Study Area, the West Indian manatee's secondary range includes the coastal waters of North Carolina. The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to manatees and sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.1.3 Cetaceans (General)

5.3.3.1.3.1 Planning Awareness Areas

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue the currently implemented measures within the existing planning awareness areas, and (2) extend the boundary of the eastern Gulf of Mexico planning awareness area to encompass the draft Bryde's whale Biologically Important Area. The recommended measures are provided below.

For events involving active sonar, the Navy will avoid planning major exercises in the planning awareness areas where feasible. To the extent operationally feasible, the Navy will not conduct more than one of the four major exercises or similar scale events per year in the Gulf of Mexico planning awareness areas. If national security needs require conducting more than four major exercises or similar scale events in the planning awareness areas per year, or more than one within the Gulf of Mexico planning awareness areas per year, the Navy will provide NMFS with prior notification and include the information in any associated exercise or monitoring reports.

Effectiveness and Operational Assessments

The Navy has designated several planning awareness areas based on areas of high productivity that have been correlated with high concentrations of marine mammals (e.g., persistent oceanographic features such as upwellings associated with the Gulf Stream front where it is deflected off the east coast near the

Outer Banks of North Carolina), and areas of steep bathymetric contours that are frequented by deep-diving marine mammals (e.g., beaked whales and sperm whales).

As part of the ESA and MMPA processes, NMFS requested that the Navy consider some specific preliminary draft Biologically Important Areas as part of its mitigation analysis. As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Surveys of Bryde's whales throughout the Gulf of Mexico suggest that the Biologically Important Area could potentially be more important for this species than any other area within the Gulf of Mexico. The existing planning awareness areas and expanded area are depicted in Figure 5.3-1.

Within the Study Area, the Navy is not tied to a specific range support structure for the majority of its training requirements. Additionally, the topography and bathymetry along the east coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break affording a wider range of training opportunities. Avoiding planning major training exercises in these areas will help avoid any subsequent potential impacts on marine mammals from these activities in these specific areas.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.2 Seafloor Resources

5.3.3.2.1 Marine Habitats and Cultural Resources

5.3.3.2.1.1 Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify some of the mitigation measures for seafloor habitats and shipwrecks, (2) discontinue the currently implemented measures for medium- and large-caliber gunnery exercises and missile exercises using airborne targets, and (3) add a mitigation requirement for at-sea explosive testing. The recommended measures are provided below. These measures will be implemented wherever applicable throughout the entire AFTT Study Area.

To aid in the implementation of these measures, the Navy will include maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom in the Protective Measures Assessment Protocol. For mitigation, the term "surveyed" refers to bottom features where the available data indicate the natural boundary of the feature at a generally constant accuracy. Data that are generalized within large geometric areas (e.g., grid cells) are not included. Point and transect data will also be included if actual moderate- to high-relief hard bottom is being documented. This criterion excludes some data (e.g., grid-based hard bottom polygons and indicator fish transects).

The shipwreck data documented in Section 3.3 (Marine Habitats) were refined to only accurate positions using the following criteria: (1) not an obstruction, sounding, unknown (non-wreck), dump site, mooring buoy, sewer outfall, piling, or rock; (2) high or medium accuracy location; (3) not disproved; (4) not an approximate position (applied to medium accuracy only); and (5) source information provided.

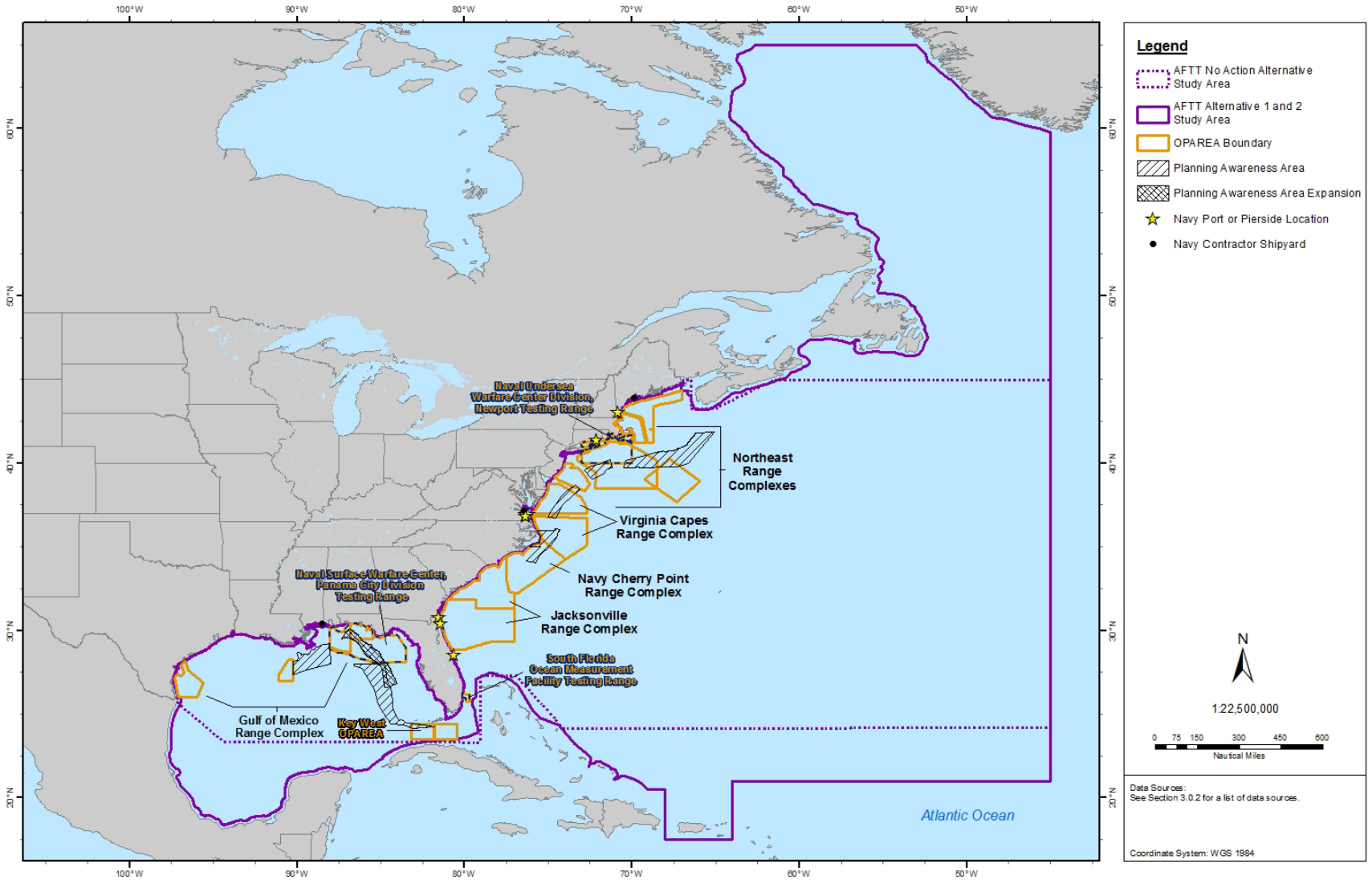

Figure 5.3-1: Navy Planning Awareness Areas

AFTT: Atlantic Fleet Training and Testing; OPAREA: Operating Area

The Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks.

The Navy will not conduct explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target; explosive or non-explosive missile exercises using a surface target; explosive or non-explosive bombing exercises; or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs.

Effectiveness and Operational Assessments

The Navy's currently implemented seafloor habitats and shipwreck mitigation zones are based off the range to effects for marine mammals or sea turtles, which are driven by hearing thresholds. The Navy's recommended measures are modified to focus on reducing potential physical impacts on seafloor habitats and shipwrecks from explosives and physical strike from military expended materials. The recommended 350-yd. (320-m) mitigation zone is based off the estimated maximum seafloor impact zone for explosions discussed in Section 3.3 (Marine Habitats). The use of non-explosive military expended materials would result in a smaller footprint of potential impact; however, the Navy recommends applying the explosive mitigation zone to all explosive and non-explosive activities as listed above for ease of implementation. This standard mitigation zone will consequently result in an additional protection buffer during the non-explosive activities listed above.

It is not possible to definitively predict or to effectively monitor where the military expended materials from airborne gunnery and missile exercises using aerial targets would be likely to strike seafloor habitats and shipwrecks. The potential debris fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location during some missile exercises, and thousands of yards for shorter events, which can occur within several thousand yards of the firing location.

Live hard bottom, shallow water coral reefs, artificial reefs, and shipwrecks fulfill important ecosystem functions. Avoiding or minimizing physical disturbance and strikes of these resources will likely reduce the impact on these resources. This measure is only effective with regard to surveyed resources since the Navy needs specific locations to restrict the specified activities. It is not possible for the Navy to avoid these seafloor features when their exact locations are unknown.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of physical disturbance and strikes to seafloor habitats and shipwrecks, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.2.1.2 Live Hard Bottom and Shallow Coral Reefs Within South Florida Ocean Measurement Facility

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to 1) continue the South Florida Ocean Measurement Facility Testing Range measures as currently implemented for installation, deployment, and recovery of anchors and mine-like objects, and 2) add measures for use of bottom crawling unmanned underwater vehicles. Currently, measures do not exist for bottom crawling unmanned underwater vehicles. The recommended measures are provided below.

Anchors and Mine-like Objects

Installation of anchors and mine-like objects are conducted using real-time geographic information system and global positioning system, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. The following procedures will be followed:

- Mooring (anchors and mine-like objects) placement locations would be identified in advance to minimize at-sea mission time and navigation.
- The deployment vessel will hold a relatively fixed position over the work area using a dynamic positioning navigation system with global positioning system.
- Vessel movement and drift will be minimized to ensure that the proposed mooring installation plan is followed with limited deviation.
- Construction work vessels will not anchor or spud over coral, coral reef, and hard bottom habitat.
- Semi-permanent anchoring that was surveyed and installed clear of sensitive resources will be used. These anchoring systems will be assisted with riser buoys to prohibit contact of the mooring cable with the sea floor.
- All watercraft associated with the construction and use of the permitted structures will only operate within waters of sufficient depth so as to preclude bottom scouring or prop dredging. Specifically, there shall be a minimum 12-in. clearance between the deepest draft of the vessel (with the motor in the down position) and the bottom substrate at mean low water.
- Operations will only be conducted when sea and wind conditions allow the vessels to maintain maximum position and speed control.

Bottom Crawling Unmanned Underwater Vehicles

Deployment of the bottom crawling unmanned underwater vehicles would mainly occur in waters less than 9.8 ft. (3 m) in depth. However, if deployment is necessary greater than 9.8 ft. (3 m) in depth, it will be conducted using real-time geographic information system and global positioning system, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities. In addition, any of the procedures for anchors and mine-like objects that are applicable to deployment and recovery of bottom crawling unmanned underwater vehicles will be followed.

Effectiveness and Operational Assessments

Live hard bottom and shallow water coral reefs fulfill important ecosystem functions. Avoiding or minimizing physical disturbance and strikes of these resources will reduce the impact on these resources.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of physical disturbance and strikes to live hard bottom and shallow coral reefs, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.3 Reptiles

5.3.3.3.1 Sea Turtles

5.3.3.3.1.1 Sea Turtle Habitat off Panama City, Florida

Recommended Mitigation and Comparison to Current Mitigation

To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) modify the definition of nesting season to be from March through September (i.e., adding March and April), (2) modify the time of day requirement for conducting ordnance testing – line charge testing at Naval Surface Warfare Center, Panama City Division Testing Range, and (3) eliminate the requirement to avoid conducting electromagnetic mine countermeasure and neutralization activities within 32 yd. (30 m) of shore during sea turtle nesting season at Naval Surface Warfare Center, Panama City Division Testing Range. For reference, the Navy currently defines the nesting season as May through September. The recommended measures are provided below.

The Navy will avoid conducting ordnance testing – line charge testing activities at Naval Surface Warfare Center, Panama City Division Testing Range at night from March through September.

Effectiveness and Operational Assessments

Kemp's ridley sea turtles have a nesting season that extends from April through June (U.S. Fish and Wildlife Service 2001b). Kemp's ridley sea turtles nest in low numbers along the northern Texas, Alabama, and Florida coasts (fewer than 10 nests per year). Green sea turtle nesting season extends from June through September from the coasts of Florida to the Carolinas (U.S. Fish and Wildlife Service 2001a). Loggerhead nesting season extends from May through August from the coast of Texas to Virginia (U.S. Fish and Wildlife Service 2001d). Leatherback nesting season extends from March through July from the coast of Texas to the Carolinas (U.S. Fish and Wildlife Service 2001c). The Navy proposes extending the sea turtle nesting season definition to be from March through September (adding March and April) to account for the full leatherback sea turtle nesting season.

The designated line charge testing location on Santa Rosa Island within the Naval Surface Warfare Center, Panama City Division Testing Range is currently the Navy's only location capable of supporting this type of activity. The seasonal restriction is preventing the Navy from conducting line charge testing activities for 5 months out of the year, which is resulting in an unacceptable impact on military readiness and increased risk to personnel safety. The seasonal restriction is eliminating opportunities to test the capabilities of line charge testing munitions to safely clear surf zone areas for sea-based expeditionary operations. The Navy needs the flexibility to conduct these tests year-round in order to meet changing operational timelines and combat deployment schedules.

Avoidance of ordnance testing – line charge testing activities at Naval Surface Warfare Center, Panama City Division Testing Range at night from March through September is likely to reduce potential impacts on green, Kemp's ridley, loggerhead, and leatherback sea turtles during the time of day when they would be most likely to transit to and from their nesting beaches. As discussed in Section 5.3.2.1.2.14 (Ordnance Testing – Line Charge Testing), the Navy will visually observe for sea turtles immediately before and during the activity.

The Navy is proposing to eliminate the measure to avoid conducting electromagnetic mine countermeasure and neutralization activities within 32 yd. (30 m) of shore during sea turtle nesting season at Naval Surface Warfare Center, Panama City Division Testing Range due to the environmental

consequences analysis suggesting that impacts are not expected on sea turtles from electromagnetic activities. Therefore, this measure would not be necessary for avoiding or reducing potential environmental impacts.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.3.1.2 Sea Turtle Habitat off North Carolina

Recommended Measure and Comparison to Current Mitigation

To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), during mine countermeasure and neutralization activities using positive control diver-placed charges and mine neutralization activities using diver-placed time-delay firing devices, the Navy is proposing to (1) clarify the applicable season for the currently implemented measure during sea turtle nesting season within the Navy Cherry Point Range Complex, and (2) discontinue the requirement that detonations are not allowed within 3.2 nm of an estuarine inlet and within 1.6 nm of shoreline for the VACAPES or JAX Range Complexes. The recommended measures are provided below.

Within the Navy Cherry Point Range Complex, the Navy will not conduct mine countermeasure and neutralization activities using positive control diver-placed charges and mine neutralization activities using diver-placed time-delay firing devices within 3.2 nm of an estuarine inlet and within 1.6 nm of the shoreline from March through September.

Effectiveness and Operational Assessments

The measure regarding distance from shore was initially established for mine countermeasure and neutralization activities using positive control diver-placed charges and was intended to reduce potential impacts on nesting sea turtles and hatchlings that may be close to shore. These activities are not typically conducted within 3.2 nm of an estuarine inlet and within 1.6 nm of the shoreline within the VACAPES or JAX Range Complexes, so mitigation is not typically needed in those areas. However, flexibility is necessary due to these activities being conducted with the use of small boats that would typically leave from a coastal inlet and operate in nearshore waters. Although sea turtle nesting does occur along the coast of Virginia, it is mainly concentrated further south along the coast of Florida and in the Gulf of Mexico. In the rare instance that a mine countermeasure and neutralization activity would occur within the specified distance from shore within the VACAPES and JAX Range Complexes, the mitigation zone measures would help reduce the potential impacts on sea turtles that are available to be observed (Section 5.3.2.1.2.4, Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices and Section 5.3.2.1.2.5, Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices). The Navy proposes discontinuing the measures within the VACAPES and JAX Range Complexes because the measures would not be necessary for avoiding or reducing the potential of injury to sea turtles. The Navy recommends continuing the measure during sea turtle nesting season within the Navy Cherry Point Range Complex due to the proximity to the Onslow Beach sea turtle sanctuary.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to sea turtles, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.4 Birds

5.3.3.4.1 Piping Plovers

5.3.3.4.1.1 Piping Plover Breeding Habitat in Virginia

Recommended Mitigation and Comparison to Current Mitigation

To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) continue implementing additional measures near piping plover breeding habitat in Virginia. The recommended measures are provided below.

Within the VACAPES Range Complex, during mine countermeasure and neutralization activities using positive control diver-placed charges and mine neutralization activities using diver-placed time-delay firing devices, helicopters will remain at least 1 nm from the beach except when transiting offshore. When transiting from Norfolk Naval Station to offshore, helicopters will avoid overflying Fisherman Island National Wildlife Refuge off the coast of Cape Charles, Virginia by at least 3,000 ft. (914 m) vertically and horizontally to avoid disturbing piping plovers and other birds.

Effectiveness and Operational Assessments

The Eastern Shore of Virginia's barrier islands serve as important breeding habitat for the ESA-listed piping plover. Due to the location of Fisherman Island National Wildlife Refuge to Norfolk Naval Station, piping plovers and other seabirds could potentially be exposed to aircraft overflights as aircraft transit offshore. The helicopter measures recommended during mine countermeasure and neutralization activities using positive control diver-placed charges and mine neutralization activities using diver-placed time-delay firing devices within the VACAPES Range Complex and near Fisherman Island National Wildlife Refuge will likely reduce the potential to disturb piping plovers and other birds within this breeding habitat.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to piping plovers, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3.5 Fish

5.3.3.5.1 Gulf Sturgeon

5.3.3.5.1.1 Gulf Sturgeon Habitat in the Gulf of Mexico

Recommended Mitigation and Comparison to Current Mitigation

The Gulf sturgeon mitigation area, which is modeled after the species' critical habitat (depicted in Figure 3.9-3), is defined as nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida from the shoreline to 1 mi. (1.6 km) offshore. The mitigation area includes migration habitat for Gulf sturgeon en route from Gulf of Mexico winter and feeding grounds to their spring and summer natal (hatching) rivers (the Yellow, Choctawhatchee, and Apalachicola Rivers). To supplement the mitigation measures described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy is proposing to (1) continue implementing ordnance testing – line charge testing restrictions within the Gulf sturgeon mitigation area, and (2) eliminate the seasonal limitation at one designated location in order to allow ordnance testing – line charge testing to occur year-round on Santa Rosa Island. For reference, the Navy does not currently conduct ordnance testing – line charge testing activities in the mitigation area between October and March. The recommended measures are provided below.

The Navy will not conduct ordnance testing – line charge testing activities in the mitigation area between October and March (except within the designated location on Santa Rosa Island).

Effectiveness and Operational Assessments

Santa Rosa Island is located within the Naval Surface Warfare Center, Panama City Division Testing Range. The designated line charge testing location on Santa Rosa Island is currently the Navy's only location capable of supporting this type of activity. The seasonal restriction is preventing the Navy from conducting line charge testing activities for 6 months out of the year, which is resulting in an unacceptable impact on military readiness and increased risk to personnel safety. The seasonal restriction is eliminating opportunities to test the capabilities of line charge testing munitions to safely clear surf zone areas for sea-based expeditionary operations. The Navy needs the flexibility to conduct these tests year-round in order to meet changing operational timelines and combat deployment schedules.

Avoidance of ordnance testing – line charge testing activities within the mitigation area (except within the designated location on Santa Rosa Island) is likely to reduce potential impacts on the Gulf sturgeon during the species' migration. As discussed in Section 5.3.2.1.2.14 (Ordnance Testing – Line Charge Testing), during testing at Santa Rosa Island, activity in the surf zone (e.g., deployment of the line charges) prior to commencement of the detonation will likely result in Gulf sturgeon leaving the immediate area of their own volition, which will further reduce potential impacts on the species.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to the Gulf sturgeon, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.4 MITIGATION MEASURES CONSIDERED BUT ELIMINATED

A number of mitigation measures were suggested during the public comment periods of previous Navy environmental documents and throughout the development of this Final EIS/OEIS. As a result of the assessment process identified in Section 5.2 (Introduction to Mitigation), the Navy determined that some of the suggested measures would likely be ineffective at reducing environmental impacts, have an unacceptable operational impact based on the operational assessment, or be incompatible with Section 5.2.2 (Overview of Mitigation Approach). The measures that the Navy does not recommended for implementation are discussed in Section 5.3.4.1 (Previously Considered but Eliminated) and Section 5.3.4.2 (Previously Accepted but Now Eliminated). There is a distinction between effective and feasible observation procedures for data collection, and measures employed to prevent impacts or otherwise serve as mitigation. The discussion below is in reference to those procedures meant to serve as mitigation measures.

5.3.4.1 Previously Considered but Eliminated

5.3.4.1.1 Reducing Amount of Training and Testing Activities

Reducing training and testing for the purpose of mitigation would result in an unacceptable impact on readiness for the following reasons:

The requirements to train are designed to provide the experience needed to ensure Sailors are properly prepared for operational success. Training requirements have been developed through many years of iteration and are designed to ensure Sailors achieve the levels of readiness needed to properly respond

to the many contingencies that may occur during an actual mission. The Proposed Action does not include training beyond levels required for maintaining satisfactory levels of readiness due to the need to efficiently use limited resources (e.g., fuel, personnel, and time). Therefore, any reduction of training would not allow Sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

The requirements to test systems prior to their implementation in military activities are identified in Department of Defense (DoD) Directive 5000.1. This directive states that test and evaluation support is to be integrated throughout the defense acquisition process. The Navy rigorously collected data during the developmental stages of this EIS/OEIS to accurately quantify test activities necessary to meet requirements of DoD Directive 5000.1. These testing requirements are designed to determine whether systems perform as expected and are operationally effective, suitable, survivable, and safe for their intended use. Any reduction of testing activities would not allow the Navy to meet its purpose and need to achieve requirements set forth in DoD Directive 5000.1.

5.3.4.1.2 Replacing Training and Testing with Simulated Activities

Replacing training and testing activities with simulated activities for the purpose of mitigation would result in an unacceptable impact on readiness for the following reasons:

As described in Section 2.5.1.3 (Simulated Training and Testing), the Navy currently uses computer simulation for training and testing whenever possible. Computer simulation can provide familiarity and complement live training; however, it cannot provide the fidelity and level of training necessary to prepare naval forces for deployment. The Navy is required by law to operationally test major platforms, systems, and components of these platforms and systems in realistic combat conditions before full-scale production can occur. Substituting simulation for live training and testing fails to meet the purpose of and need for the Proposed Action and therefore was eliminated from consideration as a mitigation measure.

5.3.4.1.3 Reducing Sonar Source Levels and Total Number of Hours

Active sonar is only used when required by the mission since it has the potential to alert opposing forces to the sonar platform's presence. Passive sonar and all other sensors are used in concert with active sonar to the maximum extent practicable when available and when required by the mission. Reducing active sonar source levels and the total number of active sonar hours used during training and testing activities for the purpose of mitigation would adversely impact the effectiveness of military readiness activities and increase safety risks to personnel for the following reasons:

Sonar operators need to train as they would operate during real world combat situations. Operators of sonar equipment are always cognizant of the environmental variables affecting sound propagation. In this regard, sonar equipment power levels are always set consistently with mission requirements. Reducing sonar source levels for the purpose of mitigation precludes sonar operators from learning to operate the sonar systems with their entire range of capabilities throughout the extremely diverse range of environmental conditions they may encounter. Failure to train with the entire range of capabilities will reduce the effectiveness of the sonar operators, should their skills be required during real world events. Sonar operators would not develop the skills necessary to identify and track submarines at the maximum distances of their systems' capabilities. They would also not learn how to use their systems' capabilities during the entire range of environmental conditions they may encounter. Likewise, they would not learn how to fully integrate multiple anti-submarine warfare capabilities, including other ships and aircraft into an integrated anti-submarine warfare team.

Failure to train with the entire range of capabilities also compromises training by reducing the ability for a sonar operator to detect, track, and hold an enemy target, mine, or other object; and by reducing the realism of other training scenarios (e.g., navigation training). Particularly during a strike group exercise, sonar operators need to learn to handle real world combat situations (e.g., the ability to manage sonar operations during periods of mutual interference, which can occur when more than one sonar system is operating simultaneously). Training with reduced sonar source levels would ultimately condition Sailors to expect conditions that they would not experience in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the strike group's ability to achieve mission success.

The Navy must test its systems in the same way they would be used for military readiness activities. Reducing sonar source levels during testing would impact the ability to determine whether systems are operationally effective, suitable, survivable, and safe. Ultimately, reducing sonar source levels would reduce training and testing realism. Reducing the total number of sonar hours used during training and testing would prevent the Navy from meeting its military readiness qualification standards.

5.3.4.1.4 Implementing Active Sonar Ramp-Up Procedures During Training

Implementing active sonar ramp-up procedures (slowly increasing the sound in the water to necessary levels) in an attempt to clear the range prior to conducting activities for the purpose of mitigation during training activities would result in an unacceptable impact on readiness and would not necessarily be effective at reducing potential impacts on marine species for the following reasons:

Ramp-up procedures would alert opponents to the participants' presence. This would consequently negatively affect the realism of training because the target submarine could detect the searching unit before the searching unit could detect the target submarine, enabling the target submarine to take evasive measures. This is not representative of a real world situation and thereby would impact training realism and effectiveness. Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and sonar operators' ability to achieve mission success.

Although ramp-up procedures have been used for some testing activities, effectiveness at avoiding or reducing impacts on marine mammals has not been demonstrated. Until evidence suggests that ramp-up procedures are effective means of avoiding or reducing potential impacts on marine mammals, the Navy will not implement this measure for training activities and is also proposing to eliminate its implementation for testing activities as part of the Proposed Action (Section 5.3.4.2.1, Implementing Active Sonar Ramp-Up Procedures During Testing).

5.3.4.1.5 Reducing Vessel Speed

As described in Section 5.1.1 (Vessel Safety), as a standard operating procedure, Navy personnel are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety. These standard operating procedures are designed to allow a vessel to take proper and effective action to avoid a collision with any sighted object or disturbance (which may include a marine mammal), and to stop within a distance appropriate to the prevailing circumstances and conditions.

Additionally, Navy-recommended mitigation includes reducing vessel speed within several mitigation areas that have been well-documented as important habitat for the North Atlantic right whale and West Indian manatee. Refer to Section 5.3.3.1.1.1 (North Atlantic Right Whale Southeast Calving Habitat), Section 5.3.3.1.1.2 (North Atlantic Right Whale Northeast Foraging Habitat), and Section 5.3.3.1.2.1

(Manatee Habitat near Mayport, Florida) for additional discussion on these speed restriction mitigation measures. Otherwise implementing widespread reductions in vessel speed throughout the Study Area for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, and result in an unacceptable impact on readiness for several reasons. Vessel operators need to be able to react to changing tactical situations and evaluate system capabilities in training and testing as they would in actual combat. Widespread speed restrictions would not allow the Navy to properly test vessel capabilities (e.g., full power propulsion testing during sea trials). Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the vessel operators' ability to achieve mission success.

5.3.4.1.6 Limiting Access to Training and Testing Locations

Limiting training and testing activities to specific locations for the purpose of mitigation would be impractical with regard to implementation, would adversely impact the effectiveness of military readiness activities, and would increase safety risks to personnel for the following reasons:

As described in Section 2.5.1.1 (Alternative Training and Testing Locations), the ability to use the diverse and multidimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Major exercises using integrated warfare components require large areas of the littorals, open ocean, and certain nearshore areas for realistic and safe training. Limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to specific locations (e.g., abyssal waters and surveyed offshore waters) and avoiding areas (e.g., embayments or large areas of the littorals and open ocean such as waters west of the Florida Keys and Dry Tortugas) would be impractical to implement with regard to the need to conduct activities in proximity to certain facilities, range complexes, and testing ranges. The Navy typically conducts activities in proximity to certain facilities, range complexes, and testing ranges in order to reduce travel time and funding required to conduct training away from a unit's home base. Activities involving the use of helicopters typically occur in proximity to shore or refueling stations due to fuel restrictions and personnel safety. Training and testing location limitations would also adversely impact the safety of the training and testing activities by requiring activities to take place in more remote areas where safety support may be limited.

Training and testing activities require continuous access to large areas consisting potentially of thousands of square miles of ocean and air space to provide naval personnel the ability to train with and develop competence and confidence in their capabilities and their entire suite of weapons and sensors. Exercises may change mid-stream based on evaluators' assessments of performance and other conditions including weather or mechanical issues. These may preclude use of a permission scheme for access to water space. Threats to national security are constantly evolving and the Navy requires the ability to adapt training to meet these emerging threats as well as develop and test systems to effectively operate by sharpening knowledge of how to operate in these environments. Restricting access to limited locations would impact the ability for Navy training and testing to evolve as the threat evolves.

Operational units already incorporate requirements for safety of personnel, including air space and shipping routes. Safety restrictions may include limits on distance from military air fields during carrier flight operations and air traffic corridors for safety of military and civilian aviation. These types of limitations shape how exercise planners develop and implement training scenarios, including those involving defense of aircraft carriers from submarines.

Therefore, limiting access to training and testing locations would reduce realism of training by restricting access to important real world combat situations, such as bathymetric features and varying oceanographic features. As described in Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions), Sailors must be trained to handle bottom bounce, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity. Training in a few specific locations would alter Sailors' abilities to effectively operate in varying real world combat situations, thereby resulting in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

5.3.4.1.7 Avoiding Locations Based on Bathymetry and Environmental Conditions

As discussed in Section 5.3.3.1.3.1 (Planning Awareness Areas), the Navy has designated several planning awareness areas based on areas of high productivity that have been correlated with high concentrations of marine mammals (e.g., persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep-diving marine mammals such as beaked whales and sperm whales. For reference, the planning awareness areas encompass the Mississippi Canyon and a portion of the DeSoto Canyon.

For events involving active sonar, the Navy will avoid planning major exercises in the planning awareness areas where feasible. Otherwise avoiding locations for training and testing activities based on bathymetry and environmental conditions for the purpose of mitigation would result in unacceptable impacts on readiness and increased risk to personnel safety for the following reasons:

Areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events. As described in Section 2.5.1.1 (Alternative Training and Testing Locations), the varying environmental conditions of the Study Area (e.g., bathymetry and topography) maximize the training realism and testing effectiveness. Limiting training and testing, including the use of sonar and other active acoustic sources or explosives, to avoid steep or complex bathymetric features (e.g., submarine canyons and large seamounts) and oceanographic features (e.g., surface fronts and variations in sea surface temperatures) would reduce the realism of the military readiness activity. Systems must be tested in a variety of bathymetric and environmental conditions to ensure functionality and accuracy in a variety of environments. Sonar operators need to train as they would operate during real world combat situations. Because real world combat situations include diverse bathymetric and environmental conditions, Sailors must be trained to handle bottom bounce, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity. Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the sonar operators' ability to achieve mission success.

5.3.4.1.8 Avoiding or Reducing Active Sonar at Night and During Periods of Low Visibility

Avoiding or reducing active sonar at night and during periods of low visibility for the purpose of mitigation would result in an unacceptable impact on readiness for the following reasons:

The Navy must train in the same manner as it will fight. Anti-submarine warfare can require a significant amount of time to develop the "tactical picture," or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). Reducing or securing power in low-visibility conditions would affect a commander's ability to develop this tactical picture and would not provide the needed training realism. Training differently from what would be

needed in an actual combat scenario would decrease training effectiveness, reduce crews' abilities, and introduce an increased safety risk to personnel.

Mid-frequency active sonar training is required year-round in all environments, including night and low-visibility conditions. Training occurs over many hours or days, which requires large teams of personnel working together in shifts around the clock to work through a scenario. Training at night is vital because environmental differences between day and night affect the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day, which affects sound propagation and could affect how sonar systems are operated. Consequently, personnel must train during all hours of the day to ensure they identify and respond to changing environmental conditions, and not doing so would unacceptably decrease training effectiveness and reduce the crews' abilities. Therefore, the Navy cannot operate only in daylight hours or wait for the weather to clear before training.

The Navy must test its systems in the same way they would be used for military readiness activities. Reducing or securing power in adverse weather conditions or at night would impact the ability to determine whether systems are operationally effective, suitable, survivable, and safe. Additionally, some systems have a nighttime testing requirement. Therefore, Navy personnel cannot operate only in daylight hours or wait for the weather to clear before or during all test events.

5.3.4.1.9 Avoiding or Reducing Active Sonar During Strong Surface Ducts

Avoiding or reducing active sonar during strong surface ducts for the purpose of mitigation wouldincrease safety risks to personnel, be impractical with regard to implementation of military readiness activities, and result in unacceptable impacts on readiness for the following reasons:

The Navy must train in the same manner as it will fight. Anti-submarine warfare can require a significant amount of time to develop the "tactical picture," or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). Surface ducting is a condition when water conditions (e.g., temperature layers, lack of wave action) result in little sound energy penetrating beyond a narrow layer near the surface of the water. Submarines have long been known to exploit the phenomena associated with surface ducting. Therefore, training in surface ducting conditions is a critical component to military readiness because sonar operators need to learn how sonar transmissions are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively in this environment. Avoiding or reducing active sonar during surface ducting conditions would affect a commander's ability to develop this tactical picture and would not provide the needed training realism. Diminished realism would reduce a sonar operator's ability to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

Furthermore, avoiding surface ducting would be impractical to implement because ocean conditions contributing to surface ducting change frequently, and surface ducts can be of varying duration. Surface ducting can also lack uniformity and may or may not extend over a large geographic area, making it difficult to determine where to reduce power and for what periods.

5.3.4.1.10 Avoiding Locations Based on Distances From Isobaths or Shorelines

Avoiding locations for training and testing activities within the AFTT Study Area based on wide-scale distances from isobaths or the shoreline for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, result in unacceptable impact on readiness, would not

be an effective means of mitigation, and would increase safety risks to personnel for the following reasons:

A measure requiring avoidance of mid-frequency active sonar within 13 nm of the 656 ft. (200 m) isobaths was part of the Rim of the Pacific exercise 2006 authorization by NMFS. The Rim of the Pacific exercise was outside of the AFTT Study Area. This measure, as well as similar measures of like distances, lacks any scientific basis when applied to the context of the AFTT Study Area (e.g., bathymetry, sound propagation, and width of channels). There is no scientific analysis indicating this measure is protective and no known basis for these specific metrics. The Rim of the Pacific Exercise 2006 mitigation measure precluded active anti-submarine warfare training in the littoral region, which significantly impacted realism and training effectiveness (e.g., protecting ships from submarine threats during amphibious landings). This mitigation procedure had no observable impact on the protection of marine mammals during Rim of the Pacific Exercise 2006, and its value is unclear; however, its adverse impact on realistic training, as with all arbitrary distance-from-land restrictions, is significant.

Training in shallow water is an essential component to maintaining military readiness. Sound propagates differently in shallow water and operators must learn to train in this environment. Additionally, submarines have become quieter through the use of improved technology and have learned to hide in the higher ambient noise levels of the shallow waters of coastal environments. In real world events, it is highly likely that Sailors would be working in, and therefore must train in, these types of areas.

Areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events. The proximity to facilities, range complexes, and testing ranges is essential to the training and testing realism and effectiveness required to train and certify naval forces ready for combat operations. Limiting access to nearshore areas would restrict access to certain training and testing locations and would increase transit time for these activities, which would result in an increased risk to personnel safety, particularly for platforms with fuel restrictions (e.g., aircraft) or for certain activities such as mine countermeasures and neutralization activities using diver-placed mines.

The ability to use the diverse and multi-dimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Otherwise limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to avoid arbitrary distances from isobaths or the shoreline would adversely impact the effectiveness of the training and testing. This includes avoiding conducting activities within 12 nm from shore, 25 nm from shore, between shore and the 20 m isobath, and 13 nm out from the 656 ft. (250 m) isobath. Operating in shallow water is essential in order to provide realistic training during real world combat conditions with regard to shallow water sound propagation.

5.3.4.1.11 Avoiding Marine Species Habitats

The Navy has recommended measures within several mitigation areas (Section 5.3.3, Mitigation Areas) that have been well-documented as important habitats for particular species and in which implementation of mitigation would not result in unacceptable impacts on readiness. These mitigation areas have been carefully selected on a case-by-case basis through consultation with NMFS and the U.S. Fish and Wildlife Service. Otherwise avoiding all marine species habitats (e.g., foraging locations, reproductive locations, migration corridors, and locations of modeled takes) for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, would result in unacceptable impacts on readiness, and would increase safety risks to personnel for the following reasons:

As described in Section 5.3.4.1.6 (Limiting Access to Training and Testing Locations) and Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions), areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events, and the varying environmental conditions of these areas maximize the training realism and testing effectiveness. Activity locations inevitably overlap a wide array of marine species habitats, including foraging habitats, reproductive areas, and migration corridors. Otherwise limiting activities to avoid these habitats would adversely impact the effectiveness of the training or testing activity, and would therefore result in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

As described in the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Marine Species Modeling Team 2013), modeling locations were developed based on historical data and anticipated future needs. The model does not provide information detailed enough to analyze or compare locations based on potential take levels for each activity; therefore applying the modeling results to inform development of mitigation areas would not be appropriate.

5.3.4.1.12 Avoiding Marine Protected Areas

This section discusses marine protected areas (excluding national marine sanctuaries). Refer to Section 5.3.4.2.8 (Limiting Active Sonar Activities within National Marine Sanctuaries) for a discussion specific to national marine sanctuaries.

The Navy has recommended measures within several mitigation areas (Section 5.3.3, Mitigation Areas) that have been well-documented as important habitats for particular species and in which implementation of mitigation would not result in unacceptable impacts on readiness. These mitigation areas have been carefully selected on a case-by-case basis through consultation with NMFS and the U.S. Fish and Wildlife Service. Otherwise avoiding all marine protected areas for the purpose of mitigation would result in an unacceptable impacts on readiness; increase safety risks to personnel; be impractical with regard to implementation; and would not be warranted based on the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for biological resources, Section 6.1.2 (Marine Protected Areas) discussions, and the discussions below. Furthermore, the mitigation measures outlined in Section 5.3.1 (Lookout Procedural Measures) and Section 5.3.2 (Mitigation Zone Procedural Measures) have been developed to reduce potential impacts on marine species regardless of activity location.

As described in Section 6.1.2 (Marine Protected Areas), due to the nature of most training and testing activities (e.g., requiring deep water), proposed activities are unlikely to occur in the extremely shallow nearshore waters typical of most marine protected areas. Within most marine protected areas, the only activity likely to occur is an aircraft overflight during transit from an airfield to an offshore training or testing location. Exposure of marine protected area resources to aircraft overflights would be brief and is expected to cause only a minor and temporary behavioral reaction due to noise for marine mammals, sea turtles, birds, or fish that may be present in the area. There is potential for birds to be struck by aircraft; however, the Navy implements standard operating procedures that require pilots of Navy aircraft to make every attempt to avoid large flocks of birds in order to reduce the safety risk involved with a potential bird strike. Additional mitigation or avoidance of these marine protected areas would be unnecessary, and limiting passage through the areas would restrict direct access to training and testing locations. Such avoidance would ultimately increase transit time and for platforms with fuel restrictions (e.g., aircraft) would therefore result in an unacceptable increased risk to personnel safety.

For marine protected areas (e.g., gear restricted areas) located further offshore, activities in addition to aircraft overflights may occur. Refer to Section 6.1.2 (Marine Protected Areas) for a more detailed discussion on the activities that are expected to occur within marine protected areas in the Study Area. Ultimately, limiting access to training and testing locations that overlap, are contained within, or are adjacent to marine protected areas would reduce realism of training by restricting access to important real world combat situations, such as bathymetric features and varying oceanographic features. As described in Section 2.5.1.1 (Alternative Training and Testing Locations), the ability to use the diverse and multidimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Major exercises using integrated warfare components require large areas of the littorals, open ocean, and certain nearshore areas for realistic and safe training. Limiting training and testing to specific locations and avoiding all marine protected areas would be impractical to implement with regard to the need to conduct activities in proximity to certain facilities, range complexes, and testing ranges. The Navy typically conducts activities in proximity to certain facilities, range complexes, and testing ranges in order to reduce travel time and funding required to conduct training away from a unit's home base. Activities involving the use of helicopters typically occur in proximity to shore or refueling stations due to fuel restrictions and personnel safety. Training and testing location limitations would also adversely impact the safety of the training and testing activities by requiring activities to take place in more remote areas where safety support may be limited. Refer to Section 5.3.4.1.6 (Limiting Access to Training and Testing Locations) for further discussion on the impacts of limiting access to training and testing locations on the Navy's ability to maintain military readiness.

5.3.4.1.13 Increasing Visual and Passive Acoustic Observations

Increasing visual and passive acoustic observations for the purpose of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impacts on readiness for the following reasons:

The Navy-recommended mitigation measures already represent the maximum level of effort (e.g., numbers of Lookouts and passive sonobuoys) that the Navy can commit to observe mitigation zones given the number of personnel that will be involved and the number and type of assets and resources available. The number of Lookouts that the Navy recommends for each measure often represents the maximum capacity based on limited resources (e.g., space and manning restrictions). For example, platforms such as the Littoral Combat Ship are minimally manned and are therefore physically unable to accommodate more than one Lookout. Furthermore, training and testing activities are carefully planned with regard to personnel duties. Requiring additional Lookouts would either require adding personnel, for which there would be no additional space, or reassigning duties, which would divert Navy personnel from essential tasks required to meet mission objectives.

The Navy will conduct passive acoustic monitoring during several activities with Navy assets, such as sonobuoys, already participating in the activity (e.g., sinking exercises, torpedo [explosive] testing, and Improved Extended Echo Ranging sonobuoys). Refer to Section 5.3.2 (Mitigation Zone Procedural Measures) for additional information on the use of passive acoustics during training and testing activities. The Navy does not have the resources to construct and maintain additional passive acoustic monitoring systems for each training and testing activity.

5.3.4.1.14 Increasing the Size of Observed Mitigation Zones

Increasing the size of observed mitigation zones for the purpose of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impact on readiness for the following reasons:

The Navy developed activity-specific mitigation zones based on the Navy's acoustic propagation model. In this AFTT analysis, the Navy developed each recommended mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, PTS, out to the predicted maximum range. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also covers the predicted average range to TTS. In some instances, the Navy recommends mitigation zones that are larger or smaller than the predicted maximum range to PTS based on the associated effectiveness and operational assessments presented in Section 5.3.2 (Mitigation Zone Procedural Measures).

The Navy-recommended mitigation zones represent the maximum area the Navy can effectively observe based on the platform of observation, number of personnel that will be involved, and the number and type of assets and resources available. As mitigation zone sizes increase, the potential for reducing impacts decreases. For instance, if a mitigation zone increases from 1,000 to 4,000 yd. (914 to 3,658 m), the area that must be observed increases sixteen-fold. The Navy-recommended mitigation measures balance the need to reduce potential impacts with the ability to provide effective observations throughout a given mitigation zone. Implementation of mitigation zones is most effective when the zone is appropriately sized to be realistically observed. The Navy does not have the resources to maintain additional Lookouts or observer platforms that would be needed to effectively observe mitigation zones of increased size. Further, as explained above, the number of Lookouts that the Navy recommends for each measure often represents the maximum capacity based on limited resources (e.g., space and manning restrictions). For example, platforms such as the Littoral Combat Ship are minimally manned and are therefore physically unable to accommodate more than one Lookout. Training and testing activities are carefully planned with regard to personnel duties. Requiring observation of mitigation zones of increased size would either require adding personnel, for which there would be no additional space or resources, or reassigning duties, which would divert Navy personnel from essential tasks required to meet mission objectives. For most activities, Lookouts are required to observe for concentrations of detached floating vegetation (*Sargassum* or kelp paddies), which are indicators of potential marine mammal and sea turtle presence, within the mitigation zone to further help reduce the potential for injury to occur.

5.3.4.1.15 Conducting Visual Observations Using Third-Party Observers

With limited exceptions, use of third-party observers (e.g., trained marine species observers) in air or on surface platforms in addition to existing Navy Lookouts for the purposes of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impacts on readiness for the following reasons:

Navy personnel are extensively trained in spotting items on or near the water surface. Use of Navy Lookouts ensures immediate implementation of mitigation if marine species are sighted. A critical skill set of effective Navy training is communication. Navy Lookouts are trained to act swiftly and decisively to ensure that appropriate actions are taken. Additionally, multiple training and testing events can occur simultaneously and in various regions throughout the Study Area, and can last for days or weeks at a

time. The Navy does not have the resources to maintain third-party observers to accomplish the task for every event.

The use of third-party observers would compromise security for some activities involving active sonar due to the requirement to provide advance notification of specific times and locations of Navy platforms. Reliance on the availability of third-party personnel would impact training and testing flexibility. The presence of other aircraft in the vicinity of naval activities would raise safety concerns for both the commercial observers and naval aircraft. Furthermore, vessels have limited passenger capacity. Training and testing event planning includes careful consideration of this limited capacity in the placement of personnel on vessels involved in the event. Inclusion of non-Navy observers onboard these vessels would require that in some cases there would be no additional space for essential Navy personnel required to meet the exercise objectives.

The areas where training events will most likely occur in the Study Area cover approximately 1 million square nm. Contiguous anti-submarine warfare events may cover many hundreds or even thousands of square miles. The number of civilian vessels or aircraft required to monitor the area of these events would be considerable. It is, thus, not feasible to survey or monitor the large exercise areas in the time required. In addition, marine mammals may move into or out of an area, if surveyed before an event, or an animal could move into an area after an event took place. Given that there are no adequate controls to account for these or other possibilities, there is little utility to performing extensive before or after event surveys of large exercise areas as a mitigation measure.

Surveying during an event raises safety issues with multiple, slow civilian aircraft operating in the same airspace as military aircraft engaged in combat training activities. In addition, many of the training and testing events take place far from land, limiting both the time available for civilian aircraft to be in the event area and presenting a concern should aircraft mechanical problems arise. Scheduling civilian vessels or aircraft to coincide with training events would impact training effectiveness, since exercise event timetables cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the progress of the exercise and impact the effectiveness of the military readiness activity.

5.3.4.1.16 Adopting Mitigation Measures of Foreign Navies

Adopting mitigation measures of foreign navies generally for the purpose of mitigation, such as expanding the mitigation zones to match those used by a particular foreign navy, would be impractical with regard to implementation of military readiness activities and result in unacceptable impacts on readiness for the following reasons:

Mitigation measures are carefully customized for and agreed upon by each individual navy based on potential impacts of the activities on marine species and the impacts of the mitigation measures on military readiness. The mitigation measures developed for one navy would not necessarily be effective at reducing potential impacts on marine species by all navies. Similarly, mitigation measures that do not cause an unacceptable impact on one navy may cause an unacceptable impact on another. For example, most other navies do not possess an integrated strike group and do not have integrated training requirements. The Navy's training is built around the integrated warfare concept and is based on the Navy's capabilities, the threats faced, the operating environment, and the overall mission. Implementing other navies' mitigation would be incompatible with U.S. Navy requirements.

Other particular measures used by foreign navies are discussed throughout this section. The U.S. Navy's recommended mitigation measures have been carefully designed to reduce potential impacts on marine species while not causing an unacceptable impact on readiness.

5.3.4.1.17 Increasing Reporting Requirements

The Navy has extensive reporting requirements, including exercise, testing, and monitoring reporting designed to verify implementation of mitigation, comply with current permits, and improve future environmental assessments (Section 5.5.2, Reporting). Increasing the requirement to report marine species sightings to augment scientific data collection and to further verify the implementation of mitigation measures is unnecessary and would increase safety risks to personnel, be impractical with regard to implementation of military readiness activities, and result in unacceptable impacts on readiness for the following reasons:

Vessels, aircraft, and personnel engaged in training and testing events are intensively employed throughout the duration of training and testing activities. Any additional workload assigned that is unrelated to their primary duty would adversely impact personnel safety and the effectiveness of the military readiness activity they are undertaking. Lookouts are not trained to make accurate species-specific identification and would not be able to provide the detailed information that the scientific community would use. Alternatively, the Navy has an integrated comprehensive monitoring program (Section 5.5, Monitoring and Reporting) that does provide information that is available and useful to the scientific community in annual monitoring reports.

5.3.4.2 Previously Accepted but Now Eliminated

5.3.4.2.1 Implementing Active Sonar Ramp-Up Procedures During Testing

Some testing activities have implemented active sonar ramp-up procedures (slowly increasing the sound in the water to necessary levels) in an attempt to clear the range prior to conducting activities for the purpose of mitigation. Although ramp-up procedures have been used for some testing activities, the effectiveness at avoiding or reducing impacts on marine mammals has not been demonstrated. Until evidence suggests that ramp-up procedures are an effective means of avoiding or reducing potential impacts on marine mammals, and for reasons discussed in Section 5.3.4.1.4 (Implementing Active Sonar Ramp-Up Procedures During Training), the Navy is proposing to eliminate the implementation of this measure for testing activities as part of the Proposed Action.

5.3.4.2.2 Implementing a Mitigation Zone for Missile Exercises with Airborne Targets

Per current mitigation, a mitigation zone of 1,000 yd. (915 m) is observed around the expected expended material field. The Navy is proposing to eliminate the need for a Lookout to maintain a mitigation zone for missile exercises involving airborne targets. Most airborne targets are recoverable aerial drones, and missile impact with the target does not typically occur. Most anti-air missiles used in training are telemetry configured (i.e., they do not have an actual warhead). Impact of a target is unlikely because missiles are designed to detonate (simulated detonation for telemetry missiles) in the vicinity of the target and not as a result of a direct strike on the target. Given the speed of the missile and the target, the high altitudes involved, and the long ranges of missile travel possible, it is not possible to definitively predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location, and thousands of yards for shorter events, which can occur within several thousand yards from the firing location. Establishment of a mitigation zone for activities involving airborne targets would be ineffective at reducing potential impacts.

Furthermore, the potential risk to any marine mammal or sea turtle from a missile exercise with an airborne target is a direct strike from falling military expended materials. Based on the extremely low potential for a target strike and associated expended material field to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible.

5.3.4.2.3 Implementing a Mitigation Zone for Medium- and Large-Caliber Gunnery Exercises with Airborne Targets

Per current mitigation, a mitigation zone is observed in the vicinity of the expected military expended materials field. The Navy is proposing to eliminate the need for a Lookout to observe the vicinity of the expected military expended materials for medium- and large-caliber gunnery exercises involving airborne targets. The potential military expended materials fall zone can only be predicted within thousands of yards, which can be up to 7 nm from the firing location. Establishment of a mitigation zone for activities involving airborne targets would be ineffective at reducing potential impacts.

Furthermore, the potential risk to any marine mammal or sea turtle from a gunnery exercise with an airborne target is a direct strike from falling military expended materials. Based on the extremely low potential for military expended materials to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible.

5.3.4.2.4 Implementing Measures for Laser Test Operations

Per current mitigation, within the Naval Surface Warfare Center, Panama City Division Testing Range, visual surveys would be conducted for all testing activities involving laser line scan, light imaging detection and ranging lasers. Per current standard operating procedures, only trained personnel operate lasers and visual observation of the area is conducted to ensure human safety. The Navy is proposing to discontinue this procedure as a mitigation measure because (1) it is currently a standard operating procedure conducted for human safety, and (2) the environmental consequences analysis suggests that impacts on resources from laser activities are not expected.

5.3.4.2.5 Implementing an Additional Mitigation Zone for Non-Explosive Bombing Exercises in the North Atlantic Right Whale Southeast Mitigation Area

Per current mitigation, the Navy does not release non-explosive bombs within 2 nm of a North Atlantic right whale during the non-calving season from 16 April to 14 November. The Navy recommends discontinuing this measure, and implementing (year-round) the recommended 1,000-yd. (914-m) mitigation zone for non-explosive bombing exercises described in Section 5.3.2 (Mitigation Zone Procedural Measures) for all marine mammal and sea turtle species observed. Since the potential risk to any marine mammal or sea turtle from a non-explosive bomb is a direct strike, a 1,000 yd. mitigation zone is sufficient to reduce this risk. Furthermore, Lookouts are not trained to make accurate species-specific identification and implementing the current mitigation measure just for North Atlantic right whales is impractical.

5.3.4.2.6 Conducting Explosive Large-Caliber Gunnery Exercises Using the Integrated Maritime Portable Acoustic Scoring System in Specified Training Areas

Per current mitigation within the JAX Range Complex, the Navy currently only conducts explosive large-caliber gunnery exercises using the integrated maritime portable acoustic scoring system in training areas BB and CC during the North Atlantic right whale non-calving season (16 April to 14 November), and in the deep water training area year-round. The Navy recommends discontinuing these measures to not confine this activity within these training areas due to the unacceptable impact these measures have on readiness. Additional training areas are necessary because (1) the BB and CC ranges are often fouled

from commercial and recreational vessels, and (2) training area CC experiences high surface currents, which are incompatible with the scoring system's buoys. The mitigation zone will be applied regardless of the location of the activity. Per other current mitigation, the Navy will continue to not conduct this activity within the North Atlantic right whale southeast calving habitat mitigation area.

5.3.4.2.7 Limiting Electromagnetic Testing Operations During Sea Turtle Nesting Season

Per current mitigation within the Naval Surface Warfare Center, Panama City Division Testing Range, when operationally feasible, the Navy does not conduct electromagnetic activities and tests within 33 yd. (30 m) of shore during sea turtle nesting and hatching season between May 1 and September 30. The Navy is proposing to discontinue this measure because the environmental consequences analysis suggests that impacts on sea turtles from electromagnetic activities are not expected. Therefore, this mitigation measure is not necessary to reduce potential impacts.

5.3.4.2.8 Limiting Active Sonar Activities in National Marine Sanctuaries

Per current mitigation, the Navy had voluntarily restricted active sonar within (including a 2.7 nm buffer around) Gerry E. Studds Stellwagen Bank, Gray's Reef, *Monitor*, Florida Keys, and Flower Garden Banks National Marine Sanctuaries. The Navy is proposing to discontinue this restriction because (1) as discussed in Section 6.1.2.5.1 (Gerry E. Studds Stellwagen Bank National Marine Sanctuary), the Navy does not plan to use active sonar within (including a 2.7 nm buffer around) Gerry E. Studds Stellwagen Bank National Marine Sanctuary as part of its Proposed Action, and (2) avoiding active sonar activities within Gray's Reef, *Monitor*, Florida Keys, and Flower Garden Banks National Marine Sanctuaries is not warranted based on the discussions presented in the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for biological resources. Additionally, the Navy has operated under a worldwide set of mitigation measures for over 7 years, and has been providing monitoring and activity reports annually for nearly 5 years. The information gained during the past 7 years has supplemented the Navy's knowledge and understanding regarding the limited impacts of active sonar on protected species and other resources.

Sonar and other active acoustic sources are expected to cause only a minor and temporary behavioral reaction for invertebrates (cephalopods and crustaceans), diving birds, or fish that may be present in the area. No effect is anticipated to corals or the *Monitor* shipwreck. There is potential for marine mammals and sea turtles to be injured (PTS) from sonar and other active acoustic sources. Although marine mammals and sea turtles may occur within Gray's Reef and Flower Garden Banks National Marine Sanctuaries, there is no evidence to suggest that these species would be concentrated in these areas; therefore the likelihood of injury is low. Within (including a 2.7 nm buffer around) the Florida Keys National Marine Sanctuary, sonar and other active acoustic sources that have the highest potential to result in injury to marine mammals (e.g., bin MF1) would not be conducted as part of the Proposed Action. For a more detailed discussion of potential impacts on these resources from the use of sonar and other active acoustic sources, see the following sections:

- Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) for marine mammals
- Section 3.5.3.1.7 (Impacts from Sonar and Other Active Acoustic Sources) for sea turtles
- Section 3.6.3.1.1 (Impacts from Sonar and Other Active Acoustic Sources) for birds
- Section 3.8.3.1.1 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for invertebrates
- Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

Although the Navy recommends discontinuing the mitigation specific to national marine sanctuaries, the Navy will continue implementing mitigation measures to reduce the potential for marine mammals and sea turtles to be exposed to sonar and other active acoustic sources throughout the entire AFTT Study Area wherever and whenever active sonar activities are conducted (Section 5.3.1.2.1, Acoustic Stressors – Non-Impulsive Sound, and Section 5.3.2.1.1, Non-Impulsive Sound).

5.4 MITIGATION SUMMARY

Table 5.4-1 provides a summary of the Navy's recommended mitigation measures. For reference, currently implemented mitigation measures for each activity category are also summarized in the table. The process for developing each of these measures is detailed in Section 5.2.3 (Assessment Method) and involved (1) an effectiveness assessment to determine if implementation of the measure will likely result in avoidance or reduction of an impact on a resource, and (2) an operational assessment to determine if implementation of the measures will have acceptable operational impacts on the Proposed Action with regard to personnel safety, practicality of implementation, readiness, and Navy policy. Measures are intended to meet applicable regulatory compliance requirements for NEPA, Executive Order 12114, and Council on Environmental Quality guidance. The Navy-recommended mitigation measures were also developed consistent with resource-specific environmental requirements, as follows:

- Measures specifying marine mammals and indicators of marine mammal presence (e.g., floating vegetation [*Sargassum* or kelp paddies], large schools of fish, or flocks of seabirds) as the protection focus are intended to meet MMPA requirements.

- Measures specifying marine mammals, sea turtles, flocks of seabirds, piping plovers, floating vegetation (*Sargassum* or kelp paddies), large schools of fish, jellyfish aggregations, or shallow coral reefs as the protection focus are intended to meet ESA requirements.

- Measures specifying shallow coral reefs, live hard bottom, or artificial reefs as the protection focus are intended to meet Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act.

- Measures specifying shipwrecks as the protection focus are intended to meet Abandoned Shipwreck Act and National Historic Preservation Act requirements.

The measures presented in Table 5.4-1 are discussed in greater detail in Section 5.3.1 (Lookout Procedural Measures), Section 5.3.2 (Mitigation Zone Procedural Measures), and Section 5.3.3 (Mitigation Areas). As discussed in Section 5.2.2.2 (Protective Measures Assessment Protocol), the final suite of mitigations resulting from the ongoing planning for this Final EIS/OEIS, as well as the regulatory consultation and permitting processes will be integrated into the Protective Measures Assessment Protocol for implementation purposes. Section 5.5 (Monitoring and Reporting) describes the monitoring and reporting efforts the Navy will undertake to investigate the effectiveness of implemented mitigation measures and to better understand the impacts of the Proposed Action on marine resources.

Table 5.4-1: Summary of Recommended Mitigation Measures

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Specialized Training	Lookouts will complete the Introduction to the U.S. Navy Afloat Environmental Compliance Training Series and the U.S. Navy Marine Species Awareness Training or civilian equivalent.	The mitigation zones observed by Lookouts are specified for each Mitigation Zone Procedural Measure below.	The mitigation zones observed by Lookouts are specified for each Mitigation Zone Procedural Measure below.
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar during Anti-Submarine Warfare and Mine Warfare	2 Lookouts (general) 1 Lookout (minimally manned, moored, or anchored)	Sources that can be powered down: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals (hull-mounted mid-frequency and low-frequency) and sea turtles (low-frequency only). Sources that cannot be powered down: 200 yd. (183 m) shutdown for marine mammals and sea turtles. Both: observation for concentrations of floating vegetation (*Sargassum* or kelp paddies).	Hull-mounted mid-frequency: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals and sea turtles; avoidance of *Sargassum* rafts. Low-frequency: None
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	1 Lookout	200 yd. (183 m) for marine mammals (high-frequency and mid-frequency), sea turtles (bins MF8, MF9, MF10, and MF12 only), and concentrations of floating vegetation (*Sargassum* or kelp paddies).	Non-hull mounted mid-frequency: 200 yd. (183 m) for marine mammals, floating vegetation, and kelp paddies. High-frequency: None
Improved Extended Echo Ranging Sonobuoys	1 Lookout	600 yd. (549 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Passive acoustic monitoring conducted with Navy assets participating in the activity.	1,000 yd. (914 m) for marine mammals and sea turtles; 400 yd. (366 m) for floating vegetation and kelp paddies. Passive acoustic monitoring conducted with Navy assets participating in the activity.
Explosive Sonobuoys Using 0.6–2.5 Pound NEW	1 Lookout	350 yd. (320 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Passive acoustic monitoring conducted with Navy assets participating in the activity.	None
Anti-Swimmer Grenades	1 Lookout	200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	200 yd. (183 m) for marine mammals, sea turtles, floating vegetation, and kelp paddies.

m: meter; NEW: net explosive weight; yd.: yard;

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	General: 1 or 2 Lookouts (NEW dependent) Diver-placed: 2 Lookouts Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom.	Both: NEW dependent for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) from surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. Both: 1 nm from beach in the VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island for birds. Diver-placed: 3.2 nm from an estuarine inlet and 1.6 nm from shoreline within the Navy Cherry Point Range Complex for sea turtles.	General: NEW dependent for marine mammals and sea turtles. Diver-placed: 700 yd. (640 m) for up to 20 lb. NEW for marine mammals and turtles. Both: 1,000 ft. (305 m) from surveyed live hard bottom, artificial reefs, and shipwrecks. Both: 1 nm from beach and 3,000 ft. (914 m) around Fisherman Island in the VACAPES Range Complex for birds. Diver-placed: 3.2 nm from estuarine inlet and 1.6 nm from shoreline in VACAPES, Navy Cherry Point, and JAX Range Complexes for sea turtles.
Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices	4 Lookouts Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom.	Up to 10 min. time-delay using up to 20 lb. NEW: 1,000 yd. (915 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. 1 nm from beach in the VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island for birds. 3.2 nm from an estuarine inlet and 1.6 nm from shoreline within the Navy Cherry Point Range Complex for sea turtles.	10 min. time-day on 20 lb. NEW: 1,450 yd. (1.3 km) for marine mammals and sea turtles.

ft.: feet; JAX: Jacksonville; km: kilometer; lb.: pound; m: meter; min.: minute; NEW: net explosive weight; nm: nautical mile; yd.: yard; VACAPES: Virginia Capes

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Explosive and Non-Explosive Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	200 yd. (183 m) for marine mammals, sea turtles, floating vegetation, and surveyed shallow coral reefs.
Explosive and Non-Explosive Gunnery Exercises – Large-Caliber Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	Explosive: 600 yd. (549 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Non-Explosive: 200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) for surveyed shallow coral reefs.	Explosive: 600 yd. (549 m) for marine mammals, sea turtles, floating vegetation, and surveyed shallow coral reefs. Non-Explosive: 200 yd. (183 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 70 yd. (64 m) around entire ship for marine mammals and sea turtles.
Non-Explosive Missile Exercises and Explosive Missile Exercises (Including Rockets) up to 250 Pound NEW Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	900 yd. (823 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	1,800 yd. (1.6 km) for marine mammals, sea turtles, floating vegetation, and kelp paddies.
Explosive Missile Exercises Using 251–500 Pound NEW Using a Surface Target	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	2,000 yd. (1.8 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	None

km: kilometer; lb.: pound; m: meter; NEW: net explosive weight; yd.: yard

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Explosive and Non-Explosive Bombing Exercises	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	Explosive: 2,500 yd. (2.3 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Non-Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). Both: 350 yd. (320 m) for surveyed shallow coral reefs.	Explosive: 5,100 yd. (4.7 km) for marine mammals, sea turtles, and floating vegetation. Non-Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles, floating vegetation, and kelp paddies.
Torpedo (Explosive) Testing	1 Lookout	2,100 yd. (1.9 km) for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.	5,063 yd. (4.6 km) for marine mammals, sea turtles, floating vegetation, and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.
Sinking Exercises	2 Lookouts	2.5 nm for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.	4.5 nm for marine mammals and sea turtles. 2.5 nm for floating vegetation and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.
At-Sea Explosive Testing	1 Lookout Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs.	1,600 yd. (1.4 km) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies). 350 yd. (320 m) for surveyed shallow coral reefs.	None
Ordnance Testing – Line Charge Testing	1 Lookout	900 yd. (823 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	880 yd. (805 m) for marine mammals and sea turtles. 0.5 mi. (0.8 km) for Gulf sturgeon.

km: kilometer; lb.: pound; m: meter; mi: mile; nm: nautical mile; yd.: yard

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Ship Shock Trials	At least 10 Lookouts or trained marine species observers (or combination)	10,000-lb. and 40,000-lb. charge: 3.5 nm for all locations for marine mammals, sea turtles, concentrations of floating vegetation (*Sargassum* or kelp paddies), jellyfish aggregations, large schools of fish, and flocks of seabirds.	10,000-lb. charge: 3 nm/3.5 nm for VACAPES / JAX for marine mammals, sea turtles, floating vegetation, jellyfish aggregations, large schools of fish, and flocks of seabirds. 40,000-lb. charge: None.
Elevated Causeway System – Pile Driving	1 Lookout	60 yd. (55 m) for marine mammals, sea turtles, and concentrations of floating vegetation (*Sargassum* or kelp paddies).	None
Vessel Movements	1 Lookout	500 yd. (457 m) for whales. 200 yd. (183 m) for all other marine mammals (except bow riding dolphins).	500 yd. (457 m) for whales. 200 yd. (183 m) for all other marine mammals (except bow riding dolphins).
Towed In-Water Device Use	1 Lookout	250 yd. (229 m) for marine mammals.	250 yd. (229 m) for marine mammals.
Precision Anchoring	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom	Avoidance of precision anchoring within the anchor swing diameter of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks.	Avoidance of precision anchoring within the anchor watch circle diameter of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks.
North Atlantic Right Whale Calving Habitat off the Southeast United States	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Avoidance or minimization of conduct of specific activities seasonally. Use Early Warning System sightings data.	Avoidance or minimization of conduct of specific activities seasonally. Use Early Warning System sightings data.

JAX: Jacksonville; km: kilometer; lb.: pound; m: meter; nm: nautical mile; VACAPES: Virginia Capes; yd.: yard

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
North Atlantic Right Whale Foraging Habitat off the Northeast	3 Lookouts during torpedo (non-explosive) testing activities All other activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Avoidance or minimization of conduct of specific activities seasonally. Use Sighting Advisory System sightings data. Specific measures for torpedo (non-explosive) testing activities year-round.	Avoidance or minimization of conduct of specific activities seasonally. Use Sighting Advisory System sightings data. Conduct torpedo (non-explosive) testing activities in five designated areas seasonally. Submit written requests prior to conducting hull-mounted surface and submarine active sonar training or helicopter dipping in the mitigation area.
North Atlantic Right Whale Mid-Atlantic Migration Corridor	1 Lookout	Practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives.	Practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives.
West Indian Manatee Habitat	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Mayport, Florida: Comply with all federal, state, and local Manatee Protection Zones; sightings communication. Port Canaveral, Florida: Pierside sonar observations and sightings communication. Kings Bay, Georgia: Pierside sonar observations and sightings communication. Camp Lejeune, North Carolina: Pile driving observations and sightings log.	Mayport, Florida: Comply with all federal, state, and local Manatee Protection Zones; sightings communication. Port Canaveral, Florida: Pierside sonar observations and sightings communication. Kings Bay, Georgia: Pierside sonar observations and sightings communication. Camp Lejeune, North Carolina: None
Planning Awareness Areas	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Limit planning major active sonar exercises.	Limit planning major active sonar exercises.

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs, artificial reefs, shipwrecks, and live hard bottom	No precision anchoring within the anchor swing diameter and no explosive mine countermeasure and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. No explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target; explosive or non-explosive missile exercises using a surface target; explosive or non-explosive bombing exercises; or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs.	Varying mitigation zone distances based on marine mammal ranges to effects.
Live Hard Bottom and Shallow Coral Reefs within South Florida Ocean Measurement Facility	No Lookouts in addition to standard personnel standing watch Protective Measures Assessment Protocol will contain maps of surveyed shallow coral reefs and live hard bottom	Anchors and Mine-like Objects: Installation of anchors and mine-like objects are conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. Bottom Crawling Unmanned Underwater Vehicles: If deployment occurs greater than 9.8 ft. (3 m) in depth, it will be conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities.	Anchors and Mine-like Objects: Installation of anchors and mine-like objects are conducted using real-time GIS and GPS, along with groundtruth and verification support, which will help the Navy avoid sensitive marine species and communities during deployment, installation, and recovery. Bottom Crawling Unmanned Underwater Vehicles: None

ft.: feet; GIS: Geographic Information System; GPS: Global Positioning System; m: meter; yd.: yard

Table 5.4-1: Summary of Recommended Mitigation Measures (Continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Sea Turtle Nesting Habitat	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	Naval Surface Warfare Center, Panama City Division: Sea turtle nesting season is defined as from March through September; Avoidance of ordnance testing – line charge testing activities during the night during nesting season. Navy Cherry Point Range Complex: Positive control and time-delay diver-placed mine neutralization and countermeasure activities remain 3.2 nm from estuarine inlets and 1.6 nm from shoreline from March through September.	Naval Surface Warfare Center, Panama City Division: Sea turtle nesting season is defined as from May through September; Avoidance of electromagnetic mine countermeasure and neutralization activities within 32 yd. (30 m) of shore during nesting season; Avoidance of ordnance testing – line charge testing activities (day and night) during nesting season. VACAPES, Navy Cherry Point, and JAX Range Complexes: Positive control diver-placed mine neutralization and countermeasure activities remain 3.2 nm from estuarine inlets and 1.6 nm from shoreline.
Piping Plover Habitat in Virginia	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	1 nm from beach in VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island during positive control and time-delay diver-placed mine neutralization and countermeasure activities.	1 nm from beach in VACAPES Range Complex and 3,000 ft. (914 m) around Fisherman Island during positive control diver-placed mine neutralization and countermeasure activities.
Gulf Sturgeon Habitat in the Gulf of Mexico	Activity-specific measures described in the Lookout Procedural Measures and Mitigation Zone Procedural Measures	No ordnance testing – line charge testing activities will occur within nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida from the shoreline to 1 mi. (1.6 km) offshore between October and March (except within the designated line charge testing location on Santa Rosa Island).	No ordnance testing – line charge testing activities will occur within nearshore Gulf of Mexico waters in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties in Florida from the shoreline to 1 mi. (1.6 km) offshore between October and March.

ft: feet; JAX: Jacksonville; km: kilometer; m: meter; mi.: mile; VACAPES: Virginia Capes; yd.: yard

5.5 MONITORING AND REPORTING

5.5.1 APPROACH TO MONITORING

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and complying with the suite of federal environmental laws and regulations. As a complement to the Navy's commitment to avoiding and reducing impacts of the Proposed Action through mitigation, the Navy will undertake monitoring efforts to track compliance with take authorizations, help evaluate the effectiveness of implemented mitigation measures, and gain a better understanding of the impacts of the Proposed Action on marine resources. Taken together, mitigation and monitoring comprise the Navy's integrated approach for reducing environmental impacts from the Proposed Action. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible.

Consistent with the cooperating agency agreement with NMFS, mitigation and monitoring measures presented in this Final EIS/OEIS focus on the requirements for protection and management of marine resources. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management of marine resources. Since monitoring will be required for compliance with the Letters of Authorization issued for the Proposed Action under the MMPA, details of the monitoring program will be developed in coordination with NMFS through the regulatory process. Discussions with resource agencies during the consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the Records of Decision and consultation documents such as the ESA Biological Opinion.

5.5.1.1 Integrated Comprehensive Monitoring Program

The Integrated Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy trains and tests and to allocate the most appropriate level and type of effort for each range complex (U.S. Department of the Navy 2010). The current Navy monitoring program is composed of a collection of range-specific monitoring plans, each of which was developed individually as part of MMPA and ESA compliance processes as environmental documentation was completed. These individual plans establish specific monitoring requirements for each range complex or testing range and are collectively intended to address the Integrated Comprehensive Monitoring Plan top-level goals.

A 2010 Navy-sponsored monitoring meeting in Arlington, Virginia, initiated a process to critically evaluate the current Navy monitoring plans and begin development of revisions and updates to both existing region-specific plans as well as the Integrated Comprehensive Monitoring Plan. Discussions at that meeting as well as the following Navy and NMFS annual adaptive management meeting established a way ahead for continued refinement of the Navy's monitoring program. This process included establishing a Scientific Advisory Group of leading marine mammal scientists with the initial task of developing recommendations that would serve as the basis for a Strategic Plan for Navy monitoring. The Strategic Plan is intended to be a primary component of the Integrated Comprehensive Monitoring Program, provide a "vision" for Navy monitoring across geographic regions, and serve as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address Integrated Comprehensive Monitoring Plan top-level goals and satisfy MMPA Letter of Authorization regulatory requirements.

The objective of the Strategic Plan is to continue the evolution of Navy marine species monitoring towards a single integrated program, incorporating Scientific Advisory Group recommendations, and

establishing a more transparent framework for soliciting, evaluating, and implementing monitoring work across the range complexes and testing ranges. The Strategic Plan must consider a range of factors in addition to the scientific recommendations including logistic, operational, and funding considerations and will be revised regularly as part of the annual adaptive management process.

The Integrated Comprehensive Monitoring Plan establishes top-level goals that have been developed in coordination with NMFS (U.S. Department of the Navy 2010). The following top-level goals will become more specific with regard to identifying potential projects and monitoring field work through the Strategic Plan process as projects are evaluated and initiated in the AFTT Study Area.

- An increase in the understanding of the likely occurrence of marine mammals or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and density of species).
- An increase in the understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulsive sound), through better understanding of one or more of the following: (1) the action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels); (2) the affected species (e.g., life history or dive patterns); (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part) associated with specific adverse impacts; or (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving, or feeding areas).
- An increase in the understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action in specific contexts, where possible (e.g., at what distance or received level).
- An increase in the understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) the long-term fitness and survival of an individual; or (2) the population, species, or stock (e.g., through impacts on annual rates of recruitment or survival).
- An increase in the understanding of the effectiveness of mitigation and monitoring measures.
- A better understanding and record of the manner in which the authorized entity complies with the Incidental Take Authorization and Incidental Take Statement.
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the mitigation zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals.
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

5.5.1.2 Scientific Advisory Group Recommendations

Navy established the Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Plan and existing MMPA Letters of Authorization and developing objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not prescriptive from a range complex perspective, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Navy Marine Species Monitoring

Program and provide a direction for the Strategic Plan to move this development. Key recommendations include:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from a "box-checking" mentality. Monitoring studies should be designed and conducted according to scientific objectives, rather than on merely cataloging effort expended.
- Approach the monitoring program holistically and select projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.5.2 REPORTING

The Navy is committed to documenting and reporting relevant aspects of training and testing activities to verify implementation of mitigation, comply with current permits, and improve future environmental assessments. Navy reporting initiatives are described below.

5.5.2.1 Exercise, Testing, and Monitoring Reporting

The Navy will submit annual exercise, testing, and monitoring reports to the Office of Protected Resources at NMFS. The exercise reports will describe the level of training and testing conducted during the reporting period, and the monitoring reports will describe both the nature of the monitoring that has been conducted and the actual results of the monitoring. All of the details regarding the content of the annual reports will be coordinated with NMFS through the permitting process. All reports submitted to date can be found on the NMFS Office of Protected Resources webpage.

5.5.2.2 Stranding Response Plan

In coordination with NMFS, the Navy will have a stranding response plan. All of the details regarding the content of the stranding response plan will be coordinated with NMFS through the permitting process.

5.5.2.3 Bird Strike Reporting

The Navy will report all damaging and non-damaging bird strikes to the Naval Safety Center.

5.5.2.4 Marine Mammal Incident Reporting

If any injury or death of a marine mammal is observed during training or testing activities, the Navy will immediately halt the activity and report the incident, including dead or injured animals, to NMFS, the U.S. Fish and Wildlife Service, or the Florida Fish and Wildlife Conservation Commission as appropriate.

If any harassment, injury, or death of a manatee is observed during training and testing activities, the Navy will immediately halt the activity and report the incident (including dead or injured animals). Depending on the location of the incident, the Navy will make a report to one or more agencies as appropriate, which may include NMFS; the Florida Fish and Wildlife Conservation Commission, Law Enforcement Division; the U.S. Fish and Wildlife Service, Jacksonville Ecological Field Office; the U.S. Fish and Wildlife Service, Raleigh Field Office; and the North Carolina Wildlife Resources Commission.

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6 ADDITIONAL REGULATORY CONSIDERATIONS

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action, consistency with other federal, state, and local plans, policies, and regulations not considered in Chapter 3 (Affected Environment and Environmental Consequences); the relationship between short-term impacts and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources; and energy conservation.

6.1 CONSISTENCY WITH APPLICABLE LAWS, EXECUTIVE ORDERS, INTERNATIONAL STANDARDS, AND GUIDANCE

Implementation of the Proposed Action for the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), would comply with applicable federal, state, and local laws, regulations, and executive orders. The Navy is consulting with and will continue to consult with regulatory agencies, as appropriate, during the NEPA process and prior to implementation of the Proposed Action to ensure that requirements are met. Table 6.1-1 summarizes the additional environmental compliance requirements not specifically assessed in the resource chapters. Section 3.0.1 (Regulatory Framework) provides brief excerpts of the federal statutes, executive orders, international standards, and guidance that form the regulatory framework for evaluation of the resources that appeared in Chapter 3 (Affected Environment and Environmental Consequences). Documentation of consultation and coordination with regulatory agencies is provided in Appendix C (Agency Correspondence).

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Act to Prevent Pollution from Ships (33 United States Code [U.S.C.] §§ 1901-1915)	Requirements associated with the Act to Prevent Pollution from Ships are implemented by the *Navy Environmental and Natural Resources Program Manual* and related Navy guidance documents governing waste management, pollution prevention, and recycling. At sea, the Navy complies with these regulations and operates in a manner that minimizes or eliminates any adverse effects to the marine environment. See Section 3.1 (Sediments and Water Quality) for the assessment.
Antiquities Act (16 U.S.C. §§ 431-433)	In accordance with Navy procedures, the Proposed Action is consistent with the act's objectives for protection of archaeological and historical sites and objects, preservation of cultural resources, and the public's access to them. See Section 3.10 (Cultural Resources) for the assessment.
Coastal Zone Management Act (16 U.S.C. §§ 1451-1464)	The Navy submitted coastal consistency determinations to those states and territories whose coastal uses or resources may be affected by the Proposed Action.
Historic Sites Act (16 U.S.C. §§ 461–467)	In accordance with Navy procedures, the Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. See Chapter 3.10 (Cultural Resources) for the assessment.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (Continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801–1882)	The Navy prepared an Essential Fish Habitat Assessment. The Proposed Action may have potential impacts on essential fish habitat and managed species. Consultation with NMFS was conducted for affected species and their habitats. The Essential Fish Habitat Assessment was prepared as a separate document.
Migratory Bird Treaty Act (16 U.S.C. §§ 703–712)	Implementation of the Proposed Action is not anticipated to result in significant adverse effects on migratory birds; therefore, the Navy does not need to confer with the U.S. Fish and Wildlife Service. See Section 3.6 (Birds) for the assessment.
National Fishery Enhancement Act (33 U.S.C. §§ 2101-2106)	The Proposed Action is consistent with regulations administered by NMFS and U.S. Army Corps of Engineers concerning artificial reefs in the navigable waters of the United States. See Section 3.9 (Fish) for the assessment.
National Marine Sanctuaries Act (16 U.S.C. §§ 1431-1445c-1)	Five National Marine Sanctuaries administered by National Oceanic and Atmospheric Administration Office of National Marine Sanctuaries lie within the Study Area. These are discussed further in Section 6.1.2.5 (National Marine Sanctuaries).
Submerged Lands Act of 1953 (43 U.S.C. §§ 1301–1315)	In accordance with the coastal states' regulations, the Proposed Action is consistent with regulations concerning the Submerged Lands Act.
Sunken Military Craft Act (Public Law 108–375, 10 U.S.C. § 113 Note and 118 Stat. 2094–2098)	The Sunken Military Craft Act does not apply to actions taken by, or at the direction of, the United States. See Section 3.10 (Cultural Resources) for the assessment.
R.M.S. *Titanic* Maritime Memorial Preservation Act (16 U.S.C. §§ 450rr-450rr-6)	In accordance with Navy procedures, implementation of the Proposed Action would not affect efforts to designate the shipwreck of the R.M.S. *Titanic* as an international maritime memorial and the development of international guidelines for reasonable research, exploration, and, if appropriate salvage activities with respect to the shipwreck..
EXECUTIVE ORDERS	
Executive Order (EO) 11990, *Protection of Wetlands*	In accordance with Navy procedures, implementation of the Proposed Action would not affect wetlands as defined in Executive Order 11990.
Executive Order 12114, *Environmental Effects Abroad of Major Department of Defense Actions*	The Navy prepared this OEIS in accordance with EO 12114 and Navy-implementing regulations found at 32 Code of Federal Regulations (C.F.R.) Part 187, *Environmental Effects Abroad of Major Department of Defense Actions*.
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	In accordance with Navy procedures, the Proposed Action would not result in any disproportionately high and adverse human health or environmental effects on minority or low-income populations. See Section 3.0.5.2 (Resources and Issues Eliminated from Further Consideration).
Executive Order 12962, *Recreational Fisheries*	In accordance with Navy procedures, the Proposed Action would not affect federal agencies' ability to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. See Section 3.11 (Socioeconomic Resources) for the assessment.
Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	In accordance with Navy procedures, the Proposed Action would not result in disproportionate environmental health or safety risks to children. See Section 3.0.5.2 (Resources and Issues Eliminated from Further Consideration).

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (Continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Executive Order 13089, *Coral Reef Protection*	The Navy has prepared this EIS/OEIS in accordance with requirements that federal agencies whose actions affect U.S. coral reef ecosystems shall provide for implementation of measures needed to research, monitor, manage, and restore them, including reducing impacts from pollution and sedimentation. See Section 3.3 (Marine Habitats) for the assessment.
Executive Order 13112, *Invasive Species*	In accordance with Navy procedures, the Proposed Action would not increase the number of or introduce new invasive species nor require the Navy to take measures to avoid introduction and spread of those species. Naval vessels are exempt from 33 C.F.R. Part 151 Subpart D, *Ballast Water Management for Control of Nonindigenous Species in Waters of the United States*.
Executive Order 13158, *Marine Protected Areas*	The Navy has prepared this EIS/OEIS in accordance with requirements for the protection of existing national system marine protected areas. See Section 6.1.2 (Marine Protected Areas) for more information.
Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*	In accordance with Navy procedures, the Proposed Action would not have substantial direct effects on one or more Indian tribes, on the relationship between the federal government and Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes. See Section 8.0 (Distribution List) for federally-recognized tribes that were provided notification letters of the AFTT EIS/OEIS.
Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*	In accordance with Navy procedures, the Proposed Action is consistent with the integrated strategy toward sustainability in the federal government and to making reduction of greenhouse gas emissions a priority for federal agencies.
Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	In accordance with Navy procedures, the Proposed Action is consistent with the comprehensive national policy for the Stewardship of the Ocean, Our Coasts, and the Great Lakes.
INTERNATIONAL STANDARDS	
International Convention for the Prevention of Pollution from Ships	This standard prohibits certain discharges of oil, garbage, and other substances from vessels. The convention and its annexes are implemented by national legislation, including the Act to Prevent Pollution from Ships (33 U.S.C. §§ 1901 to 1915) and the Federal Water Pollution Control Act (33 U.S.C. §§ 1321 to 1322). The Proposed Action does not include vessel operation and discharge from ships; however, Navy vessels operating in the Study Area would comply with the discharge requirements established in this program, minimizing or eliminating potential impacts from discharges from ships.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (Continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
GUIDANCE	
Military Munitions Rule	The Military Munitions Rule identifies when conventional and chemical military munitions are considered solid waste under the Resource Conservation and Recovery Act (42 U.S.C. §§ 6901-6992k). Military munitions are not considered solid waste based on two conditions stated at 40 C.F.R. § 266.202(a)(1)(i-iii). Specifically, munitions are not considered hazardous waste when: 1. Used for their intended purpose, including training of military personnel and explosive emergency response specialists; research and development activities; and when recovered, collected, and destroyed during range clearance events. 2. Unused and being repaired, reused, recycled, reclaimed, disassembled, reconfigured, or subjected to other material recovery activities. These two conditions cover the uses of munitions included in the Proposed Action; therefore, the Resource Conservation and Recovery Act does not apply.

6.1.1 COASTAL ZONE MANAGEMENT ACT COMPLIANCE

The Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451-1464) encourages coastal states to be proactive in managing coastal zone uses and resources. The act established a voluntary coastal planning program and required participating states to submit a Coastal Management Plan to the National Oceanic and Atmospheric Administration for approval. Under the act, federal actions that have an effect on a coastal use or resource are required to be consistent, to the maximum extent practicable, with the enforceable policies of approved Coastal Management Plans. See Section 4.3.8 (Development of Coastal Lands) for further information.

The Coastal Zone Management Act defines the coastal zone as extending offshore "to the outer limit of State title and ownership under the Submerged Lands Act" (i.e., 3 nm from the shoreline, 9 nm for the west coast of Florida, Texas, and Puerto Rico). The coastal zone extends inland only to the extent necessary to control the shoreline, but the shoreward extent is not relevant to the Proposed Action.

A consistency determination, a negative determination, or a d*e minimis* exemption may be submitted for review of federal agency activities. A federal agency submits a consistency determination when it determines that its activity may have either a direct or an indirect effect on a state coastal use or resource. In accordance with 15 C.F.R. § 930.39, the consistency determination will include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program. The consistency determination should be based on evaluation of the relevant enforceable policies of the management program. In accordance with 15 C.F.R. § 930.35, "if a Federal agency determines that there will not be coastal effects, then the Federal agency shall provide the State agencies with a negative determination for a federal agency activity: (1) Identified by a State agency on its list, as described in § 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) Which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) For which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity." Thus, a negative determination must be submitted to a state if the agency determines no coastal effects and one or more of the triggers above is met. *De minimis*

exemptions are activities proposed by the federal agency that have already been reviewed and approved by the state (after allowing for public review and comment), and those that the state has recognized as having insignificant direct or indirect (secondary or cumulative) effects on its coastal resources.

In accordance with the Coastal Zone Management Act, the Navy reviewed the enforceable policies of each state's federally approved Coastal Zone Management Plan relevant to the Study Area. There are 18 states (Alabama, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Texas, and Virginia) and two U.S. territories (Puerto Rico and U.S. Virgin Islands) whose coastal zones could be affected by the Proposed Action. Based on an evaluation of the effects of the Proposed Action discussed in this EIS/OEIS and the enforceable policies of each state's Coastal Zone Management Plan, and pursuant to 15 C.F.R. § 930.39, the Navy prepared consistency determinations. Consistency determinations for each state adjacent to the Study Area are available for public viewing on the project web site. Coastal Zone Management Act correspondence with the states is presented in Appendix C, Agency Correspondence.

6.1.2 MARINE PROTECTED AREAS

Many areas of the marine environment have some level of federal, state, or local management or protection. Marine protected areas are designated and managed at all levels of government by a variety of agencies and have been established by more than 100 legal authorities. Marine protected areas vary widely in purpose, managing agencies, management approaches, level of protection, and restrictions on human uses. They have been designated to achieve objectives ranging from the conservation of biodiversity, to the preservation of sunken historic vessels, to the protection of spawning species important to commercial and recreational fisheries. The levels of protection provided by these marine protected areas range from fully protected reserves (i.e., no take of any species is permitted) to sites allowing multiple uses including fishing, recreation, and industrial uses (National Marine Protected Areas Center 2008).

Executive Order (EO) 13158, *Marine Protected Areas* (Federal Register (FR) 65(105): 34909-34911, May 26, 2000), directs the National Oceanic and Atmospheric Administration to establish a National Marine Protected Areas Center charged with developing a national system of marine protected areas, and with maintaining a list of sites formally accepted into the national system. A full list and map of areas accepted in the national system of marine protected areas is available from the National Marine Protected Areas Center (National Marine Protected Areas Center 2011). EO 13158 requires each federal agency whose actions affect the natural or cultural resources protected by a marine protected area to identify such actions, and in taking such actions, avoid harm to those natural and cultural resources to the maximum extent practicable. Pursuant to Section 5 of EO 13158, agency requirements apply only to the natural or cultural resources specifically afforded protection by the sites recognized in the List of National System Marine Protected Areas. Although many sites contain coastal (within the continental shelf) lands and islands, only the resources of the protected coastal and ocean waters, and the submerged lands thereunder, are subject to Section 5 of EO 13158 (National Park Service 2006a).

All resources of the marine protected areas located within the Study Area have been incorporated into the analyses in Sections 3.1 through 3.9 (Sediments and Water Quality, Air Quality, Marine Habitats, Marine Mammals, Sea Turtles and Other Marine Reptiles, Birds, Marine Vegetation, Marine Invertebrates, and Fish). In accordance with EO 13158, the Navy has considered the potential impacts of

its proposed activities under the Preferred Alternative (Alternative 2) to the national system marine protected areas that contain marine waters within the Study Area.

Table 6.1-2 presents information on the national system marine protected areas located in the Study Area, as well as the training and testing activities that could occur within each area. As described in Chapter 2 (Description of Proposed Action and Alternatives), many training and testing activities could occur anywhere in the Study Area; however, due to the nature of these activities (e.g., requiring deep water), they are unlikely to occur in the extremely shallow nearshore waters typical of most marine protected areas. These activities include:

- anti-air warfare testing (air combat maneuver test; air platform/vehicle testing; intelligence, surveillance, and reconnaissance);
- testing and evaluation of catapult launch;
- new ship construction and maintenance testing (propulsion testing, littoral combat ship mission package testing–surface warfare), excluding pierside testing;
- anti-surface/anti-submarine warfare testing (missile testing, torpedo [explosive] testing, counter-measure testing/acoustic systems testing);
- hydrodynamic testing;
- anti-submarine tracking exercise/torpedo exercise;
- anti-air and anti-surface gunnery exercise; and
- torpedo testing.

Because the activities listed above are unlikely to occur in shallow nearshore waters, the impacts of such activities to marine protected areas located nearshore will not be considered further in this document.

Military activities are sometimes exempted from the prohibitions applicable to marine protected areas. In cases where the military conducted activities within an area prior to its establishment as a marine protected area, those activities are often incorporated into the area's management plan. Management policies specific to military activities are described below for the five different types of marine protected areas found in the Study Area, with area-specific prohibitions listed in Table 6.1-2, where applicable.

Table 6.1-2: National System Marine Protected Areas within the Study Area

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Northeast U.S. Continental Shelf Large Marine Ecosystem				
Assateague Island National Seashore	Maryland/Virginia: Other AFTT Areas, within 3 nm of VACAPES OPAREA and W-386 of VACAPES Range Complex	Ecosystem (barrier island and aquatic habitats and species, natural coastal environment and processes) (National Park Service 2011a)	Prohibited: personal watercraft beaching on the ocean side of the island unless in an emergency (36 C.F.R. § 7.65 (National Park Service 2011a).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Assateague Island National Seashore.
Lydonia Canyon Gear Restricted Area	Massachusetts: Other AFTT Areas	Tilefish (*Lopholatilus chamaeleonticeps*)	Fishing gear restrictions are not applicable to Navy; however, they are intended to prevent damage to bottom habitat (National Marine Fisheries Service 2011).	Navy training and testing activities that release military expended materials are expected to occur in the vicinity of this area. This area is considered a Habitat Area of Particular Concern; see the Essential Fish Habitat Assessment for a map and detailed analysis of this area.
Monomoy National Wildlife Refuge	Massachusetts: Within 2 nm of Boston OPAREA, Northeast Range Complexes	Habitat for migratory birds, including the federally protected piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii*)	Prohibited: destruction, disturbance and removal of wildlife, vegetation, and government property. Closed areas apply between 15 April and 15 September (U.S. Fish and Wildlife Service 2011b).	Unmanned vehicle development and payload testing is planned to occur in proximity to this marine protected area. The resources protected by this area could also be briefly exposed to aircraft overflights. However, the proposed activities are not likely to impact the area's protected natural resources.
Oceanographer Canyon Gear Restricted Area	Massachusetts: Other AFTT Areas	Tilefish	Fishing gear restrictions are not applicable to Navy; however, they are intended to prevent damage to bottom habitat (National Marine Fisheries Service 2011).	Navy training and testing activities that release military expended materials are expected to occur in the vicinity of this area. This area is considered a Habitat Area of Particular Concern; see the Essential Fish Habitat Assessment for a map and detailed analysis of this area.

AFTT: Atlantic Fleet Training and Testing; C.F.R.: Code of Federal Regulations; nm: nautical mile; OPAREA: Operating Area; VACAPES: Virginia Capes
Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Northeast U.S. Continental Shelf Large Marine Ecosystem (Continued)				
Veatch Canyon Gear Restricted Area	Massachusetts: Within W-105 of the Narragansett Bay OPAREA, Northeast Range Complexes	Tilefish	Fishing gear restrictions are not applicable to Navy; however, they are intended to prevent damage to bottom habitat (National Marine Fisheries Service 2011).	Navy training and testing activities that release military expended materials are expected to occur in the vicinity of this area. This area is considered a Habitat Area of Particular Concern; see the Essential Fish Habitat Assessment for a map and detailed analysis of this area.
Jacques Cousteau Estuarine Research Reserve	New Jersey: Overlaps W-107 of the Atlantic City OPAREA, Northeast Range Complexes	Ecosystem (coastal and estuarine watershed, including habitat for migratory birds, wading birds, and fish)	Prohibited: most construction, dredging, and mining operations that would alter the shape of the ocean bottom or reduce fishery productivity (Jacques Cousteau National Estuarine Research Reserve 2009).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Jacques Cousteau Estuarine Research Reserve.
Gateway National Recreational Area	New Jersey/New York: Other AFTT Areas (Sandy Hook Bay, less than 2 nm from the pier of Naval Weapons Station Earle, New Jersey)	Ecosystem (nesting habitat for piping plover, shorebirds, and migratory birds; salt marshes)	Prohibited: landing vessels on ocean beaches between15 March and Labor Day; vessel operations within Spermaceti Cove or within 46 m (150 ft.) of marshes (36 C.F.R. § 1.5) (National Park Service 2011b). National Park Service Management Policies (2006) apply (36 C.F.R. § 7.29) (National Park Service 2006a).	The Navy would conduct homeland security and anti-terrorism/force protection training activities in the waters around the nearby Naval Weapons Station Earle, New Jersey; however, these proposed activities are not expected to occur in the marine protected area. The resources protected by this area could also be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. Therefore, no impacts are expected within Gateway National Recreational Area.

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Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Northeast U.S. Continental Shelf Large Marine Ecosystem (Continued)				
Blue Crab Sanctuary	Virginia: Chesapeake Bay; overlaps mine warfare training areas, borders the VACAPES Range Complex and VACAPES OPAREA, and abuts pierside location at Joint Expeditionary Base Little Creek, Virginia Beach, Virginia	Blue crab (*Callinectes sapidus*)	State regulations apply. Harvest restrictions are not applicable to Navy activities (Virginia Marine Resources Commission 2011).	Ship signature testing activities and surface ship and submarine sonar testing activities would occur pierside at Little Creek; however, these activities are not expected to impact the blue crab or Blue Crab Sanctuary.
Kiptopeke State Park	Virginia: Lower Chesapeake Bay; 1 nm from mine warfare training area	Ecosystem (migratory birds)	State regulations apply: prohibited to cut or scar any plant or tree, or to collect any plant or animal, except as authorized by permit (Virginia State Parks n.d.).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Kiptopeke State Park.
Fisherman Island National Wildlife Refuge	Virginia: Lower Chesapeake Bay; 1 nm from mine warfare training area	Ecosystem (migratory birds)	Prohibited: commercial and recreational fishing.	The resources protected by this area could be briefly exposed to aircraft overflights; however, there is a mitigation measure in place that states helicopters will avoid overflying Fisherman Island National Wildlife Refuge off the coast of Cape Charles, Virginia by at least 3,000 ft. (914 m) vertically and horizontally to avoid disturbing piping plovers and other birds. Therefore, no impacts are expected within Fisherman Island National Wildlife Refuge.

ft.: feet; m: meter; nm: nautical mile; OPAREA: Operating Area; VACAPES: Virginia Capes
Note: National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Northeast U.S. Continental Shelf Large Marine Ecosystem (Continued)				
Norfolk Canyon Gear Restricted Area	Virginia: Overlaps W-386 of the VACAPES OPAREA (Surface Area Grid 8C)	Tilefish	Fishing gear restrictions are not applicable to Navy; however, they are intended to prevent damage to bottom habitat (National Marine Fisheries Service 2011).	Navy training and testing activities that release military expended materials are expected to occur in the vicinity of this area. This area is considered a Habitat Area of Particular Concern; see the Essential Fish Habitat Assessment for a map and detailed analysis of this area.
Southeast U.S. Continental Shelf Large Marine Ecosystem				
Biscayne National Park	Florida: Other AFTT Areas, bordering South Florida Ocean Measurement Facility Testing Range	Ecosystem (corals, sea turtles, smalltooth sawfish [*Pristis pectinata*], West Indian manatee [*Trichechus manatus*], American crocodile [*Crocodylus acutus*], least tern [*Sterna antillarum*], Johnson's seagrass [*Halophila johnsonii*])	State regulations and National Park Service Management Policies apply (National Park Service 2006a). Lobster and sponge closed areas. Tropical fish are protected (National Park Service 2006b).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Biscayne National Park.

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Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Southeast U.S. Continental Shelf Large Marine Ecosystem (Continued)				
Guana Tolomato Matanzas National Estuarine Research Reserve	Florida: Other AFTT Areas, bordering JAX OPAREA, mine warfare warning area W-158E of JAX Range Complex	Ecosystem (aquatic reserve for preservation of natural conditions and conservation of biodiversity, including ESA-listed marine mammals, sea turtles, and shore birds)	No alteration of physical conditions within the reserve shall be permitted except for public navigation or to enhance the quality of the reserve. Other uses or human activity may be permitted if determined to be compatible (Guana Tolomato Matanzas National Estuarine Research Reserve 2009).	Proposed activities that could reasonably be expected to occur in the area include: • search and rescue • aircraft overflights However, search and rescue activities and aircraft overflights are not likely to impact the area's protected natural resources. Therefore, no impacts are expected within Guana Tolomato Matanzas National Estuarine Research Reserve.
Cape Romain National Wildlife Refuge	South Carolina: Other AFTT Areas, 1 nm from Charleston OPAREA, Charleston mine warfare alternate location #3	Ecosystem (loggerhead sea turtle [*Caretta caretta*], waterfowl, and shorebirds including the piping plover)	Prohibited: bearing weapons, except during open hunting seasons and in open hunt areas (U.S. Fish and Wildlife Service 2002).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Cape Romain National Wildlife Refuge.

AFTT: Atlantic Fleet Training and Testing; JAX: Jacksonville; nm: nautical mile; OPAREA: Operating Area
Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Gulf of Mexico Large Marine Ecosystem				
Cedar Keys National Wildlife Refuge	Florida: Other AFTT Areas	Ecosystem (wilderness island areas; nesting and breeding ground for colonial birds, wading birds and shorebirds)	Prohibited: injuring, disturbing, or destroying any plant or animal; carrying, possessing, or discharging firearms, fireworks, or explosives, or other weapons (except for hunting purposes as allowed under state regulations). Closed areas: interiors of all islands (except Atsena Otie Key). Seahorse Key and a 300 ft. (91 m) zone around the island is closed to all public entry from 1 March until 30 June (U.S. Fish and Wildlife Service 2010).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Cedar Keys National Wildlife Refuge.
Chassahowitzka National Wildlife Refuge	Florida: Other AFTT Areas	Ecosystem (estuarine habitat, waterfowl, West Indian manatees [*Trichechus manatus*])	Restricted vessel speed in posted zones between 1 April and 31 August. Prohibited: firearms and weapons except during designated hunts (U.S. Fish and Wildlife Service 2003).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Chassahowitzka National Wildlife Refuge.

AFTT: Atlantic Fleet Training and Testing; ft.: feet; m: meters
Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Gulf of Mexico Large Marine Ecosystem (Continued)				
Dry Tortugas National Park	Florida: Entirely within W-174B of Key West Range Complex; 5 nm from Key West OPAREA	Ecosystem (corals)	Prohibited: anchoring outside of designated areas and times; operating a vessel in certain areas; discharging most materials; damaging or disturbing any living or dead organisms; allowing a vessel to strike or damage any immobile organism attached to the seabed; allowing a chain, rope, etc., to cause damage to coral, seagrasses, or submerged cultural resources. Closed areas apply (36 C.F.R. § 7.27).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. Section 3.10.2.3.2 (Tortugas Military Operating Area) contains additional details regarding these activities. No other proposed activities are expected to occur in the area; therefore, no impacts are expected within the Dry Tortugas National Park.
Everglades National Park	Florida: Other AFTT Areas	Ecosystem (subtropical wilderness, mangrove forest, wading birds, reptiles)	Prohibited: disturbance of aquatic life, except as allowable for fishing. Vessel closure areas and landing restrictions apply (36 C.F.R. § 7.45).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Everglades National Park.

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Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Gulf of Mexico Large Marine Ecosystem (Continued)				
Great White Heron National Wildlife Refuge	Florida: Other AFTT Areas, within 10 nm of Key West OPAREA and Key West Range Complex	Ecosystem (wading birds, coral reefs)	Prohibited: weapons, unless cased and left in vehicles/ boats; feeding/molesting wildlife; storing equipment on refuge lands. Personal watercraft allowed in designated areas only (U.S. Fish and Wildlife Service 1994). Closed areas: all refuge-managed islands; public access is limited to state-owned islands during daylight hours (U.S. Fish and Wildlife Service n.d.-b).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Great White Heron National Wildlife Refuge.
Key West National Wildlife Refuge	Florida: Bordering Key West OPAREA and Key West Range Complex	Breeding grounds for native birds and other wildlife	Prohibited: weapons, unless cased and left in vehicles/ boats; feeding/molesting wildlife; storing equipment on refuge lands. Personal watercraft in designated areas only (U.S. Fish and Wildlife Service 1994).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Key West National Wildlife Refuge.
Lower Suwannee National Wildlife Refuge	Florida: Other AFTT Areas	Ecosystem (West Indian manatees, Gulf sturgeon [*Acipenser oxyrinchus desotoi*], shorebirds and wading birds)	Prohibited: injuring, disturbing, or destroying any plant or animal; carrying, possessing, or discharging firearms, fireworks, explosives, or other weapons (except for hunting as allowed under state regulations) (U.S. Fish and Wildlife Service 2010).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Lower Suwannee National Wildlife Refuge.

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Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Gulf of Mexico Large Marine Ecosystem (Continued)				
National Key Deer Refuge	Florida: Other AFTT Areas (within 10 nm of Key West OPAREA and Key West Range Complex)	Protect and preserve Key deer (*Odocoileus virginianus clavium*) and other wildlife resources in the Florida Keys	Prohibited: weapons, unless cased and left in vehicles/boats; feeding/molesting wildlife; storing equipment on refuge lands. Personal watercraft in designated areas only (U.S. Fish and Wildlife Service 1994).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the National Key Deer Refuge.
Rookery Bay National Estuarine Research Reserve	Florida: Other AFTT Areas (within 10 nm of W-174 of Key West Range Complex)	Ecosystem (birds, fish, manatees, sea turtles)	Prohibited: removing, damaging, or introducing any live animals or plants (except for fishing), or introducing any physical components from or to the reserve; use or possession of firearms; any activity that degrades ambient water quality; approaching islands beyond posted boundary areas in the vicinity of nesting birds; anchoring longer than 2 days (Rookery Bay National Estuarine Research Reserve 2000).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Rookery Bay National Estuarine Research Reserve.
St. Marks National Wildlife Refuge	Florida: Other AFTT Areas	Ecosystem (shorebirds, marine mammals, American alligator [*Alligator mississippiensis*], sea turtles)	Prohibited: taking government property or any natural feature, artifact, animal or plant; bearing weapons or firearms (U.S. Fish and Wildlife Service 1999).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within St. Marks National Wildlife Refuge.

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Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Gulf of Mexico Large Marine Ecosystem (Continued)				
Ten Thousand Islands National Wildlife Refuge	Florida: Other AFTT Areas	Ecosystem (birds, manatees, sea turtles, mangroves)	Prohibited: disturbing any plants or animals; removing any artifacts (U.S. Fish and Wildlife Service n.d.-c).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Ten Thousand Island National Wildlife Refuge.
Breton National Wildlife Refuge	Louisiana: Other AFTT Areas	Ecosystem (nesting or wintering birds)	Prohibited: landing a plane or helicopter on refuge land; entry into the nesting areas and any disturbance of the nesting colonies (U.S. Fish and Wildlife Service n.d.-a).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Breton National Wildlife Refuge.
Delta National Wildlife Refuge	Louisiana: Other AFTT Areas	Ecosystem (waterfowl, American alligator)	No area-specific regulations apply to Navy activities (U.S. Fish and Wildlife Service 2011a).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Delta National Wildlife Refuge.
Shell Keys National Wildlife Refuge	Louisiana: Other AFTT Areas	Ecosystem (nesting birds)	Public access is restricted; areas will be closed when nesting has occurred (U.S. Fish and Wildlife Service 2008).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Shell Keys National Wildlife Refuge.

AFTT: Atlantic Fleet Training and Testing
Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Caribbean Sea Large Marine Ecosystem				
Buck Island Reef National Monument	U.S. Virgin Islands: Other AFTT Areas	Ecosystem (coral reefs, sea turtles, reef fishes)	No take of any resources is allowed. Prohibited: operating a watercraft in such a manner as to cause damage to any underwater feature; maneuvering watercraft within waters that contain marked swimming trails or interpretive signs; anchoring (36 C.F.R. § 7.73).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Buck Island Reef National Monument.
Jobos Bay National Estuarine Research Reserve	Puerto Rico: Other AFTT Areas	Ecosystem (mangroves, seagrass beds, coral reefs, manatees, sea turtles)	All boats using anchors will be restricted to areas specifically designated for that purpose. Vessels with a maximum size of 22.0 ft. (6.7 m) are permitted to transit in Conservation Sectors and Limited Use Sectors. No motor vessels will be allowed in Preservation Sectors, with the exception of researchers and shellfish fishermen (Laboy et al. 2008).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within Jobos Bay National Estuarine Research Reserve.
St. Croix East End Marine Park	U.S. Virgin Islands: Other AFTT Areas	Ecosystem (mangroves, reefs, invertebrates, seagrass beds, sea turtles)	State regulations apply, including designated areas in which no take of any resources is allowed; speed or other vessel restrictions; and restriction on the removal of coral or live rock (U.S. Virgin Islands Department of Planning and Natural Resources 2005).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within St. Croix East End Marine Park.

AFTT: Atlantic Fleet Training and Testing; C.F.R.: Code of Federal Regulations; ft.: feet; m: meters; U.S.: United States
Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.
National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

Table 6.1-2: National System Marine Protected Areas within the Study Area (Continued)

Marine Protected Area	Location within the Study Area	Protection Focus	Summary of Relevant Regulations	Navy Proposed Activities Under the Preferred Alternative and Marine Protected Area Considerations
Caribbean Sea Large Marine Ecosystem (Continued)				
Salt River Bay National Historic Park and Ecological Preserve	U.S. Virgin Islands: Other AFTT Areas	Ecosystem (mangrove forests, estuaries, coral reefs, submarine canyon)	Firearms may be legally possessed as provided under state, local, and federal regulations (National Park Service 2010). National Park Service Management Policies apply (National Park Service 2006a).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Salt River Bay National Historic Park and Ecological Preserve.
Virgin Islands Coral Reef National Monument	U.S. Virgin Islands: Other AFTT Areas (partially overlaps the North Atlantic Gyre Open Ocean Area)	Ecosystem (coral reefs, seagrass beds, sea turtles, humpback whale [*Megaptera novaeangliae*] and many marine mammals, reef fishes)	No take of any resources is allowed. Prohibited: operating a watercraft in such a manner as to cause damage to any underwater feature; casting or dragging an anchor or other mooring device (36 C.F.R. § 7.46).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Virgin Islands Coral Reef National Monument.
North Atlantic Gyre Open Ocean Area				
Virgin Islands National Park	U.S. Virgin Islands: Other AFTT Areas	Ecosystem (tropical coastal and marine ecosystem, including mangroves, corals, and tropical fishes)	Prohibited: operating a watercraft or casting or dragging an anchor or other mooring device in such a manner as to cause damage to any underwater feature; maneuvering watercraft within waters that contain marked swimming trails or interpretive signs. Prohibited: taking any form of marine life in Trunk Bay and in other waters containing underwater signs and markers (36 C.F.R. § 7.74).	The resources protected by this area could be briefly exposed to aircraft overflights; however, overflights are not likely to harm the area's protected natural resources. No other proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Virgin Islands National Park.

Source: List of national system marine protected areas in the Study Area and their protection focuses (National Marine Protected Areas Center 2011)

AFTT: Atlantic Fleet Training and Testing; C.F.R.: Code of Federal Regulations; OPAREA: Operating Area; U.S.: United States

Notes: Other AFTT Areas include areas outside of range complexes and testing ranges but still within the AFTT Study Area. Other AFTT Area events typically refer to those events that occur while vessels are in transit.

National Marine Sanctuaries are not included in this table and are discussed in detail in Section 6.1.2.5 (National Marine Sanctuaries).

6.1.2.1 National Estuarine Research Reserves

National Estuarine Research Reserve System sites protect estuarine land and water and provide habitat for wildlife; educational opportunities for students, teachers, and the public; and serve as laboratories for scientists (15 C.F.R. Part 921). The National Estuarine Research Reserve Program is administered in coordination with the National Marine Sanctuary System. Each reserve is managed by a state agency on a site-specific basis.

6.1.2.2 National Parks

The National Park Service administers all national parks, national seashores, and some of the national recreation areas and national monuments to conserve the scenery and the natural and historic objects and wildlife contained within. Park managers control all park usage to ensure that park resources and values are preserved for the future; they must always seek ways to avoid, or to minimize to the greatest extent practicable, adverse impacts on park resources and values. In general, military activities are discouraged in parks; the use of weaponry is not allowed, and unacceptable impacts from aircraft overflights (e.g., flights that unreasonably interfere with the atmosphere of peace and tranquility, or the natural soundscape maintained within the park) should be avoided. Unacceptable impacts are those that fall short of impairment but are still not acceptable within a particular park's environment, as determined by the professional judgment of the park manager in accordance with *National Park Service Management Policies 2006* (National Park Service 2006a). Military services may request the use of park areas for noncombat exercises. Permits are approved at the discretion of the park superintendent.

6.1.2.3 National Wildlife Refuges

Refuges are managed by the U.S. Fish and Wildlife Service in accordance with EO 12996, *Management and General Public Use of the National Wildlife Refuge System*, the National Wildlife Refuge System Administration Act of 1966, and the National Wildlife Refuge System Improvement Act of 1997. The National Wildlife Refuge System serves as a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and habitats. National wildlife refuges are managed on a site-specific basis. Activities conducted within a refuge must not impair existing wildlife-dependent recreational uses or reduce the potential of the refuge to provide quality, compatible, wildlife-dependent recreation into the future. The U.S. Fish and Wildlife Service is directed to continue, consistent with existing laws and interagency agreements, authorized or permitted refuge uses necessary to facilitate military preparedness; however, new agreements permitting military preparedness activities on refuges are discouraged (U.S. Fish and Wildlife Service 2006).

6.1.2.4 State Marine Protected Areas

State governments have established marine protected areas, including state parks and species-specific sanctuaries, for the management of fisheries, nursery grounds, shellfish beds, recreation, tourism, and for other uses. These areas have a diverse array of conservation objectives, from protecting ecological functions, to preserving shipwrecks, to maintaining traditional or cultural interaction with the marine environment.

6.1.2.5 National Marine Sanctuaries

Under the Marine Protection, Research, and Sanctuaries Act of 1972 (also known as the National Marine Sanctuaries Act), the National Oceanic and Atmospheric Administration establishes a national marine sanctuary for marine areas with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. Sanctuary regulations prohibit destroying, causing the loss of, or injuring any sanctuary resource managed under the law or regulations for that

sanctuary (15 C.F.R. Part 922). National marine sanctuaries are managed on a site-specific basis, and military exemptions vary. The national marine sanctuaries within the Study Area are mapped in Figures 6.1-1, 6.1-2, and 6.1-3. They are described in additional detail below.

6.1.2.5.1 Gerry E. Studds Stellwagen Bank National Marine Sanctuary

The Gerry E. Studds Stellwagen Bank National Marine Sanctuary is located within in the Northeast U.S. Continental Shelf Large Marine Ecosystem in the eastern portion of Massachusetts Bay between Cape Ann and Cape Cod and the southwest corner of the Gulf of Maine (Figure 6.1-1). The sanctuary includes an area of nearly 638 nm^2 and was designated in 1992 to preserve the area's natural and historic resources, including nearly 50 shipwrecks (National Oceanic and Atmospheric Administration 2010). Stellwagen Bank provides habitat for invertebrates, sea turtles including the leatherback and Kemp's ridley, and 17 species of cetaceans (National Marine Sanctuary Program 2007b). The area supports important feeding grounds for the fin, humpback, and North Atlantic right whale. Human uses of the Gerry E. Studds Stellwagen Bank National Marine Sanctuary include commercial shipping, recreational fishing, whale watching, and diving.

General regulations for the Gerry E. Studds Stellwagen Bank National Marine Sanctuary prohibit the following (15 C.F.R. § 922.142(a)):

(1) (i) Discharging or depositing, from within the boundary of the sanctuary, any material or other matter except:

(A) Fish, fish parts, chumming materials or bait used in or resulting from traditional fishing operations in the sanctuary;
(B) Biodegradable effluent incidental to vessel use and generated by marine sanitation devices approved in accordance with Section 312 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1322 et seq.;
(C) Water generated by routine vessel operations (e.g., cooling water, deck wash down and graywater as defined by Section 312 of the Federal Water Pollution Control Act) excluding oily wastes from bilge pumping; or
(D) Engine exhaust.

(ii) Discharging or depositing, from beyond the boundary of the sanctuary, any material or other matter, except those listed in paragraphs (a)(1)(i) (A) through (D) of this section, that subsequently enters the sanctuary and injures a sanctuary resource or quality.

(2) Exploring for, developing or producing industrial materials within the sanctuary.
(3) Drilling into, dredging or otherwise altering the seabed of the sanctuary; or constructing, placing or abandoning any structure, material or other matter on the seabed of the sanctuary, except as an incidental result of:

(i) Anchoring vessels;
(ii) Traditional fishing operations; or
(iii) Installation of navigation aids.

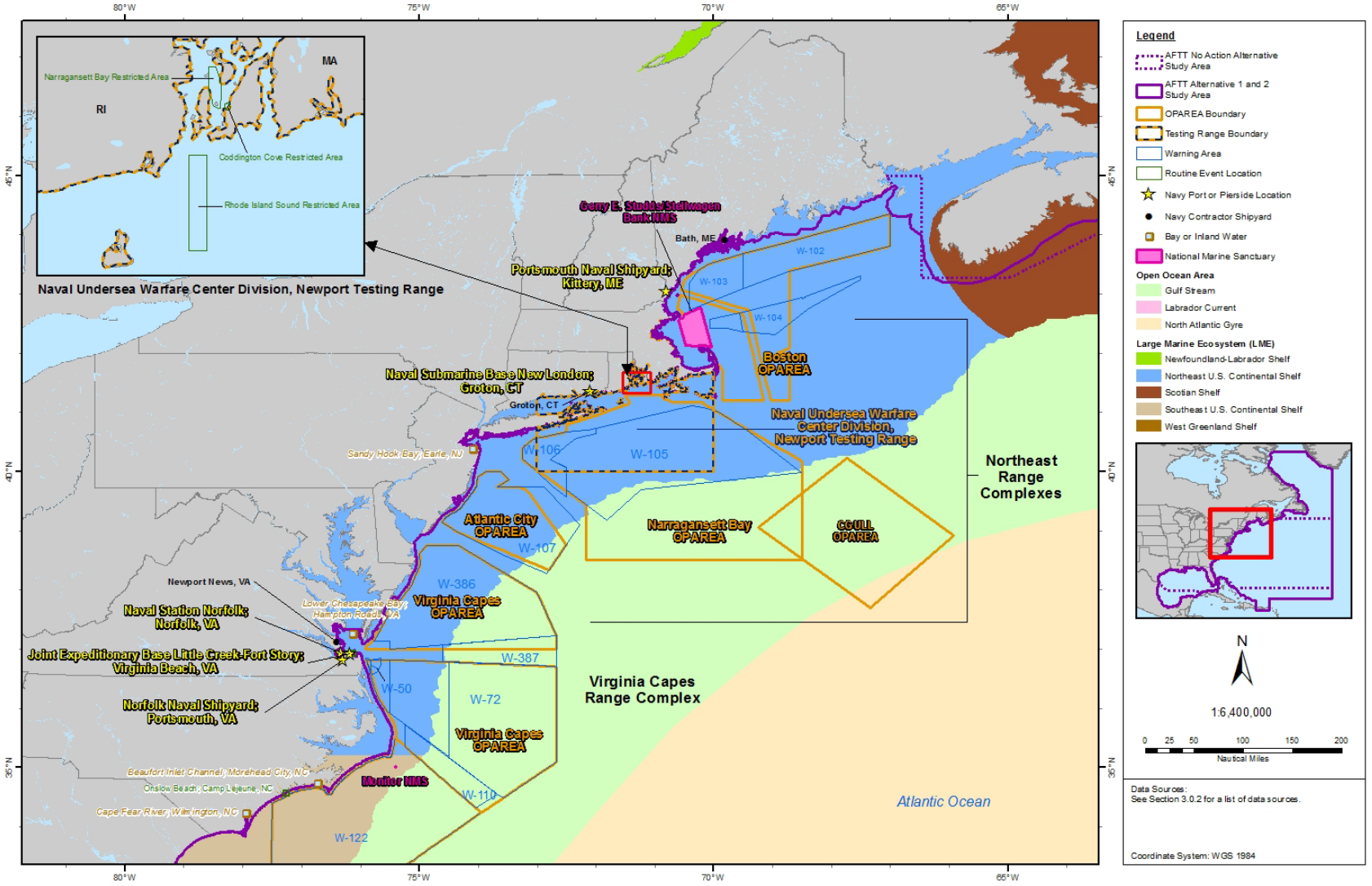

Figure 6.1-1: Location of National Marine Sanctuaries within the Mid-Atlantic Region of the Study Area

AFTT: Atlantic Fleet Training and Testing; CT: Connecticut; MA: Massachusetts; ME: Maine; NC: North Carolina; NJ: New Jersey; NMS: National Marine Sanctuary; OPAREA: Operating Area; RI: Rhode Island

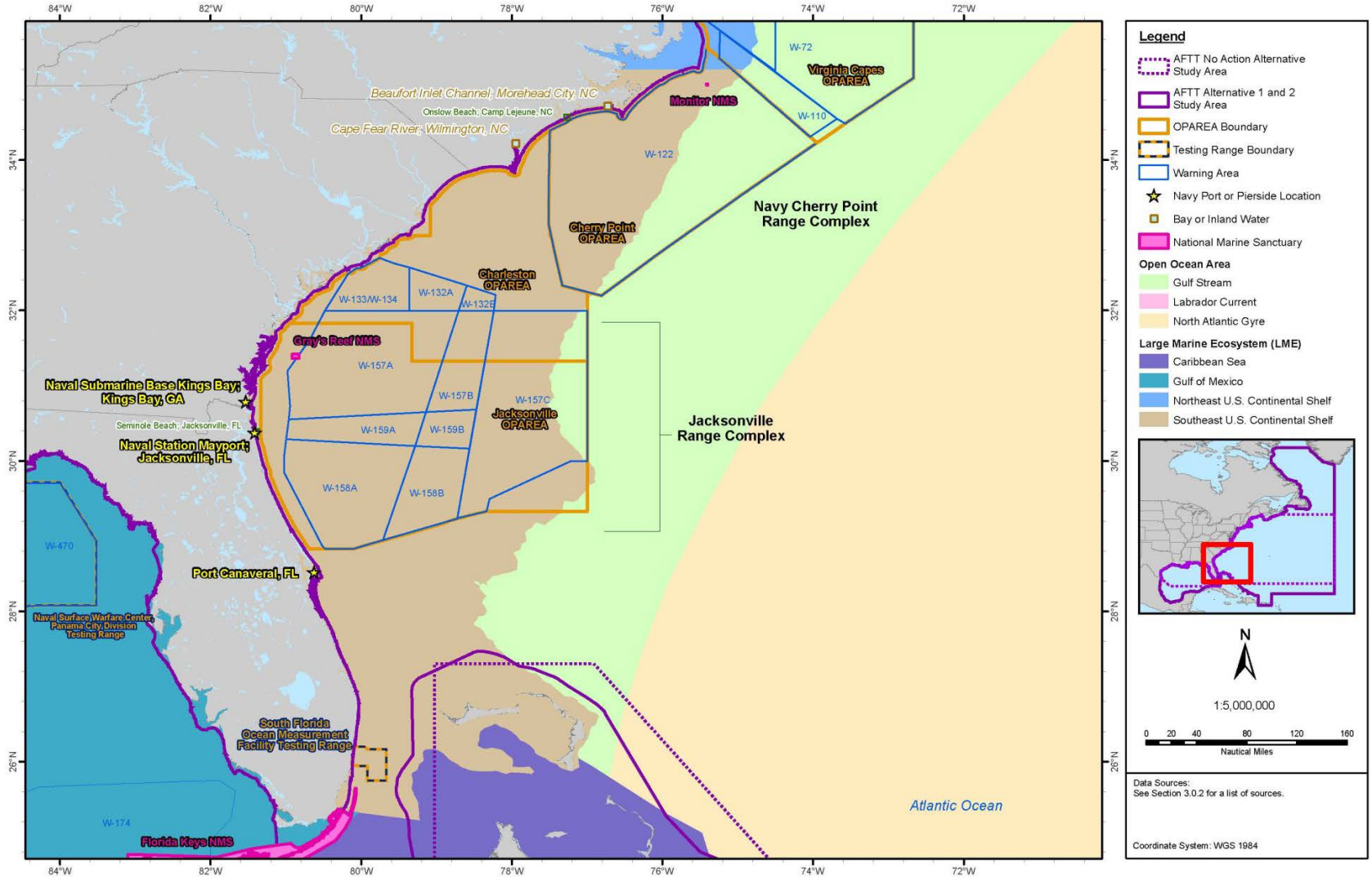

Figure 6.1-2: Location of National Marine Sanctuaries within the Southeast Atlantic Region of the Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; NMS: National Marine Sanctuary; OPAREA: Operating Area

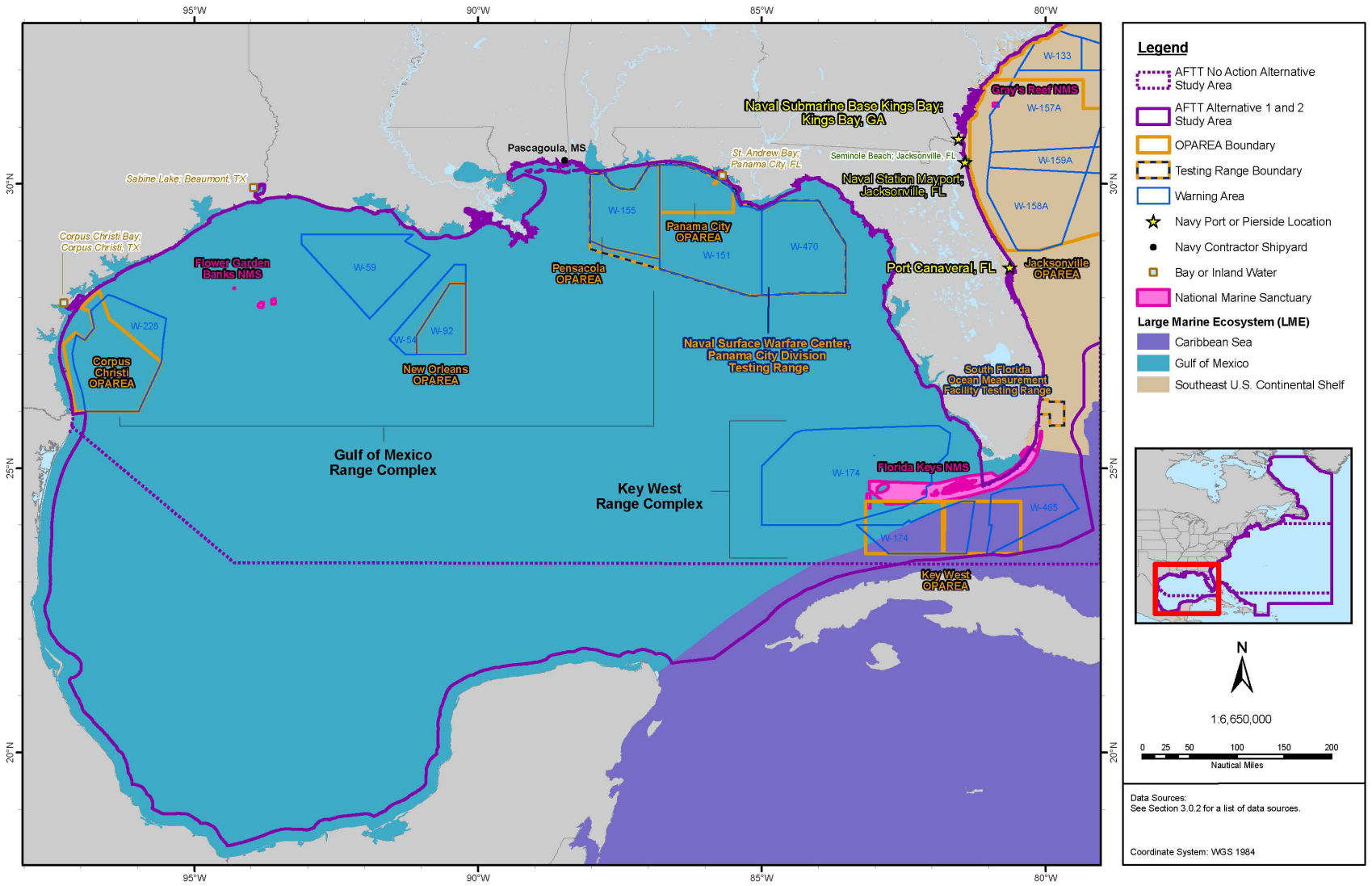

Figure 6.1-3: Location of National Marine Sanctuaries within the Gulf of Mexico Region of the Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; MS: Mississippi; NMS: National Marine Sanctuary; OPAREA: Operating Area; TX: Texas

(4) Moving, removing or injuring, or attempting to move, remove or injure, a sanctuary historical resource. This prohibition does not apply to moving, removing or injury resulting incidentally from traditional fishing operations.
(5) Taking any marine reptile, marine mammal or seabird in or above the sanctuary, except as permitted by the Marine Mammal Protection Act, as amended, (MMPA), 16 U.S.C. 1361 et seq., the Endangered Species Act, as amended, (ESA), 16 U.S.C. 1531 et seq., and the Migratory Bird Treaty Act, as amended, (MBTA), 16 U.S.C. 703 et seq.
(6) Lightering [cargo transfer between vessels] in the sanctuary.
(7) Possessing within the sanctuary (regardless of where taken, moved or removed from), except as necessary for valid law enforcement purposes, any historical resource, or any marine mammal, marine reptile or seabird taken in violation of the MMPA, ESA or MBTA.
(8) Interfering with, obstructing, delaying or preventing an investigation, search, seizure or disposition of seized property in connection with enforcement of the Act or any regulation or permit issued under the Act.

The Gerry E. Studds Stellwagen Bank National Marine Sanctuary does not have specific military exemptions from the applicable National Marine Sanctuary Program Regulations. The regulations simply state that all Department of Defense (DoD) military activities are to be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities (15 C.F.R. § 922.142(c)(1)(i)). Activities carried out by the DoD may be exempted from certain sanctuary prohibitions after consultation with the Office of National Marine Sanctuaries (15 C.F.R. § 922.142(c)(1)(ii)).

The Stellwagen Bank National Marine Sanctuary Management Plan and Environmental Assessment was released in June 2010 (Office of National Marine Sanctuaries 2010). It states:

> DoD's U.S. Navy seldom conducts operations in the sanctuary, due to the shallow depths which are unsuitable for submarine operations, and the crowded waters which make warfare training exercises inadvisable. Naval ships transit the sanctuary approximately seven times a year primarily to access the Port of Boston and in so doing follow internal protocols of posting a lookout for whales and avoiding discharges in the sanctuary (Tom Fetherston, U.S. Navy, personal communication, 2004). Operations in deep waters (greater than 200 m) beyond the sanctuary have the potential to acoustically disturb sanctuary resources.

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities are likely to destroy, cause the loss of, or injure sanctuary resources or qualities. The Navy concluded that the proposed activities could fall into the following two categories:

1. The following platforms, sources, or items that are part of Navy activities may be used within the Gerry E. Studds Stellwagen Bank National Marine Sanctuary, because they (1) are not likely to destroy, cause the loss of, or injure sanctuary resources or qualities, or (2) are carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities (15 C.F.R. § 922.142(c)(1)(i)):

   - Aircraft and Aerial Targets

   Aircraft and aerial targets are expected to cause only a minor and temporary behavioral reaction due to noise for marine mammals, sea turtles, or fish that may be present in the

area. However, in addition to behavioral reactions due to noise, there is potential for seabirds to be struck by aircraft or aerial targets. The Navy implements standard operating procedures that require pilots of Navy aircraft to make every attempt to avoid birds in order to reduce the safety risk involved with a potential bird strike. For a more detailed discussion of potential impacts to these resources from the use of aircraft and aerial targets, see the following sections:

- Section 3.4.3.1.14 (Impacts from Aircraft Noise) for marine mammals
- Section 3.5.3.1.12 (Impacts from Vessel and Aircraft Noise) for sea turtles
- Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise) and Section 3.6.3.3.1 (Impacts from Aircraft and Aerial Targets) for birds, which includes discussion of applicable seabirds
- Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

- Vessels and in-water devices (that do not make contact with seafloor)

Noise from vessels and in-water devices (excluding sonar and other active acoustic sources) is expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, seabirds, or fish that may be present in the area. There is potential for marine mammals, sea turtles, seabirds, floating vegetation, invertebrates, and large slow-moving fish species, to be struck by or to collide with vessels. However, the Navy implements mitigation measures to reduce the potential for vessel strikes of marine mammals (Section 5.3.2.2, Physical Disturbance and Strikes, and Section 5.3.3.1, Marine Mammal Habitats). In addition, all vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions. For a more detailed discussion of potential impacts to these resources from the use of vessels and in-water devices, see the following sections:

- Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices) for marine mammals
- Section 3.5.3.3.1 (Impacts from Vessels) and Section 3.5.3.3.2 (Impacts from In-Water Devices) for sea turtles
- Section 3.6.3.3.2 (Impacts from Vessels and In-Water Devices) for birds
- Section 3.7.3.2.1 (Impacts from Vessels and In-Water Devices) for vegetation
- Section 3.8.3.3.1 (Impacts from Vessels and In-Water Devices) for invertebrates
- Section 3.9.3.3.1 (Impacts from Vessels and In-Water Devices) for fish

2. The following platforms, sources, or items that are part of Navy activities, but are not planned to be used within the Gerry E. Studds Stellwagen Bank National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action:

   - Sonar and other active acoustic sources
   - Explosives detonated in-air, at the surface, or underwater
   - Military expended materials
   - Seafloor devices

Activities the Navy proposes to conduct in Stellwagen Bank National Marine Sanctuary are consistent with the activities considered when the Sanctuary was designated and are consistent with Navy activities and planning during the development of the most recent management plan. Navy activities carried out in the sanctuary are conducted in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities. The Navy does not propose to conduct any new activities in the sanctuary that are likely to destroy, cause the loss of, or injure sanctuary resources or qualities. Further, the Navy does not proposed to increase the level of existing activities within the sanctuary from what was previously considered at the time of sanctuary designation.

6.1.2.5.2 Gray's Reef National Marine Sanctuary

The Gray's Reef National Marine Sanctuary is located within in the Southeast U.S. Continental Shelf Large Marine Ecosystem 17.5 nm off Sapelo Island, Georgia (Figure 6.1-2). The sanctuary includes an area of approximately 17 nm^2 and was designated in 1981 to preserve the area's open ocean and live bottom habitat (National Marine Sanctuary Program 2006). Gray's Reef supports an unusual assemblage of temperate and tropical species. A series of rock ledges and sand expanses have created deep burrows, troughs, and caves that support bottom-dwelling plants and animals, such as sponges, barnacles, sea fans, hard coral, crabs, lobsters, and snails. The diverse topography provides habitat for a diverse fish community, with an estimated 180 species, including black sea bass, snapper, grouper, and mackerel.

Numerous cover types are found on the sanctuary's ledges, including macroalgae, sponges, tunicates, coral, and gorgonians; sessile invertebrates are the most diverse and abundant components, while corals are less common and form smaller colonies than in tropical regions (Bauer et al. 2008). The primary coral species in Gray's Reef National Marine Sanctuary is the branching coral *Oculina arbuscula*—present on 75 percent of ledge sites, but contributing to a small percentage of overall cover. Sessile benthic organisms are susceptible to both direct and indirect damage from marine debris, ranging from abrasion by lines and wires, to entanglement (particularly *Oculina* sp.), to algal fouling and eventual coral death (Bauer et al. 2008).

General regulations for the Gray's Reef National Marine Sanctuary prohibit the following (15 C.F.R. § 922.92(a)):

(1) Dredging, drilling into, or otherwise altering in any way the submerged lands of the sanctuary (including bottom formations).
(2) Constructing any structure other than a navigation aid, or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands of the sanctuary.
(3) Discharging or depositing any material or other matter except:

    (i) Fish or fish parts, bait, or chumming materials;
    (ii) Effluent from marine sanitation devices; and
    (iii) Vessel cooling water.

(4) Operating a watercraft other than in accordance with the Federal rules and regulations that would apply if there were no sanctuary.

(5) (i) Injuring, catching, harvesting, or collecting, or attempting to injure, catch, harvest, or collect, any marine organism, or any part thereof, living or dead, within the sanctuary by any means except by use of rod and reel, and handline gear;

(ii) There shall be a rebuttable presumption that any marine organism or part thereof referenced in this paragraph found in the possession of a person within the sanctuary has been collected from the sanctuary.

(6) Using any fishing gear within the sanctuary except rod and reel, and handline gear, or for law enforcement purposes.
(7) Using underwater any explosives, or devices that produce electric charges underwater.
(8) Breaking, cutting, damaging, taking, or removing any bottom formation.
(9) Moving, removing, damaging, or possessing, or attempting to move, remove, damage, or possess, any sanctuary historical resource.
(10) Anchoring any vessel in the sanctuary, except as provided in § 922.92 when responding to an emergency threatening life, property, or the environment.
(11) Possessing or carrying any fishing gear within the sanctuary except:

(i) Rod and reel, and handline gear;
(ii) Fishing gear other than rod and reel, handline gear, and spearfishing gear, provided that it is stowed on a vessel and not available for immediate use;
(iii) Spearfishing gear provided that it is stowed on a vessel, not available for immediate use, and the vessel is passing through the sanctuary without interruption; and
(iv) For law enforcement purposes.

All activities carried out by the DoD within the sanctuary at the time of designation were considered essential for national defense and therefore are not subject to the sanctuary's general prohibitions. These activities include surface and aerial gunnery, bombing, torpedo and missile activities, as well as vessel and submarine maneuvers, and aircraft overflights (typically above 1,500 ft. [457 m] or beyond a 1 nm radius of the sanctuary). The exemption does not apply to new activities that could potentially have significant impacts, which would require consultation with the Office of National Marine Sanctuaries (15 C.F.R. § 922.92(b)).

The Gray's Reef National Marine Sanctuary Final Management Plan/Final Environmental Impact Statement was released in July 2006 (National Marine Sanctuary Program 2006). It states:

> The Department of Defense has a general exemption from GRNMS [Gray's Reef National Marine Sanctuary] regulations. The Sanctuary lies within the western edge of the Navy's Jacksonville Fleet Operating Area W-157, where training operations are conducted. Although use of this area can be intense and include surface and aerial gunnery, bombing, torpedo, and missile activity, as well as ship and submarine maneuvers, these activities have not affected the Sanctuary in the past. Military aircraft do not fly below 1500 feet or within a one nautical mile radius of the Sanctuary in order to minimize disturbance of marine resources.

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities could potentially have significant impacts on sanctuary resources. The Navy concluded that the proposed activities could fall into the following three categories:

1. The following platforms, sources, or items that are part of Navy activities may be used within the Gray's Reef National Marine Sanctuary because they were specifically exempted:

   - Aircraft and Aerial Targets

   Aircraft and aerial targets are expected to cause only a minor and temporary behavioral reaction due to noise for marine mammals, sea turtles, birds, or fish that may be present in the area. However, in addition to behavioral reactions due to noise, there is potential for seabirds to be struck by aircraft or aerial targets. The Navy implements standard operating procedures that require pilots of Navy aircraft to make every attempt to avoid birds in order to reduce the safety risk involved with a potential bird strike. For a more detailed discussion of potential impacts to these resources from the use of aircraft and aerial targets, see the following sections:

   - Section 3.4.3.1.14 (Impacts from Aircraft Noise) for marine mammals
   - Section 3.5.3.1.12 (Impacts from Vessel and Aircraft Noise) for sea turtles
   - Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise) and Section 3.6.3.3.1 (Impacts from Aircraft and Aerial Targets) for birds, which includes discussion of applicable seabirds
   - Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

   - Vessels and in-water devices (that do not make contact with seafloor)

   Noise from vessels and in-water devices (excluding sonar and other active acoustic sources) is expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, seabirds, or fish that may be present in the area. There is potential for marine mammals, sea turtles, seabirds, floating vegetation, invertebrates, and large slow-moving fish species, to be struck by or to collide with vessels. However, the Navy implements mitigation measures to reduce the potential for vessel strikes of marine mammals (Section 5.3.2.2, Physical Disturbance and Strikes, and Section 5.3.3.1, Marine Mammal Habitats). In addition, all vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions. For a more detailed discussion of potential impacts to these resources from the use of vessels and in-water devices, see the following sections:

   - Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices) for marine mammals
   - Section 3.5.3.3.1 (Impacts from Vessels) and Section 3.5.3.3.2 (Impacts from In-Water Devices) for sea turtles
   - Section 3.6.3.3.2 (Impacts from Vessels and In-Water Devices) for birds
   - Section 3.7.3.2.1 (Impacts from Vessels and In-Water Devices) for vegetation
   - Section 3.8.3.3.1 (Impacts from Vessels and In-Water Devices) for invertebrates
   - Section 3.9.3.3.1 (Impacts from Vessels and In-Water Devices) for fish

- Explosives detonated in-air or at the surface (includes gunnery, bombing, torpedoes, and missiles)

Explosives detonated in-air or at the surface could impact marine mammals, sea turtles, birds, invertebrates, floating vegetation, or fish that may be present in the area. Impacts are expected to range from temporary behavioral reactions to injury, damage, or death. However, the Navy implements mitigation measures to reduce the potential for impacts from the use of explosives (Section 5.3.1.2.2, Acoustic Stressors—Explosives and Impulsive Sound, and Section 5.3.2.1.2, Explosives and Impulsive Sound). For a more detailed discussion of potential impacts to these resources from the use of explosives detonated in-air or at the surface, see the following sections:

- Section 3.4.3.1.9 (Impacts from Explosives) for marine mammals
- Section 3.5.3.1.8 (Impacts from Explosives) for sea turtles
- Section 3.6.3.1.2 (Impacts from Explosives and Swimmer Defense Airguns) for birds
- Section 3.7.3.1.1 (Impacts from Explosives) for vegetation
- Section 3.8.3.1.2 (Impacts from Explosives and Other Impulsive Acoustic Sources) for invertebrates
- Section 3.9.3.1.3 (Impacts from Explosives and Other Impulsive Acoustic Sources) for fish

- Military expended materials resulting from exempted activities

Military expended materials resulting from exempted activities include fragments from high-explosive munitions, non-explosive practice munitions, and targets. These items could directly strike marine mammals, sea turtles, birds, invertebrates, floating vegetation, or fish that may be present in the area. However, the probability of military expended materials directly striking a marine resource is extremely low. In addition, the Navy implements mitigation measures to reduce the potential for direct strike from non-explosive practice munitions (Section 5.3.1.2.3, Physical Disturbance and Strikes, and Section 5.3.2.2.2, Non-Explosive Practice Munitions). In addition to biological resources, military expended materials can land on marine substrates. The Navy implements mitigation measures to reduce the potential for direct strike to shallow coral reefs from non-explosive practice munitions (Section 5.3.3.2, Seafloor Resources). For a more detailed discussion of potential impacts to these resources from the use of non-explosive practice munitions fired in-air or at the surface, see the following sections:

- Section 3.3.3.2.1 (Impacts from Military Expended Materials) for marine habitats
- Section 3.4.3.3.3 (Impacts from Military Expended Materials) for marine mammals
- Section 3.5.3.3.3 (Impacts from Military Expended Materials) for sea turtles
- Section 3.6.3.3.3 (Impacts from Military Expended Materials) for birds
- Section 3.7.3.2.2 (Impacts from Military Expended Materials) for vegetation
- Section 3.8.3.3.2 (Impacts from Military Expended Materials) for invertebrates
- Section 3.9.3.3.2 (Impacts from Military Expended Materials) for fish

2. The following platforms, sources, or items that are part of Navy activities may be used within the Gray's Reef National Marine Sanctuary because they (1) are not likely to destroy, cause the loss of, or injure sanctuary resources or qualities, and (2) would not cause significant impacts on sanctuary resources:

   - Sonar and other active acoustic sources

   Sonar and other active acoustic sources are expected to cause only a minor and temporary behavioral reaction for invertebrates (cephalopods and crustaceans), diving birds, or fish that may be present in the area. No effect is anticipated to corals. There is potential for marine mammals and sea turtles to be injured (permanent threshold shifts in hearing) from sonar and other active acoustic sources. However, due to the water depth in the vicinity of the sanctuary, the types of active sonar and other acoustic sources that could be used would typically be limited to lower source levels and higher frequency systems such as mine-hunting, bottom mapping and underwater communication type systems. Regarding the more powerful hull-mounted mid-frequency sonars, the types of activities that could occur would typically be limited to maintenance, testing or mine countermeasure training, and these events would typically be less than an hour in the vicinity of the sanctuary. Therefore, the likelihood of destroying, causing the loss of, or injuring sanctuary resources, including marine mammals or sea turtles, is low. Furthermore, the Navy implements mitigation measures to reduce the potential for marine mammals and sea turtles to be exposed to sonar and other active acoustic sources throughout the entire AFTT Study Area (Section 5.3.1.2.1, Acoustic Stressors – Non-Impulsive Sound, and Section 5.3.2.1.1, Non-Impulsive Sound). For a more detailed discussion of potential impacts to these resources from the use of sonar and other active acoustic sources, see the following sections:

     - Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) for marine mammals
     - Section 3.5.3.1.7 (Impacts from Sonar and Other Active Acoustic Sources) for sea turtles
     - Section 3.6.3.1.1 (Impacts from Sonar and Other Active Acoustic Sources) for birds
     - Section 3.8.3.1.1 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for invertebrates
     - Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

   - Electromagnetic devices

   Electromagnetic devices are expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, birds, invertebrates (arthropods, such as lobsters), or fish that may be present in the area. For a more detailed discussion of potential impacts to these resources from the use of electromagnetic devices, see the following sections:

     - Section 3.4.3.2.1 (Impacts from Electromagnetic Devices) and Section 3.4.3.3.2 (Impacts from Electromagnetic Devices) for marine mammals
     - Section 3.5.3.2.1 (Impacts from Electromagnetic Devices) for sea turtles

- Section 3.6.3.2.1 (Impacts from Electromagnetic Devices) for birds
- Section 3.8.3.2.1 (Impacts from Electromagnetic Devices) for invertebrates
- Section 3.9.3.2.1 (Impacts from Electromagnetic Devices) for fish

3. The following platforms, sources, or items that are part of Navy activities, but are not planned to be used within the Gray's Reef National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action:

   - Explosives detonated underwater
   - Military expended materials resulting from non-exempted activities
   - Seafloor devices

Activities the Navy proposes to conduct in Gray's Reef National Marine Sanctuary are consistent with the activities exempted when the sanctuary was designated and are consistent with Navy activities and planning during the development of the most recent management plan. The Navy does not propose to conduct any new activities that would cause significant impacts on sanctuary resources. Further, the Navy does not proposed to increase the level of existing activities within the sanctuary from what was previously considered at the time of sanctuary designation.

6.1.2.5.3 *Monitor* National Marine Sanctuary

The *Monitor* National Marine Sanctuary is located within in the Southeast U.S. Continental Shelf Large Marine Ecosystem off the coast of Cape Hatteras, North Carolina (Figure 6.1-2). The geographical extent of the sanctuary is defined by the shipwreck and its surrounding 1 nm diameter area. The sanctuary includes the column of water extending from the ocean surface to the seabed. The sanctuary was established in 1975 to preserve the historical and cultural artifacts of the USS *Monitor* shipwreck, the nation's first ironclad warship. In addition to serving as a valuable national heritage and naval cultural specimen, the *Monitor* provides artificial reef habitat for numerous fish species, including black sea bass, oyster toadfish, and barracuda (National Marine Sanctuary Program 2008).

General regulations for the *Monitor* National Marine Sanctuary prohibit the following (15 C.F.R. § 922.61):

(a) Anchoring in any manner, stopping, remaining, or drifting without power at any time;
(b) Any type of subsurface salvage or recovery operation;
(c) Diving of any type, whether by an individual or by a submersible;
(d) Lowering below the surface of the water any grappling, suction, conveyor, dredging or wrecking device;
(e) Detonating below the surface of the water any explosive or explosive mechanism;
(f) Drilling or coring the seabed;
(g) Lowering, laying, positioning or raising any type of seabed cable or cable-laying device;
(h) Trawling; or
(i) Discharging waste material into the water in violation of any Federal statute or regulation.

Permissible activities include free passage through the sanctuary. The *Monitor* National Marine Sanctuary does not have specific military exemptions from the applicable National Marine Sanctuary Program Regulations (15 C.F.R. §§ 922.60–62).

The *Monitor* National Marine Sanctuary Final Management Plan and Environmental Assessment was released in February 2013 (Office of National Marine Sanctuaries 2013).

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities are likely to destroy, cause the loss of, or injure sanctuary resources or qualities. The Navy concluded that the proposed activities could fall into the following two categories:

1. The following platforms, sources, or items that are part of Navy activities may be used within the *Monitor* National Marine Sanctuary because they are not likely to destroy, cause the loss of, or injure sanctuary resources or qualities:

   - Aircraft and Aerial Targets

   Aircraft and aerial targets would have no impact on the *Monitor* shipwreck.

   - Vessels and in-water devices (that do not make contact with seafloor)

   The *Monitor* National Marine Sanctuary allows transit of vessels through the sanctuary. Furthermore, vessels and in-water devices would have no impact on the *Monitor* shipwreck.

   - Sonar and other active acoustic sources

   Sonar and other active acoustic sources would have no impact on the *Monitor* shipwreck.

   - Electromagnetic devices

   Electromagnetic devices would have no impact on the *Monitor* shipwreck.

2. The following platforms, sources, or items that are part of Navy activities, but are not planned to be used within *Monitor* National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action:

   - Explosives detonated in-air, at the surface, or underwater
   - Military expended materials
   - Seafloor devices

6.1.2.5.4 Florida Keys National Marine Sanctuary

The Florida Keys National Marine Sanctuary is located within portions of the Southeast U.S. Continental Shelf, Caribbean Sea, and Gulf of Mexico Large Marine Ecosystems (Figure 6.1-3). The geographical extent of the sanctuary encompasses an area of 2,900 nm^2, including waters surrounding the 126 mi. (203 km) long Florida Keys archipelago, Florida Bay, and portions of the Gulf of Mexico and Atlantic Ocean (National Marine Sanctuary Program 2007a). The sanctuary was established in 1990 to preserve historical, cultural, and natural resources, including coral reefs, shipwrecks, seagrass beds, and fisheries. The Florida Keys National Marine Sanctuary contains a complex marine ecosystem that supports a variety of unique and nationally significant habitats: seagrass meadows, mangrove islands, and extensive living coral reefs. The ecosystem supports more than 6,000 species of plants, fish, and invertebrates, including the nation's only coral reef that lies next to the continent and one of the largest seagrass communities in the hemisphere (National Marine Sanctuary Program 2007a).

Management of the Florida Keys National Marine Sanctuary involves a zoning strategy, with regulations applicable to either the entire sanctuary or to specific zones. Regulations focus on reducing direct and

indirect threats to the reef by protecting ecologically important habitats and resources and improving water quality. General sanctuary-wide regulations prohibit the following (15 C.F.R. § 922.163(a)):

(1) Mineral and hydrocarbon exploration, development and production. Exploring for, developing, or producing minerals or hydrocarbons within the sanctuary.
(2) Removal of, injury to, or possession of coral or live rock.

(i) Moving, removing, taking, harvesting, damaging, disturbing, touching, breaking, cutting, or otherwise injuring, or possessing (regardless of where taken from) any living or dead coral, or coral formation, or attempting any of these activities, except as permitted under 50 C.F.R. part 622.
(ii) Harvesting, or attempting to harvest, any live rock from the sanctuary, or possessing (regardless of where taken from) any live rock within the sanctuary, except as authorized by a permit for the possession or harvest from aquaculture operations in the Exclusive Economic Zone, issued by the National Marine Fisheries Service pursuant to applicable regulations under the appropriate Fishery Management Plan, or as authorized by the applicable State authority of competent jurisdiction within the sanctuary for live rock cultured on State submerged lands leased from the State of Florida, pursuant to applicable State law. See § 370.027, Florida Statutes and implementing regulations.

(3) Alteration of, or construction on, the seabed. Drilling into, dredging, or otherwise altering the seabed of the sanctuary, or engaging in prop-dredging; or constructing, placing or abandoning any structure, material, or other matter on the seabed of the sanctuary, except as an incidental result of:

(i) Anchoring vessels in a manner not otherwise prohibited by this part (see §§ 922.163(a)(5)(ii) and 922.164(d)(1)(v));
(ii) Traditional fishing activities not otherwise prohibited by this part;
(iii) Installation and maintenance of navigational aids by, or pursuant to valid authorization by, any Federal, State, or local authority of competent jurisdiction;
(iv) Harbor maintenance in areas necessarily associated with Federal water resource development projects in existence on July 1, 1997, including maintenance dredging of entrance channels and repair, replacement, or rehabilitation of breakwaters or jetties;
(v) Construction, repair, replacement, or rehabilitation of docks, seawalls, breakwaters, piers, or marinas with less than ten slips authorized by any valid lease, permit, license, approval, or other authorization issued by any Federal, State, or local authority of competent jurisdiction.

(4) Discharge or deposit of materials or other matter.

(i) Discharging or depositing, from within the boundary of the sanctuary, any material or other matter, except:

(A) Fish, fish parts, chumming materials, or bait used or produced incidental to and while conducting a traditional fishing activity in the sanctuary;

(B) Water generated by routine vessel operations (e.g., deck wash down and graywater as defined in Section 312 of the Federal Water Pollution Control Act), excluding oily wastes from bilge pumping; or
(C) Cooling water from vessels or engine exhaust;

(ii) Discharging or depositing, from beyond the boundary of the sanctuary, any material or other matter that subsequently enters the sanctuary and injures a sanctuary resource or quality, except:

(A) Those listed in paragraph (a)(4)(i)(A) through (a)(4)(i)(C) of this section;
(B) Sewage incidental to vessel use and generated by a marine sanitation device approved in accordance with Section 312 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1322 et seq.;
(C) Those authorized under Monroe County land use permits; or
(D) Those authorized under State permits.

(5) Operation of vessels.

(i) Operating a vessel in such a manner as to strike or otherwise injure coral, seagrass, or any other immobile organism attached to the seabed, including, but not limited to, operating a vessel in such a manner as to cause prop-scarring.
(ii) Having a vessel anchored on living coral other than hardbottom in water depths less than 40 feet when visibility is such that the seabed can be seen.
(iii) Except in officially marked channels, operating a vessel at a speed greater than 4 knots or in manner which creates a wake:

(A) Within an area designated idle speed only/no wake;
(B) Within 100 yards of navigational aids indicating emergent or shallow reefs (international diamond warning symbol);
(C) Within 100 yards of the red and white “divers down” flag (or the blue and white “alpha” flag in Federal waters);
(D) Within 100 yards of residential shorelines; or
(E) Within 100 yards of stationary vessels.

(iv) Operating a vessel in such a manner as to injure or take wading, roosting, or nesting birds or marine mammals.
(v) Operating a vessel in a manner which endangers life, limb, marine resources, or property.
(vi) Having a marine sanitation device that is not secured in a manner that prevents discharges or deposits of treated and untreated sewage. Acceptable methods include, but are not limited to, all methods that have been approved by the U.S. Coast Guard (at 33 C.F.R. § 159.7(b) and (c)).

(6) Conduct of diving/snorkeling without flag. Diving or snorkeling without flying in a conspicuous manner the red and white “divers down” flag (or the blue and white “alpha” flag in Federal waters).
(7) Release of exotic species. Introducing or releasing an exotic species of plant, invertebrate, fish, amphibian, or mammals into the sanctuary.

(8) Damage or removal of markers. Marking, defacing, or damaging in any way or displacing, removing, or tampering with any official signs, notices, or placards, whether temporary or permanent, or with any navigational aids, monuments, stakes, posts, mooring buoys, boundary buoys, trap buoys, or scientific equipment.

(9) Movement of, removal of, injury to, or possession of sanctuary historical resources. Moving, removing, injuring, or possessing, or attempting to move, remove, injure, or possess, a sanctuary historical resource.

(10) Take or possession of protected wildlife. Taking any marine mammal, sea turtle, or seabird in or above the sanctuary, except as authorized by the Marine Mammal Protection Act, as amended, (MMPA), 16 U.S.C. 1361 et seq., the Endangered Species Act, as amended, (ESA), 16 U.S.C. 1531 et seq., and the Migratory Bird Treaty Act, as amended, (MBTA) 16 U.S.C. 703 et seq.

(11) Possession or use of explosives or electrical charges. Possessing, or using explosives, except powerheads, or releasing electrical charges within the sanctuary.

(12) Harvest or possession of marine life species. Harvesting, possessing, or landing any marine life species, or part thereof, within the sanctuary, except in accordance with rules 68B–42 of the Florida Administrative Code, and such rules shall apply mutatis mutandis (with necessary editorial changes) to all Federal and State waters within the sanctuary.

(13) Interference with law enforcement. Interfering with, obstructing, delaying or preventing an investigation, search, seizure, or disposition of seized property in connection with enforcement of the Acts or any regulation or permit issued under the Acts.

The prohibitions listed above do not apply to existing classes of DoD military activities conducted prior to the effective date of these regulations as identified in the EIS and Management Plan for the sanctuary (15 C.F.R. § 922.163(e)(1)). New military activities in the sanctuary are allowed and may be exempted from the prohibitions summarized after consultation between the Office of National Marine Sanctuaries and the Navy. An activity is considered new when it is modified so it is likely to destroy, cause the loss of, or injure a sanctuary resource or quality in a manner significantly greater than was considered in a previous consultation under Section 304(4) of the National Marine Sanctuary Act.

The Navy has played an important role in the lower Florida Keys since the early 1800s. Existing classes of DoD military activities conducted prior to the effective date of sanctuary regulations and identified in the original Final Management Plan/Environmental Impact Statement for the Florida Keys National Sanctuary (National Marine Sanctuary Program 1996) include:

- Research on radar and missile systems and test missile operations and evaluation
- Underwater explosives testing (including weapon systems testing and shock testing of ship hull designs) in “Site A”
- Mine countermeasure research
- Corrosion and coatings tests
- Acoustic research
- General air operations
- Air combat maneuvering
- Air-to-surface ordnance (inert ordnance and smoke markers) at Patricia Range
- Submarine activities (including firing and recovery of non-explosive torpedoes outside sanctuary)
- Sonobuoy testing and diver training (typically includes recovery of sonobuoys)
- Special warfare activities at Fleming Key

- Search and rescue
- General transits, anchoring in designated areas, moorings, and pierside maintenance at Naval Air Station Key West piers
- Harbor management
- Fuel deliveries

The Florida Keys National Marine Sanctuary Revised Management Plan was released in December 2007 (National Marine Sanctuary Program 2007a). The 2007 revised management plan does not alter the exemptions of the original 1996 management plan/environmental impact statement (National Marine Sanctuary Program 1996).

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities are likely to destroy, cause the loss of, or injure sanctuary resources or qualities in a manner significantly greater than was considered in the previous consultation under Section 304(d) of the National Marine Sanctuaries Act. The Navy concluded that the proposed activities could fall into the following three categories:

1. The following platforms, sources, or items that are part of Navy activities may be used within the Florida Keys National Marine Sanctuary because they were specifically exempted:

   - Aircraft and Aerial Targets

   Aircraft and aerial targets are expected to cause only a minor and temporary behavioral reaction due to noise for marine mammals, sea turtles, birds, or fish that may be present in the area. However, in addition to behavioral reactions due to noise, there is potential for seabirds to be struck by aircraft or aerial targets. The Navy implements standard operating procedures that require pilots of Navy aircraft to make every attempt to avoid birds in order to reduce the safety risk involved with a potential bird strike. For a more detailed discussion of potential impacts to these resources from the use of aircraft and aerial targets, see the following sections:

   - Section 3.4.3.1.14 (Impacts from Aircraft Noise) for marine mammals
   - Section 3.5.3.1.12 (Impacts from Vessel and Aircraft Noise) for sea turtles
   - Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise) and Section 3.6.3.3.1 (Impacts from Aircraft and Aerial Targets) for birds, which includes discussion of applicable seabirds
   - Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

   - Vessels and in-water devices (that do not make contact with seafloor)

   Noise from vessels and in-water devices (excluding sonar and other active acoustic sources) is expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, seabirds, or fish that may be present in the area. There is potential for marine mammals, sea turtles, seabirds, floating vegetation, invertebrates, and large slow-moving fish species, to be struck by or to collide with vessels. However, the Navy implements mitigation measures to reduce the potential for vessel strikes of marine mammals (Section 5.3.2.2, Physical Disturbance and Strikes, and Section 5.3.3.1, Marine

Mammal Habitats). In addition, all vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions. For a more detailed discussion of potential impacts to these resources from the use of vessels and in-water devices, see the following sections:

- Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices) for marine mammals
- Section 3.5.3.3.1 (Impacts from Vessels) and Section 3.5.3.3.2 (Impacts from In-Water Devices) for sea turtles
- Section 3.6.3.3.2 (Impacts from Vessels and In-Water Devices) for birds
- Section 3.7.3.2.1 (Impacts from Vessels and In-Water Devices) for vegetation
- Section 3.8.3.3.1 (Impacts from Vessels and In-Water Devices) for invertebrates
- Section 3.9.3.3.1 (Impacts from Vessels and In-Water Devices) for fish

▪ Sonar and other active acoustic sources (including mine countermeasure research, acoustic research, submarine activities, sonobuoy testing, and special warfare activities)

Sonar and other active acoustic sources are expected to cause only a minor and temporary behavioral reaction for invertebrates (cephalopods and crustaceans), diving birds, or fish that may be present in the area. No effect is anticipated to corals. There is potential for marine mammals and sea turtles to be injured (permanent threshold shifts in hearing) from sonar and other active acoustic sources. However, the Navy implements mitigation measures to reduce the potential for marine mammals and sea turtles to be exposed to sonar and other active acoustic sources throughout the entire AFTT Study Area (Section 5.3.1.2.1, Acoustic Stressors – Non-Impulsive Sound, and Section 5.3.2.1.1, Non-Impulsive Sound). For a more detailed discussion of potential impacts to these resources from the use of sonar and other active acoustic sources, see the following sections:

- Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) for marine mammals
- Section 3.5.3.1.7 (Impacts from Sonar and Other Active Acoustic Sources) for sea turtles
- Section 3.6.3.1.1 (Impacts from Sonar and Other Active Acoustic Sources) for birds
- Section 3.8.3.1.1 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for invertebrates
- Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

(2) The following platforms, sources, or items that are part of Navy activities may be used within the Florida Keys National Marine Sanctuary because they are not likely to destroy, cause the loss of, or injure sanctuary resources:

▪ Electromagnetic devices

Electromagnetic devices are expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, birds, invertebrates (arthropods, such as lobsters), or fish that may be present in the area. For a more detailed discussion of potential impacts to these resources from the use of electromagnetic devices, see the following sections:

- Section 3.4.3.2.1 (Impacts from Electromagnetic Devices) and Section 3.4.3.3.2 (Impacts from Electromagnetic Devices) for marine mammals
- Section 3.5.3.2.1 (Impacts from Electromagnetic Devices) for sea turtles
- Section 3.6.3.2.1 (Impacts from Electromagnetic Devices) for birds
- Section 3.8.3.2.1 (Impacts from Electromagnetic Devices) for invertebrates
- Section 3.9.3.2.1 (Impacts from Electromagnetic Devices) for fish

3. The following platforms, sources, or items that are part of Navy activities, but are not planned to be used within the Florida Keys National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action:

   - Sonar and other active acoustic sources (not included in activities listed in Category 1 above)
   - Explosives detonated in-air, at the surface, or underwater
   - Military expended materials
   - Seafloor devices

Activities the Navy proposes to conduct in the Florida Keys National Marine Sanctuary are within the classes of activities exempted as of the effective date of the sanctuary regulations and are consistent with Navy activities and planning included in the most recent management plan. Navy activities have not been modified as to be more likely to destroy, cause the loss of, or injure a sanctuary resource or quality in a manner significantly greater than was previously considered when exempted or in the management plan. Further, the Navy does not proposed to increase the level of existing activities within the sanctuary from what was previously considered at the time of sanctuary designation.

6.1.2.5.5 Flower Garden Banks National Marine Sanctuary

The Flower Garden Banks National Marine Sanctuary is located within in the northwestern portion of the Gulf of Mexico Large Marine Ecosystem, nearly 96 nm offshore of Texas and Louisiana (Figure 6.1-3). The Flower Garden Banks National Marine Sanctuary was designated in 1992 to include East Flower Garden Bank and West Flower Garden Bank, and was expanded in 1996 to include Stetson Bank. Now encompassing an area of 42.34 nm^2, the sanctuary is designed to preserve the ecological and recreational value of three areas of coral reef that exist atop salt domes rising from the ocean floor. The East and West Flower Garden Banks coral reef ecosystem and associated biological communities support nearly 280 fish species, as well as loggerhead and hawksbill sea turtles, and a variety of shark, ray, and invertebrate species (Office of National Marine Sanctuaries 2008). Stetson Bank is primarily habitat for sponge communities, but is also scattered with coral colonies and provides habitat for diverse fish and plant assemblages (Moretzsohn et al. 2011). The sanctuary is used for recreational fishing and diving, which in some cases has degraded the quality of reef habitat because of damage from anchoring (Office of National Marine Sanctuaries 2008).

General regulations for Flower Garden Banks National Marine Sanctuary prohibit the following (15 C.F.R. § 922.122(a)):

(1) Exploring for, developing, or producing oil, gas, or minerals except outside of all no-activity zones and provided all drilling cuttings and drilling fluids are shunted to the seabed through a downpipe that terminates an appropriate distance, but no more than ten meters, from the seabed.

(2) (i) Anchoring any vessel within the sanctuary.

(ii) Mooring any vessel within the sanctuary, except that vessels 100 feet (30.48 meters) or less in registered length may moor to a sanctuary mooring buoy.

(iii) Mooring a vessel in the sanctuary without clearly displaying the blue and white International Code flag "A" ("alpha" dive flag) or the red and white "sports diver" flag whenever a SCUBA diver from that vessel is in the water and removing the "alpha" dive flag or "sports diver" flag after all SCUBA divers exit the water and return back on board the vessel, consistent with U.S. Coast Guard guidelines relating to sports diving as contained within "Special Notice to Mariners" (00–208) for the Gulf of Mexico.

(3) (i) Discharging or depositing from within or into the sanctuary any material or other matter except:

(A) Fish, fish parts, chumming materials, or bait used in or resulting from fishing with conventional hook and line gear in the sanctuary, provided that such discharge or deposit occurs during the conduct of such fishing within the sanctuary;

(B) Clean effluent generated incidental to vessel use by an operable Type I or Type II marine sanitation device (U.S. Coast Guard classification) approved in accordance with Section 312 of the Federal Water Pollution Control Act, as amended 33 U.S.C. 1322. Vessel operators must lock marine sanitation devices in a manner that prevents discharge or deposit of untreated sewage;

(C) Clean vessel deck wash down, clean vessel engine cooling water, clean vessel generator cooling water, clean bilge water, or anchor wash;

(D) Engine exhaust;

(E) In areas of the sanctuary outside the no-activity zones, drilling cuttings and drilling fluids necessarily discharged incidental to the exploration for, development of, or production of oil or gas in those areas and in accordance with the shunting requirements of paragraph (a)(1) of this section unless such discharge injures a sanctuary resource or quality.

(ii) Discharging or depositing, from beyond the boundaries of the sanctuary, any material or other matter, except those listed in paragraphs (a)(3)(i)(A) through (D) of this section, that subsequently enters the sanctuary and injures a sanctuary resource or quality.

(4) Drilling into, dredging, or otherwise altering the seabed of the sanctuary (except as allowed under paragraph (c) of this section); or constructing, placing, or abandoning any structure, material, or other matter on the seabed of the sanctuary.

(5) Injuring or removing, or attempting to injure or remove, any coral or other bottom formation, coralline algae or other plant, marine invertebrate, brine-seep biota, or carbonate rock within the sanctuary.
(6) Taking any marine mammal or turtle within the sanctuary, except as permitted by regulations, as amended, promulgated under the Marine Mammal Protection Act, as amended, 16 U.S.C. 1361 et seq., and the Endangered Species Act, as amended, 16 U.S.C. 1531 et seq.
(7) Killing, injuring, attracting, touching, or disturbing a ray or whale shark in the sanctuary. Notwithstanding the above, the incidental and unintentional injury to a ray or whale shark as a result of fishing with conventional hook and line gear is exempted from this prohibition.
(8) Injuring, catching, harvesting, collecting, or feeding, or attempting to injure, catch, harvest, collect, or feed, any fish within the sanctuary by use of bottom longlines, traps, nets, bottom trawls, or any other gear, device, equipment, or means except by use of conventional hook and line gear.
(9) Possessing within the sanctuary (regardless of where collected, caught, harvested or removed), except for valid law enforcement purposes, any carbonate rock, coral or other bottom formation, coralline algae or other plant, marine invertebrate, brine-seep biota, or fish (except for fish caught by use of conventional hook and line gear).
(10) Possessing or using within the sanctuary, except possessing while passing without interruption through it or for valid law enforcement purposes, any fishing gear, device, equipment or means except conventional hook and line gear.
(11) Possessing, except for valid law enforcement purposes, or using explosives or releasing electrical charges within the sanctuary.

The prohibitions listed above do not apply to activities being carried out by the DoD as of the effective date of sanctuary designation. Pre-existing Navy activities will be carried out in a manner that minimizes any adverse impact on sanctuary resources and qualities. New activities may be carried out by the DoD if they do not have the potential for any significant adverse impacts on sanctuary resources or qualities. New activities with the potential for significant adverse impacts on sanctuary resources or qualities may be exempted by the Office of National Marine Sanctuaries and the DoD. If it is determined that an activity may be carried out, such activity shall be carried out in a manner that minimizes any adverse impact on sanctuary resources and qualities (15 C.F.R. § 922.122(e)(1)). Activities that were carried out prior to the effective date of the sanctuary designation and identified in the original Final Environmental Impact Statement/Management Plan for the Flower Garden Banks National Sanctuary (National Marine Sanctuary Program 1991) include:

- Carrier maneuvers
- Missile testing and development
- Rocket firing
- Air-to-air gunnery
- Air-to-surface gunnery
- Minesweeping operations
- Submarine operations
- Air combat maneuvers
- Aerobatic training
- Instrument training

The Flower Garden Banks National Marine Sanctuary Final Management Plan was released in April 2012 (Office of National Marine Sanctuaries 2012), which included a summary of the revised environmental impact statement and contained the revised regulations as an appendix. The 2012 revised management plan does not alter the exemptions of the original 1991 management plan/environmental impact statement (National Marine Sanctuary Program 1991).

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities could have the potential for any significant adverse impacts on sanctuary resources or qualities. The Navy concluded that the proposed activities could fall into the following two categories:

1. The following platforms, sources, or items that are part of Navy activities may be used within the Flower Garden Banks National Marine Sanctuary because they (1) are not likely to destroy, cause the loss of, or injure sanctuary resources or qualities, (2) do not have the potential for any significant adverse impacts on sanctuary resources or qualities, and (3) are carried out in a manner that minimizes any adverse impact on sanctuary resources and qualities:

    - Aircraft and Aerial Targets

    Aircraft and aerial targets are expected to cause only a minor and temporary behavioral reaction due to noise for marine mammals, sea turtles, birds, or fish that may be present in the area. However, in addition to behavioral reactions due to noise, there is potential for seabirds to be struck by aircraft or aerial targets. The Navy implements standard operating procedures that require pilots of Navy aircraft to make every attempt to avoid birds in order to reduce the safety risk involved with a potential bird strike. For a more detailed discussion of potential impacts to these resources from the use of aircraft and aerial targets, see the following sections:

        - Section 3.4.3.1.14 (Impacts from Aircraft Noise) for marine mammals
        - Section 3.5.3.1.12 (Impacts from Vessel and Aircraft Noise) for sea turtles
        - Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise) and Section 3.6.3.3.1 (Impacts from Aircraft and Aerial Targets) for birds, which includes discussion of applicable seabirds
        - Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

    - Vessels and in-water devices

    Noise from vessels and in-water devices (excluding sonar and other active acoustic sources) is expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, seabirds, or fish that may be present in the area. There is potential for marine mammals, sea turtles, seabirds, floating vegetation, invertebrates, and large slow-moving fish species, to be struck by or to collide with vessels. However, the Navy implements mitigation measures to reduce the potential for vessel strikes of marine mammals (Section 5.3.2.2, Physical Disturbance and Strikes, and Section 5.3.3.1, Marine Mammal Habitats). In addition, all vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing

circumstances and conditions. For a more detailed discussion of potential impacts to these resources from the use of vessels and in-water devices, see the following sections:

- Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices) for marine mammals
- Section 3.5.3.3.1 (Impacts from Vessels) and Section 3.5.3.3.2 (Impacts from In-Water Devices) for sea turtles
- Section 3.6.3.3.2 (Impacts from Vessels and In-Water Devices) for birds
- Section 3.7.3.2.1 (Impacts from Vessels and In-Water Devices) for vegetation
- Section 3.8.3.3.1 (Impacts from Vessels and In-Water Devices) for invertebrates
- Section 3.9.3.3.1 (Impacts from Vessels and In-Water Devices) for fish

- Sonar and other non-impulsive acoustic sources

Sonar and other active acoustic sources are expected to cause only a minor and temporary behavioral reaction for invertebrates (cephalopods and crustaceans), diving birds, or fish that may be present in the area. No effect is anticipated to corals. There is potential for marine mammals and sea turtles to be injured (permanent threshold shifts in hearing) from sonar and other active acoustic sources. However, although marine mammals and sea turtles may occur within the Flower Garden Banks National Marine Sanctuary, there is no evidence to suggest that they would be concentrated in this area; therefore the likelihood of injury is low. In addition, the Navy implements mitigation measures to reduce the potential for marine mammals and sea turtles to be exposed to sonar and other active acoustic sources throughout the entire AFTT Study Area (Section 5.3.1.2.1, Acoustic Stressors – Non-Impulsive Sound, and Section 5.3.2.1.1, Non-Impulsive Sound). For a more detailed discussion of potential impacts to these resources from the use of sonar and other active acoustic sources, see the following sections:

- Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources) for marine mammals
- Section 3.5.3.1.7 (Impacts from Sonar and Other Active Acoustic Sources) for sea turtles
- Section 3.6.3.1.1 (Impacts from Sonar and Other Active Acoustic Sources) for birds
- Section 3.8.3.1.1 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for invertebrates
- Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) for fish

- Electromagnetic devices

Electromagnetic devices are expected to cause only a minor and temporary behavioral reaction for marine mammals, sea turtles, birds, invertebrates (arthropods, such as lobsters), or fish that may be present in the area. For a more detailed discussion of potential impacts to these resources from the use of electromagnetic devices, see the following sections:

- Section 3.4.3.2.1 (Impacts from Electromagnetic Devices) and Section 3.4.3.3.2 (Impacts from Electromagnetic Devices) for marine mammals
- Section 3.5.3.2.1 (Impacts from Electromagnetic Devices) for sea turtles
- Section 3.6.3.2.1 (Impacts from Electromagnetic Devices) for birds
- Section 3.8.3.2.1 (Impacts from Electromagnetic Devices) for invertebrates
- Section 3.9.3.2.1 (Impacts from Electromagnetic Devices) for fish

2. The following platforms, sources, or items that are part of Navy activities, but that are not planned to be used within the Flower Garden Banks National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action:

    - Explosives detonated in-air, at the surface or underwater
    - Military expended materials
    - Seafloor devices

Activities the Navy proposes to conduct in Flower Garden Banks National Marine Sanctuary are consistent with the activities exempted when the sanctuary was designated and are consistent with Navy activities and planning during the development of the most recent management plan. Navy does not propose to conduct any new activities that could have significant adverse impacts on sanctuary resources or qualities. Further, the Navy does not proposed to increase the level of existing activities within the sanctuary from what was previously considered at the time of sanctuary designation.

6.2 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with the Council on Environmental Quality regulations (Part 1502), this EIS/OEIS analyzes the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource. The Navy, in partnership with NMFS, is committed to furthering understanding of marine resources and to developing ways to lessen or eliminate the impacts Navy training and testing activities may have on these resources. For example, the Navy and NMFS collaborate on the Integrated Comprehensive Monitoring Program for marine species to assess the impacts of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs.

The Proposed Action could result in both short- and long-term environmental impacts. However, these are not expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable military range management, including co-use of the Study Area with the general public and commercial and recreational interests. This commitment to co-use of the Study Area will maintain long-term accessibility of the AFTT EIS/OEIS training and testing areas. Sustainable range management practices are specified in range complex management plans under the Navy's Tactical Training Theater Assessment and Planning Program. Among other benefits, these practices protect and conserve natural and cultural resources and preserve access to training areas for current and future training requirements while addressing potential encroachments that threaten to impact range and training area capabilities.

6.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires that environmental analyses include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (42 U.S.C. § 4332). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the impacts that the uses of these resources have on future generations. Irreversible impacts primarily result from the use or destruction of a specific resource (e.g., energy or minerals) that cannot be replaced within a reasonable time. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., the disturbance of a cultural site).

For the Proposed Action, most resource commitments would be neither irreversible nor irretrievable. Most impacts would be short term and temporary, or long lasting but within historical or desired conditions. Because there would be no building or facility construction, the consumption of material typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irretrievably lost.

Implementation of the Proposed Action would require fuels used by aircraft and vessels. Since fixed- and rotary-wing aircraft and ship activities would increase relative to the baseline, total fuel use would increase. Therefore, total fuel consumption would increase under the Proposed Action (Section 6.4), and this nonrenewable resource would be considered irretrievably lost (see Chapter 4 [Cumulative Impacts] and the following discussion on the Navy's Climate Change Roadmap).

6.4 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES AND MITIGATION MEASURES

The federal government consumes two percent of the total U.S. energy share (Jean 2010). Of that two percent, the DoD consumes 93 percent. The Navy consumes one quarter of the total DoD share. The Navy consumes 1.2 billion to 1.6 billion gallons of fuel each year. The Navy expects a 25 percent increase in fuel consumption because of new ships coming into the fleet and the growth in mission areas (Jean 2010). The DoD has published a strategy to transform the way energy is consumed in military operations; the strategy sets the overall direction for operational energy security (Department of Defense 2011). Pursuant to the operational strategy report, the DoD published an implementation plan to integrate operational energy considerations and transformation into existing programs, processes, and institutions (Department of Defense 2012). These documents will provide guidance to the DoD in how to better use energy resources and transform the way we power current and future forces.

Increased training and testing activities within the Study Area would result in an increase in energy demand over the No Action Alternative. The increased energy demand would arise from an increase in fuel consumption, mainly from aircraft and vessels participating in training and testing. Details of fuel consumption by training and testing activities on an annual basis are set forth in the air quality emissions calculation spreadsheets available on the project website. Vessel fuel consumption is estimated to increase by 131 percent and 137 percent per year under Alternative 1 and Alternative 2, respectively, when compared to the No Action Alternative. Aircraft fuel consumption is estimated to increase by 42 percent and 45 percent per year under Alternative 1 and Alternative 2, respectively, when compared to the No Action Alternative. Conservative assumptions were made in developing the estimates, and therefore the actual amount of fuel consumed during training and testing events may be less than estimated. Nevertheless, the demand for fuel consumption would increase from baseline

levels, given the proposed increases in training and testing activities. The alternatives could result in a net cumulative reduction in the global energy (fuel) supply.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed activities are identified. The Navy's energy vision given in the Operational Energy Strategy report (Department of Defense 2011) is consistent with energy conservation practices and states that the Navy values energy as a strategic resource, understands how energy security is fundamental to executing our mission afloat and ashore, and is resilient to any potential energy future.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division is taking to implement EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. The Navy's Task Force Energy is responding to the Secretary of the Navy's Energy Goals through energy security initiatives that reduce the Navy's carbon footprint.

Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supporting the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning and the Hybrid Electric Drive for DDG-51 class ships, which are improvements to existing shipboard technologies that will both help with fleet readiness and decrease the ships' energy consumption and greenhouse gas emissions. These initiatives are expected to greatly reduce the consumption of fossil fuels (Section 3.2, Air Quality). Furthermore, to offset the impact of its expected near-term increased fuel demands and achieve its goals to reduce fossil fuel consumption and greenhouse gas emissions, the Navy plans to deploy by 2016 a green strike group (a "great green fleet") composed of nuclear vessels and ships powered by biofuel in local operations and with aircraft flying only with biofuels (Jean 2010).

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Responsibility: U.S. Fleet Forces Command Action Officer

Deborah Verderame (Naval Sea Systems Command)
M.S., Chemical/Environmental Engineering, University of Maryland
B.S., Biology, Fordham University
B.S., Chemical Engineering, Drexel University
Years of Experience: 30
Responsibility: Research, Development, Testing, and Evaluation for Naval Sea Systems Command Activities

Carter Watterson (Naval Facilities Engineering Command Atlantic)
M.S., Marine Sciences, University of South Alabama
B.A., Biology, University of Richmond
Years of Experience: 15
Responsibility: Marine Science and Protected Species Support

Contractors

Brad Agius (Tetra Tech)
M.S., Biology, Northeastern University
B.S., Marine & Freshwater Biology, University of New Hampshire
Years of Experience: 17
Responsibility: Geographic Information Systems

Maren Anderson (Tetra Tech)
B.A., Ecology and Evolutionary Biology, University of Colorado
Years of Experience: 7
Responsibility: Marine Mammals

Emmy Andrews (Tetra Tech)
M.S., Environmental Management, University of San Francisco
B.S., Art and Art History, Duke University
Years of Experience: 10
Responsibility: NEPA Coordination, Marine Mammals, Technical Reviewer

Ralph Basinski (Tetra Tech)
B.S., Chemistry, University of Pittsburgh
Years of Experience: 28
Responsibility: Military Expended Materials, Technical Reviewer

Randy Bevins (Science Applications International Corporation)
B.S., Professional Aeronautics, Embry Riddle Aeronautical University
Years of Experience: 35
Responsibility: U.S. Fleet Forces Command Training Support and Data Collection

Colleena (Perez) Brazen (Tetra Tech)
M.S., Marine Science, California State University, Moss Landing Marine Laboratories
B.S., Ecology, California Polytechnic State University-San Luis Obispo
Years of Experience: 9
Responsibility: Oceanography

Susan (Chinn) Buchanan (Tetra Tech)
M.E.M., Resource Economics and Policy, Duke University
B.A., International Relations (Environmental and Economic Policy Concentration) and Spanish, Tufts University
Years of Experience: 12
Responsibility: Marine Protected Areas, Style/Format

Susan L. Bupp (Parsons)
M.A., Anthropology, University of Wyoming, Laramie
B.A., Anthropology, Wichita State University, Kansas
Years of Experience: 35
Responsibility: Cultural Resources

Jeffery Butts (Parsons)
J.D., Law, Catholic University
M.U.R.P., Urban and Regional Planning, Virginia Polytechnic Institute and University
B.A., Environmental Sciences, University of Virginia
Years of Experience: 16
Responsibility: Sediments and Water Quality, Air Quality

Joseph J. Campo (formerly with Parsons)
Ph.D., Wildlife Ecology, Texas A&M University
M.S., Wildlife Ecology, Mississippi State University
B.S., Forestry, Louisiana State University
Years of Experience: 29
Responsibility: Sediments and Water Quality, Regulatory Framework, Additional Regulatory Considerations

Mark A. Collins (Parsons)
B.S., Environmental Science, Ferrum College
Years of Experience: 23
Role in this EIS/OEIS: Approach to Analysis, Cumulative Impacts

Kitty Courtney (Tetra Tech)
Ph.D., Oceanography, University of Hawaii
M.A. Biology, San Jose State University
B.A. Biology, University of California, Santa Cruz
Years of Experience: 26
Responsibility: Ecological Characterization of the Study Area, Acoustic Modeling, Affected Environment and Environmental Consequences Introduction, Technical Reviewer

Rosemarie Crisologo (Parsons)
M.S., Environmental Engineering, University of Southern California
B.S., Biological Sciences, University of Southern California
Years of Experience: 28
Responsibility: Socioeconomics

Brian Dresser (Tetra Tech)
M.S., Ecology, University of Georgia, Odum School of Ecology
B.S., Biology, Plymouth State University
Years of Experience: 17
Responsibility: Project Manager, Fish, Essential Fish Habitat, Ecosystem Technical Report

Lauren Gilpatrick (Tetra Tech)
B.S., Wildlife Biology, University of Montana
Years of Experience: 5
Responsibility: Birds

Bill Goosmann (formerly with Parsons)
B.S., Biology, Metropolitan State College of Denver
Years of Experience: 23
Responsibility: Sediments and Water Quality

Derek Hengstenberg (Tetra Tech)
M.S., Wildlife and Fisheries Science, Mississippi State University
B.S., Biology, Plymouth State University
Years of Experience: 16
Responsibility: Birds

Dorian Houser (National Marine Mammal Foundation)
Ph.D., Physiological Ecology, University of California, Santa Cruz
B.A., Biology, Coker College
Years of Experience: 14
Responsibility: Acoustic Analysis

Kevin Kelly (Tetra Tech)
M.S., Oceanography, University of Hawaii
B.S., Biology, Pennsylvania State University
Years of Experience: 14
Responsibility: Sea Turtles and Other Marine Reptiles, Technical Reviewer

Sarah Kotecki (National Marine Mammal Foundation)
B.S., Civil Engineering, Virginia Polytechnic Institute and State University
Years of Experience: 13
Responsibility: Acoustic Analysis

Robert Kull (formerly with Parsons)
M.S., Biology, University of North Carolina
B.A., Biology, University of the Pacific
Years of Experience: 32
Responsibility: Affected Environment and Environmental Consequences Introduction

Tina Kuroiwa-Bazzan (Tetra Tech)
Ph.D., Biology, City University of New York
B.A., Psychology, University of Texas at Austin
Years of Experience: 8
Responsibility: Marine Vegetation, Marine Invertebrates, Marine Habitats, Affected Environment and Environmental Consequences Introduction, Ecosystem Technical Report

Matthew Lybolt (Tetra Tech)
Ph.D., Marine Ecology, University of Queensland, Australia
M.S., Biological Oceanography, University of South Florida
B.S., Biology, University of South Florida
Years of Experience: 14
Responsibility: Fish, Essential Fish Habitat, Marine Invertebrates, Marine Habitats, Affected Environment and Environmental Consequences Introduction, Ecosystem Technical Report

Kate Lomac MacNair (Tetra Tech)
B.S., Biology, Johns Hopkins University
Years of Experience: 5
Responsibility: Marine Mammals

Mandi McElroy (Tetra Tech)
M.S., Wildlife Ecology and Management, University of Georgia
B.S., Wildlife Biology, University of Georgia
Years of Experience: 11
Responsibility: Marine Mammals, Sea Turtles and Other Marine Reptiles

Kari Metcalf (Tetra Tech)
M.S., Environmental Science, Concentration in Water Resources, Indiana University
B.S., Environmental Studies, University of North Carolina at Asheville
Years of Experience: 3
Responsibility: Geographic Information Systems

Chris Millard (Tetra Tech)
M.S., Fish and Wildlife Biology & Management, State University of New York College of Environmental Science and Forestry
B.S., Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry
Years of Experience: 20
Responsibility: Fish

June Mire (Tetra Tech)
Ph.D., Zoology, University of California, Berkeley
M.S., Biological Sciences, University of New Orleans
B.A., Education (Science), University of New Orleans
Years of Experience: 28
Responsibility: NEPA Reviewer, Marine Habitats, Marine Vegetation, Fish, Technical Reviewer

Randall Patrick (Parsons)
B.S., Anthropology, James Madison University
Years of Experience: 13
Responsibility: GIS Mapping and Figures

Cheryl Quaine (Parsons)
M.S., Environmental Science, Christopher Newport University
B.S., Zoology, University of Rhode Island
Years of experience: 17
Responsibility: Deputy Project Manager, Executive Summary, Public Health and Safety, Appendix E

Noelle Ronan (Tetra Tech)
M.S., Wildlife Science, Oregon State University
B.S., Biology/Environmental Science, State University of New York College at Brockport
Years of Experience: 15
Responsibility: Birds

Ann Roseberry Lincoln (Tetra Tech)
S.M., Inorganic Chemistry, Massachusetts Institute of Technology
M.S., Environmental Science & Policy, The Johns Hopkins University
B.S., Biology, Bucknell University
Years of Experience: 20
Responsibility: Information Management, including Administrative Record, Literature, References

Chris Soucier (Tetra Tech)
Ph.D., Biology, City University of New York
M.A., Biology, City University of New York
B.S., Environmental Science, Long Island University–Southhampton College
Years of Experience: 15
Responsibility: Client Program Manager, Technical Reviewer

Blaine Snyder (Tetra Tech)
M.S., Fishing and Fisheries Sciences & Management, Colorado State University
M.S., Biology, Millersville University of Pennsylvania
B.S., Biology, York College
Years of Experience: 30
Responsibility: Fish

Karen Snyder (Katz & Associates, Inc.)
B.S., Journalism/Public Relations, University of Maryland
Years of Experience: 27
Responsibility: Distribution List

Lindsey Staszak
M.S., Marine Resource Management, Texas A&M University at Galveston
B.S., Biology, University of North Carolina Wilmington
Years of Experience: 5
Responsibility: Birds, Sea Turtles and Other Marine Reptiles

Amy Swiecichowski (Parsons)
M.S., Mechanical Engineering, University of Cincinnati
B.S., Mechanical Engineering, Colorado School of Mines
Years of Experience: 10
Responsibility: Project Manager

Mike Zickel (ManTech Technologies, Inc.)
M.S., Marine Estuarine Environmental Sciences, Chesapeake Biological Lab, University of Maryland – College Park
B.S., Physics, College of William and Mary
Years of Experience: 18
Responsibility: Research, Development, Testing, and Evaluation for Naval Air Systems Command Activities

Ann Zoidis (Tetra Tech)
M.S., Physiological and Behavioral Biology, San Francisco State University
B.S., Geological Sciences, Smith College
Years of Experience: 26
Responsibility: Marine Mammals, NEPA/ESA Consistency

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8 PUBLIC INVOLVEMENT AND DISTRIBUTION

This chapter describes the efforts to involve the public in preparing the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), including distribution of the Draft and Final EIS/OEIS. Comments received during the scoping and Draft EIS public comment periods can be found in Appendix E (Public Comments and Responses).

8.1 PROJECT WEB SITE

A public web site was established for this project: www.AFTTEIS.com. This web site address was published in the Notice of Intent to Prepare an Environmental Impact Statement and Overseas Environmental Impact Statement (Appendix B; Federal Register Notices). It was subsequently reprinted in newspaper advertisements, agency letters, and postcards for the Notice of Intent, Announcement of Public Scoping Meetings, Notice of Availability, and Notice of Public Meetings. The scoping meeting fact sheets, public meeting fact sheets, technical reports, and various other materials are available on the project web site and will be made available throughout the course of the project.

8.2 SCOPING PERIOD

The public scoping period began with issuance of the Notice of Intent in the *Federal Register* on 15 July 2010. This notice included a project description and scoping meeting dates and locations. The scoping period lasted 60 days, concluding on 14 September 2010. The scoping period provided a variety of opportunities for the public to comment on the scope of the EIS/OEIS.

8.2.1 PUBLIC SCOPING NOTIFICATION

The Navy made significant efforts to notify the public to ensure maximum public participation during the scoping process. A summary of these efforts follows.

8.2.1.1 Notification Letters

Notice of Intent and Notice of Scoping Meeting letters were distributed on 15 July 2010 to federally-recognized tribes; state-elected officials; and federal, regional, and state agencies. Entities that received the scoping notification letter can be found in Table 8-1 and an example of the letter can be found in Figure 8-1.

Table 8-1: Entities that Received the Scoping Notification Letter

Federally-Recognized Tribes	
Alabama-Coushatta Tribes of Texas	Narragansett Indian Tribe of Rhode Island
Aroostook Band of Micmac Indians of Maine	Oneida Nation of New York
Catawba Indian Nation	Onondaga Nation of New York
Cayuga Nation of New York	Passamaquoddy Tribe – Indian Township Reservation
Chitimacha Tribe of Louisiana	Penobscot Tribe of Maine
Coushatta Tribe of Louisiana	Poarch Band of Creek Indians of Alabama
Eastern Band of Cherokee Indians of North Carolina	Saint Regis Mohawk Tribe, New York
Jena Band of Choctaw Indians	Seminole Tribe of Florida
Kickapoo Traditional Tribe of Texas	Seneca Nation of New York
Mashantucket Pequot Tribe of Connecticut	Tonawanda Band of Seneca Indians of New York
Mashpee Wampanoag Tribe, Massachusetts	Tunica-Biloxi Indian Tribe of Louisiana
Miccosukee Tribe of Indians of Florida	Tuscarora Nation of New York
Mississippi Band of Choctaw Indians, Mississippi	Wampanoag Tribe of Gay Head of Massachusetts
Mohegan Indian Tribe of Connecticut	Ysleta del Sur Pueblo of Texas

Table 8-1: Entities that Received the Scoping Notification Letter (Continued)

Alabama	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Alabama Department of Agriculture and Industries Alabama Department of Conservation and Natural Resources Alabama Department of Economic and Community Affairs Alabama Department of Environmental Management Alabama Development Office Alabama Historical Commission
Connecticut	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Connecticut Council on Environmental Quality Connecticut Department of Economic and Community Development Connecticut Department of Environmental Protection Connecticut Department of Public Health
Delaware	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Delaware Division of Historical and Cultural Affairs Delaware Economic Development Office Delaware Heritage Commission Delaware River Basin Commission Delaware Office of Management and Budget: Budget Development, Planning, and Administration Department of Natural Resources and Environmental Control
Florida	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Florida Department of Environmental Protection Florida Fish and Wildlife Conservation Commission Florida Fish and Wildlife Conservation Commission: Office of Environmental Services Florida State Clearinghouse
Georgia	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Georgia Department of Economic Development Georgia Department of Natural Resources Georgia Environmental Facilities Authority Georgia Forestry Commission Georgia State Clearinghouse
Louisiana	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Louisiana Department of Culture, Recreation, and Tourism Louisiana Department of Economic Development Louisiana Department of Environmental Quality Louisiana Department of Natural Resources Louisiana State Military Department

Table 8-1: Entities that Received the Scoping Notification Letter (Continued)

Maine	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Historic Preservation Commission Maine Department of Conservation Maine Department of Environmental Protection Maine Department of Inland Fisheries and Wildlife Maine State Planning Office
Maryland	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Maryland Department of Environment Maryland Department of Natural Resources Maryland Department of Agriculture Maryland Department of Business and Economic Development Maryland Economic Development Corporation Maryland State Clearinghouse for Intergovernmental Assistance
Massachusetts	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Cape Cod Commission Central Massachusetts Regional Planning Commission Franklin Regional Council of Governments Massachusetts Department of Conservation and Recreation Massachusetts Department of Environmental Protection Massachusetts Department of Public Health Massachusetts Executive Office of Health and Human Services Massachusetts Port Authority (Massport) Massachusetts Regional Planning Commission Massachusetts Water Resources Authority Merrimack Valley Planning Commission
Mississippi	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Mississippi Department of Environmental Quality Mississippi Department of Finance and Administration Mississippi Department of Marine Resources, Coastal Management and Planning Mississippi Soil and Water Conservation Commission Mississippi State Port Authority
New Hampshire	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	New Hampshire Department of Cultural Resources New Hampshire Department of Environmental Services New Hampshire Department of Resources and Economic Development New Hampshire Department of Safety New Hampshire Division of Forests and Lands New Hampshire Fish and Game Department New Hampshire Office of Energy and Planning State of New Hampshire Economic Development

Table 8-1: Entities that Received the Scoping Notification Letter (Continued)

New Jersey	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Garden State Preservation Trust New Jersey Department of Agriculture New Jersey Department of Environmental Protection New Jersey Department of Environmental Protection: Office of Permit Coordination and Environmental Review New Jersey Economic Development Authority New Jersey Historic Trust
New York	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	New York State Department of Environmental Conservation
North Carolina	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	North Carolina Department of Administration North Carolina Department of Administration: State Environmental Review Clearinghouse North Carolina Department of Cultural Resources North Carolina Department of Environment and Natural Resources North Carolina Division of Parks and Recreation North Carolina Division of Water Quality North Carolina Economic Developers Association North Carolina State Ports Authority North Carolina Wildlife Resources Commission North Carolina's Southeast Economic Development Organization
Rhode Island	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Rhode Island Coastal Resources Management Council Rhode Island Department of Administration Rhode Island Department of Environmental Management Rhode Island Department of Health Rhode Island Division of Planning
South Carolina	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Department of Natural Resources Office of State Budget South Carolina Department of Agriculture South Carolina Department of Health and Environmental Control South Carolina Department of Parks, Recreation, and Tourism South Carolina Sea Grant Consortium

Table 8-1: Entities that Received the Scoping Notification Letter (Continued)

Texas	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Texas Bureau of Economic Geology Texas Commission on Environmental Quality Texas General Land Office Texas Parks and Wildlife Department Texas State Grants Team
Virginia	
State Elected Officials	**State Agencies**
Office of the Governor Congressional Delegates	Chesapeake Bay Commission Virginia Department of Conservation and Recreation Virginia Department of Environmental Quality Virginia Department of Forestry Virginia Department of Game and Inland Fisheries Virginia Department of Historic Resources Virginia Department of Natural Resources Virginia Department of Planning and Budget Virginia Department of Transportation Virginia Marine Resources Commission Virginia Port Authority Virginia Resources Authority
Regional	
Federal Agencies	
Federal Aviation Administration, Eastern Region Federal Aviation Administration, Southern Region Federal Aviation Administration, Southwest Region Fishery Management Council, Caribbean Fishery Management Council, Gulf of Mexico Fishery Management Council, Mid-Atlantic Fishery Management Council, New England Fishery Management Council, South Atlantic Gulf State Marine Fisheries Commission National Marine Fisheries Service, West Palm Beach Field Office U.S. Army Corps of Engineers, Baltimore District U.S. Army Corps of Engineers, Galveston District U.S. Army Corps of Engineers, Jacksonville District U.S. Army Corps of Engineers, Jacksonville District, West Palm Beach Office U.S. Army Corps of Engineers, Mobile District U.S. Army Corps of Engineers, New England District U.S. Army Corps of Engineers, New Orleans District U.S. Army Corps of Engineers, New York District U.S. Army Corps of Engineers, Norfolk District U.S. Army Corps of Engineers, Philadelphia District U.S. Army Corps of Engineers, Wilmington District U.S. Coast Guard, District 1 U.S. Coast Guard, District 5 U.S. Coast Guard, District 7 U.S. Coast Guard, District 8	

Table 8-1: Entities that Received the Scoping Notification Letter (Continued)

Regional (Continued)
Federal Agencies (Continued)
U.S. Coast Guard, District 9
U.S. Environmental Protection Agency, Region 1
U.S. Environmental Protection Agency, Region 2
U.S. Environmental Protection Agency, Region 3
U.S. Environmental Protection Agency, Region 4
U.S. Environmental Protection Agency, Region 5
U.S. Fish and Wildlife Service, Southeast Regional Office
U.S. Geological Survey, Northeast Regional Office
U.S. Geological Survey, South Central Regional Office
U.S. Geological Survey, Southeast Regional Office
United States of America
Federal Agencies
Bureau of Ocean Energy, Management, Regulation, and Enforcement
Marine Mammal Commission
National Marine Fisheries Service, Headquarters
National Marine Fisheries Service, Office of Protected Resources
National Park Service
U.S. Army Corps of Engineers, Headquarters
U.S. Coast Guard, Office of Operating and Environmental Standards Division, Headquarters
U.S. Department of Agriculture
U.S. Department of Agriculture, Forest Service
U.S. Department of Transportation, Maritime Administration, Office of Deepwater Ports and Offshore Activities
U.S. Environmental Protection Agency
U.S. Environmental Protection Agency, Office of Federal Activities
U.S. Fish and Wildlife Service, Headquarters
U.S. Geological Survey, Headquarters

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N4/N7/042
July 16, 2010

The Honorable Robert Riley
Governor of Alabama
State Capitol
600 Dexter Avenue
Montgomery, AL 36130

Dear Governor Riley:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT FOR ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES IN THE WESTERN NORTH ATLANTIC OCEAN, LOWER CHESAPEAKE BAY, AND THE GULF OF MEXICO

This letter is to inform you that the Department of the Navy is in the beginning stages of preparing an Environmental Impact Statement (EIS)/Overseas EIS (OEIS) for Atlantic Fleet Training and Testing (AFTT) activities in the Western North Atlantic Ocean, the lower Chesapeake Bay, and the Gulf of Mexico. The U.S. Navy is requesting your comments on the scope, content, and issues to be considered during the development of the AFTT EIS/OEIS.

The U.S. Navy's mission is to organize, train, equip, and maintain combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. This mission is mandated by federal law (Title 10 U.S. Code § 5062) which charges the Chief of Naval Operations (CNO) with the responsibility for ensuring the readiness of the nation's naval forces. The CNO meets that directive, in part, by establishing and executing training programs and ensuring naval forces have access to the ranges, operating areas, and airspace needed to develop and maintain skills.

The U.S. Navy's proposed action is to conduct military training and testing activities in the Western North Atlantic Ocean, the lower Chesapeake Bay and the Gulf of Mexico. Additional information on the U.S. Navy's proposed action and alternatives currently under consideration is enclosed.

In compliance with the National Environmental Policy Act of 1969, the U.S. Navy is holding open house public scoping meetings to support an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to the proposed action. Scoping meetings will inform the public of the U.S. Navy's proposed action and allow community members an opportunity to comment. These comments will help identify potentially significant issues to be analyzed in the Draft EIS/OEIS.

Figure 8-1: Stakeholder Letter for the Notification of Scoping Meetings

5090
Ser N4/N7/042
July 16, 2010

Five open house meetings will be held to allow the public to provide input during the scoping process. Representatives from the U.S. Navy will be available to provide information and answer questions. Members of the public can arrive anytime between 4:00 p.m. and 8:00 p.m. There will be no formal presentation.

a. The public scoping meeting schedule is as follows:

Monday, August 23, 2010
Hynes Convention Center
900 Boylston Street
Boston, MA

Tuesday, August 31, 2010
Prime F. Osborn III
Convention Center
1000 Water Street
Jacksonville, FL

Wednesday, August 25, 2010
Virginia Beach Convention Center
1000 19TH Street
Virginia Beach, VA

Wednesday, September 1, 2010
Gulf Coast Community College
5230 West Highway 98
Panama City, FL

Thursday, August 26, 2010
Crystal Coast Civic Center
3505 Arendell Street
Morehead City, NC

b. Regardless of whether you participate in the public scoping meetings, you may send written comments to the following address:

Naval Facilities Engineering Command, Atlantic
ATTN: AFTT EIS/OEIS PM - Code EV22LL
6506 Hampton Boulevard
Norfolk, VA 23508-1278

You may also submit comments on the project website at: www.AFTTEIS.com. All comments must be postmarked or received by September 14, 2010 to be considered in the Draft EIS/OEIS. For additional information about the AFTT EIS/OEIS, please visit the project website.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Readiness and Training

Enclosure: (1) AFTT EIS/OEIS Project Description and Region Map

2

Figure 8-1: Stakeholder Letter for the Notification of Scoping Meetings (Continued)

8.2.1.2 Postcard Mailers

On 12 July 2010, postcards were mailed to 1,173 recipients on the project mailing list, including individuals, nonprofit organizations, and for-profit organizations. The postcards included the dates, locations, and times for the scoping meetings as well as the website for more information. An example of the postcard is shown in Figure 8-2.

Figure 8-2: Postcard Notification of Scoping Meetings

8.2.1.3 Press Releases

Press releases to announce the scoping meetings were distributed on 15 July 2010. The press release provided a description of the Proposed Action, address of the project website, duration of the comment period, and information on the public meetings. The release also provided information on the availability of the Navy Environmental Media Officer to meet with media in advance of the meetings. An example of the press release can be found in Figure 8-3.

MEDIA RELEASE

Public Affairs Office
Commander, U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, Va. 23511-2487
(757) 836-4429
Fax: (757) 836-3601

FOR IMMEDIATE RELEASE PRESS RELEASE 25-10
19 August 2010

NAVY ASKS FOR PUBLIC INPUT AT OPEN HOUSE SCOPING MEETINGS

The Navy is holding public meetings to gather public input for the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS/OEIS) which will evaluate potential environmental effects associated with training and testing activities in the Western North Atlantic Ocean, the lower Chesapeake Bay and the Gulf of Mexico.

The Navy initiated the scoping process to identify community concerns and issues for analysis in the EIS/OEIS. The Navy seeks the public's involvement and input which are a fundamental part of the Navy's EIS/OEIS development. As part of the public participation process, the Navy has planned meetings to obtain public input on the scope of the EIS.

The AFTT region covers approximately 2.6 million square nautical miles and encompasses the at-sea portions of Navy range complexes and research, development, testing and evaluation (RDT&E) ranges along the Atlantic and Gulf coasts of the United States. With the exception of the lower Chesapeake Bay, inland waters and land-based portions of these range complexes and RDT&E ranges are not a part of the AFTT region and will not be analyzed. Piers and channels at existing Navy ports, Navy shipyards and contractor shipyards in the AFTT region where Navy ship and submarine sonar maintenance and testing occur are also included in the AFTT EIS/OEIS. Please refer to attached map.

The public is encouraged to attend the Navy's open-house style scoping meetings for additional information about the proposed action and to provide written and oral comments on concerns to be addressed in the EIS/OEIS. The public may arrive any time during the open house. There will be no formal presentation; however, Navy experts will be on hand to answer questions about the proposed action and general inquiries about the NEPA process.

All written comments must be postmarked or received during the comment period to be considered in the Draft EIS/OEIS process. Written comments must be postmarked by Sept. 14 and mailed to:

Naval Facilities Engineering Command, Atlantic

ATTN: AFTT EIS/OEIS PM – Code EV22LL

6506 Hampton Boulevard

Norfolk, VA 23508-1278

Comments may also be submitted online at www.AFTTEIS.com or at one of five open house scoping meetings being held from 4 p.m. to 8 p.m. at the following locations:

Monday, August 23, 2010: Hynes Convention Center, 900 Boylston Street, Boston, Mass.

Wednesday, August 25, 2010: Virginia Beach Convention Center, 1000 19th Street, Virginia Beach, Va.

Thursday, August 26, 2010: Crystal Coast Civic Center, 3505 Arendell Street, Morehead City, N.C.

Tuesday, August 31, 2010: The Prime F. Osborn III Convention Center, 1000 Water Street, Jacksonville, Fla.

Wednesday, September 1, 2010: Gulf Coast Community College, 5230 West Highway 98, Panama City, Fla.

-USN-

NOTE: Media interested in attending any of the scoping meetings or in need of additional information should contact Ms. Julie Ann Ripley, Environmental Media Officer at U.S. Fleet Forces Command at (757) 836-4423 or (910) 381-8385. Media are asked to arrive one-half hour prior to the start of the meeting and are welcome to remain following any interviews.

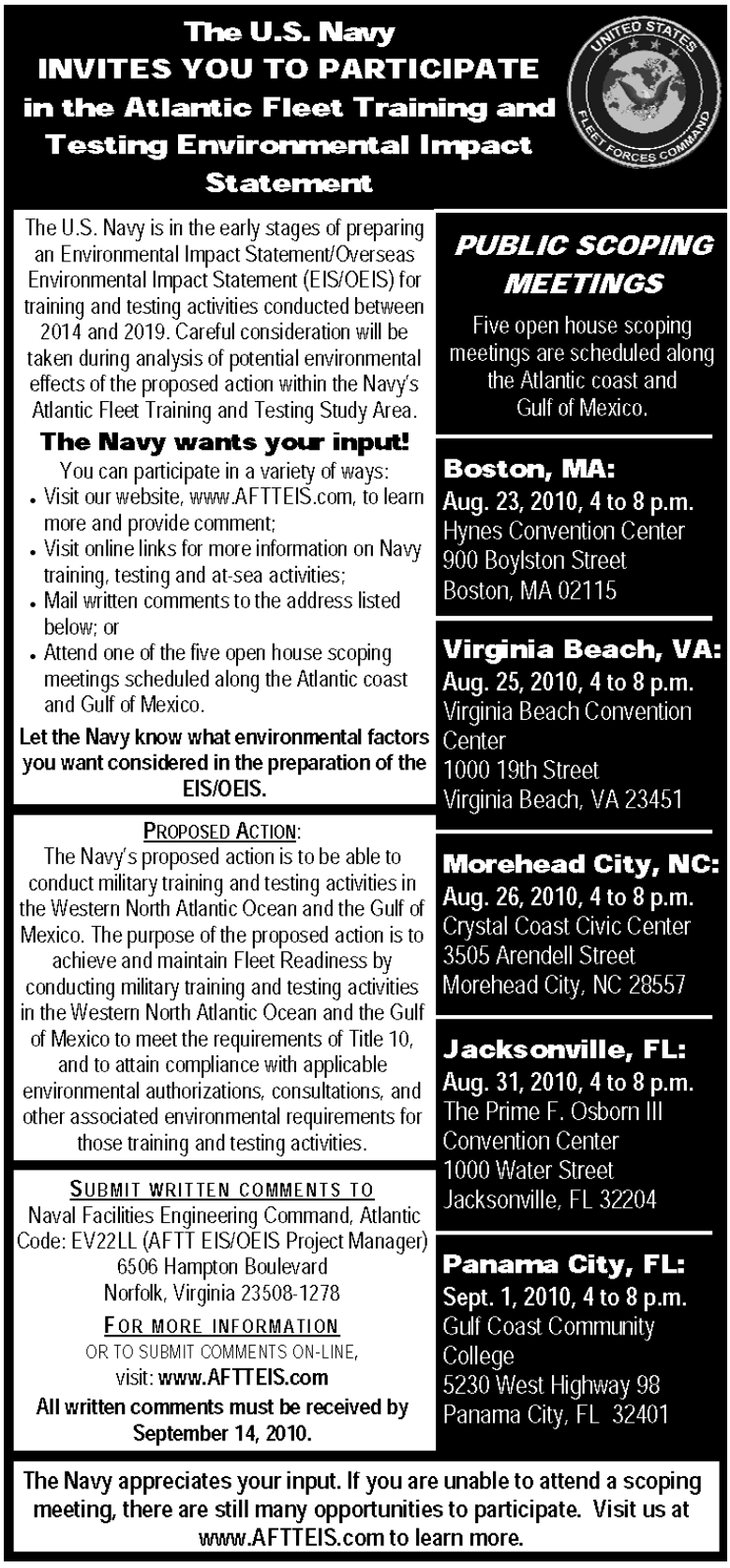
Figure 8-3: Press Release Announcing Scoping Meetings for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement

8.2.1.4 Newspaper Advertisements

To announce the scoping meetings, advertisements were placed in the listed newspapers in the following cities on the dates indicated in Table 8-2. An example of the advertisement is shown in Figure 8-4.

Table 8-2: Newspaper Announcements of Scoping Meetings

Portland, Maine *The Portland Press Herald* Friday, 16 July 2010 Monday, 16 August 2010 Friday, 20 August 2010 Saturday, 21 August 2010 Sunday, 22 August 2010	**New Bedford, Massachusetts** *The Standard Times* Friday, 16 July 2010 Friday, 13 August 2010 Friday, 20 August 2010 Saturday, 21 August 2010 Sunday, 22 August 2010	**Boston, Massachusetts** *Boston Herald* Friday, 16 July 2010 Friday, 13 August 2010 Friday, 20 August 2010 Saturday, 21 August 2010 Sunday, 22 August 2010
Newport, Rhode Island *Newport Daily News* Friday, 16 July 2010 Monday, 16 August 2010 Thursday, 19 August 2010 Friday, 20 August 2010 Saturday, 21 August 2010	**Salisbury, Maryland** *The Daily Times* Friday, 16 July 2010 Monday, 16 August 2010 Sunday, 22 August 2010 Monday, 23 August 2010 Tuesday, 24 August 2010	**Outer Banks, North Carolina** *Outer Banks Sentinel* Wednesday, 14 July 2010 Wednesday, 18 August 2010 Wednesday, 25 August 2010
Norfolk, Virginia *The Virginian-Pilot* Friday, 16 July 2010 Wednesday, 18 August 2010 Sunday, 22 August 2010 Monday, 23 August 2010 Tuesday, 24 August 2010	**Newport News, Virginia** *The Daily Press* Friday, 16 July 2010 Wednesday, 18 August 2010 Sunday, 22 August 2010 Monday, 23 August 2010 Tuesday, 24 August 2010	**Jacksonville, North Carolina** *Jacksonville Daily News* Friday, 16 July 2010 Sunday, 22 August 2010 Saturday, 28 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010
Wilmington, North Carolina *Wilmington Star News* Friday, 16 July 2010 Thursday, 19 August 2010 Monday, 23 August 2010 Tuesday, 24 August 2010 Wednesday, 25 August 2010	**Charleston, South Carolina** *Charleston Post and Courier* Friday, 16 July 2010 Thursday, 19 August 2010 Monday, 23 August 2010 Tuesday, 24 August 2010 Wednesday, 25 August 2010	**Savannah, Georgia** *Savannah Morning News* Friday, 16 July 2010 Tuesday, 24 August 2010 Saturday, 28 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010
Jacksonville, Florida *Florida Times Union* Friday, 16 July 2010 Tuesday, 24 August 2010 Saturday, 28 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010	**Fort Lauderdale, Florida** *Florida Sun Sentinel* Friday, 16 July 2010 Monday, 23 August 2010 Saturday, 28 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010	**Brevard, Florida** *Florida Today* Friday, 16 July 2010 Tuesday, 24 August 2010 Saturday, 28 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010
Panama City, Florida *Panama City News Herald* Friday, 16 July 2010 Tuesday, 24 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010 Tuesday, 31 August 2010	**Pensacola, Florida** *Pensacola News Journal* Friday, 16 July 2010 Sunday, 22 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010 Tuesday, 31 August 2010	**New Orleans, Louisiana** *Times-Picayune* Friday, 16 July 2010 Monday, 23 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010 Tuesday, 31 August 2010
Galveston, Texas *Galveston Daily News* Friday, 16 July 2010 Sunday, 22 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010 Tuesday, 31 August 2010	**Corpus Christi, Texas** *Corpus Christi Caller Times** Friday, 16 July 2010 Monday, 23 August 2010 Sunday, 29 August 2010 Monday, 30 August 2010 Tuesday, 31 August 2010 ** Printed in English and Spanish*	



The U.S. Navy
INVITES YOU TO PARTICIPATE
in the Atlantic Fleet Training and Testing Environmental Impact Statement

The U.S. Navy is in the early stages of preparing an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for training and testing activities conducted between 2014 and 2019. Careful consideration will be taken during analysis of potential environmental effects of the proposed action within the Navy's Atlantic Fleet Training and Testing Study Area.

The Navy wants your input!

You can participate in a variety of ways:

- Visit our website, www.AFTTEIS.com, to learn more and provide comment;
- Visit online links for more information on Navy training, testing and at-sea activities;
- Mail written comments to the address listed below; or
- Attend one of the five open house scoping meetings scheduled along the Atlantic coast and Gulf of Mexico.

Let the Navy know what environmental factors you want considered in the preparation of the EIS/OEIS.

PROPOSED ACTION:

The Navy's proposed action is to be able to conduct military training and testing activities in the Western North Atlantic Ocean and the Gulf of Mexico. The purpose of the proposed action is to achieve and maintain Fleet Readiness by conducting military training and testing activities in the Western North Atlantic Ocean and the Gulf of Mexico to meet the requirements of Title 10, and to attain compliance with applicable environmental authorizations, consultations, and other associated environmental requirements for those training and testing activities.

SUBMIT WRITTEN COMMENTS TO

Naval Facilities Engineering Command, Atlantic
Code: EV22LL (AFTT EIS/OEIS Project Manager)
6506 Hampton Boulevard
Norfolk, Virginia 23508-1278

FOR MORE INFORMATION

OR TO SUBMIT COMMENTS ON-LINE,
visit: **www.AFTTEIS.com**

All written comments must be received by September 14, 2010.

PUBLIC SCOPING MEETINGS

Five open house scoping meetings are scheduled along the Atlantic coast and Gulf of Mexico.

Boston, MA:
Aug. 23, 2010, 4 to 8 p.m.
Hynes Convention Center
900 Boylston Street
Boston, MA 02115

Virginia Beach, VA:
Aug. 25, 2010, 4 to 8 p.m.
Virginia Beach Convention Center
1000 19th Street
Virginia Beach, VA 23451

Morehead City, NC:
Aug. 26, 2010, 4 to 8 p.m.
Crystal Coast Civic Center
3505 Arendell Street
Morehead City, NC 28557

Jacksonville, FL:
Aug. 31, 2010, 4 to 8 p.m.
The Prime F. Osborn III Convention Center
1000 Water Street
Jacksonville, FL 32204

Panama City, FL:
Sept. 1, 2010, 4 to 8 p.m.
Gulf Coast Community College
5230 West Highway 98
Panama City, FL 32401

The Navy appreciates your input. If you are unable to attend a scoping meeting, there are still many opportunities to participate. Visit us at www.AFTTEIS.com to learn more.

Figure 8-4: Newspaper Announcement of Scoping Meeting

8.2.2 SCOPING MEETINGS

Scoping meetings were held on 23, 25, 26, and 31 August 2010 and on 1 September 2010 in the cities of Boston, Massachusetts; Virginia Beach, Virginia; Morehead City, North Carolina; Jacksonville, Florida; and Panama City, Florida, respectively. The meetings were structured in an open-house format, presenting informational posters and written information, with Navy staff and project experts available to answer participants' questions.

8.3 NOTIFICATION OF AVAILABILITY OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

8.3.1 NOTIFICATION OF DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT AND PUBLIC MEETINGS

The Navy made significant efforts to notify the public to ensure maximum public participation during the public comment period. A summary of these efforts follows.

8.3.1.1 Notification Letters

Stakeholder letters were sent to federal agencies, state agencies, and some non-governmental organizations. The letters provided a description of the Proposed Action, address of the project website, duration of the comment period, and information on the public meetings. Figure 8-5 provides an example letter.

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/717
May 7, 2012

Refuge Manager, U.S. Fish & Wildlife Service, Tybee National Wildlife Refuge
Parkway Business Center
1000 Business Center Dr., Ste. 10
Savannah, GA 31405

Dear Sir or Madam :

SUBJECT: UNITED STATES NAVY'S ATLANTIC FLEET TRAINING AND TESTING DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

This letter is to inform you that the Department of the Navy has prepared a Draft Environmental Impact Statement (EIS)/Overseas EIS (OEIS) for U.S. Navy training and testing activities conducted within the Atlantic Fleet Training and Testing (AFTT) Study Area. The U.S. Navy is requesting and welcomes your comments on the Draft EIS/OEIS.

The Study Area is in the western Atlantic Ocean and encompasses the waters off the east coast of North America and the Gulf of Mexico. The Study Area covers approximately 2.6 million square nautical miles of ocean area, and includes designated U.S. Navy operating areas and special use airspace (see enclosure).

The U.S. Navy's mission is to organize, train, equip, and maintain combat-ready Naval Forces capable of winning wars, deterring aggression, and maintaining freedom of the seas as mandated by federal law (Title 10 U.S. Code § 5062). The Chief of Naval Operations is charged with ensuring the readiness of the nation's naval forces and meets that directive, in part, by establishing and executing training programs and ensuring naval forces have access to training ranges, operating areas, and airspace needed to develop and maintain skills for the conduct of operations.

The Navy's proposed action is to conduct training and testing activities, which may include the use of active sonar and explosives, primarily within existing range complexes, operating areas, and testing ranges along the east coast of the U.S., the Gulf of Mexico, pierside locations, port transit channels, and the lower Chesapeake Bay. For more information on the U.S. Navy's proposed action and alternatives currently under consideration, please see the enclosure.

In compliance with the National Environmental Policy Act of 1969, the U.S. Navy is holding five public meetings to inform and provide an opportunity for the public to comment on the proposed action, alternatives under consideration, and the adequacy and accuracy of the analysis in the

Figure 8-5: Stakeholder Letter for the Notification of the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement

5090
Ser N46/717
May 7, 2012

Draft EIS/OEIS. All comments (oral or written) submitted during the 60-day public review period (May 11, 2012 to July 10, 2012) will become part of the public record on the Draft EIS/OEIS and will be addressed in the Final EIS/OEIS.

U.S. Navy representatives will be available during the open house public meetings to provide information and answer questions. Members of the public can arrive anytime between 4 p.m. and 8 p.m. The public meeting schedule is as follows:

Wednesday, May 30, 2012
Hotel Providence
139 Mathewson Street
Providence, RI 02903

Tuesday, June 5, 2012
The Prime F. Osborn III
Convention Center
1000 Water Street
Jacksonville, FL 32204

Wednesday, June 6, 2012
Hilton Garden Inn Panama City
1101 N. Highway 231
Panama City, FL 32405

Monday, June 11, 2012
Virginia Beach Convention Center
1000 19th Street
Virginia Beach, VA 23451

Tuesday, June 12, 2012
Hampton Inn and Suites Swansboro
215 Old Hammock Road
Swansboro, NC 28584

The Draft EIS/OEIS and additional information are available on the project website at: **www.AFTTEIS.com**. A CD-ROM of the Draft EIS/OEIS can also be sent on request.

Written comments may be submitted via the website or mailed to the following address:

Naval Facilities Engineering Command Atlantic
Attn Code EV22 (AFTT EIS Project Managers)
6506 Hampton Blvd
Norfolk, VA 23508-1278

Online comments may also be submitted on the project website at: **www.AFTTEIS.com**. All comments must be postmarked or received online by July 10, 2012, to be considered in the Final EIS/OEIS.

Sincerely,

G. L. EDWARDS
Director
Environmental Readiness Division
By direction

Enclosure (1): U.S. Navy AFTT EIS/OEIS Project Description and Study Area Map

2

Figure 8-5: Stakeholder Letter for the Notification of the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING (AFTT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) PROJECT DESCRIPTION AND STUDY AREA MAP

AFTT EIS/OEIS Proposed Action and Alternatives:

The Navy's proposed action is to conduct training and testing activities, which may include the use of active sonar and explosives primarily within existing range complexes, operating areas, and testing ranges along the east coast of the United States, the Gulf of Mexico, U.S. Navy pierside locations, port transit channels and the lower Chesapeake Bay. The proposed action also includes activities such as sonar maintenance and gunnery exercises conducted during ship transits, and which may occur outside U.S. Navy range complexes and testing ranges. The proposed action includes pierside sonar testing conducted as part of construction, overhaul, modernization, maintenance, and repair activities at shipyards and U.S. Navy piers.

The purpose of the proposed action is to conduct training and testing activities to ensure that the U.S. Navy accomplishes its mission to maintain, train, and equip combat-ready Naval Forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.

No Action Alternative - Continues baseline training and testing activities, as defined by existing U.S. Navy environmental planning documents. The baseline testing activities also include those testing events that have historically occurred in the Study Area, and have been subject to previous analysis pursuant to National Environmental Policy Act (NEPA) and Executive Order 12114. The No Action Alternative is required by regulations as a baseline against which the impacts of the proposed action are compared.

Alternative 1 - Consists of the No Action Alternative plus the expansion of the Study Area boundaries and adjustments to the locations and tempos of training and testing activities from the baseline, as necessary to support current and planned U.S. Navy training and testing requirements. This alternative considers activities occurring on the range complexes and the testing ranges, as well as activities occurring within the Study Area outside of the range complexes and testing ranges; and mission requirements associated with force structure changes, including those resulting from the development, testing, and introduction of new platforms (ships and aircraft) and weapons systems into the fleet. Alternative 1 reflects the adjustment to the baseline necessary to support all current and proposed Navy at-sea training and testing activities through 2019.

Alternative 2 - Consists of Alternative 1 plus the establishment of new range capabilities and modifications of existing capabilities, adjustments to types and tempos of training and testing, and the establishment of additional locations to conduct activities within the Study Area.

Enclosure (1)

Figure 8-5: Stakeholder Letter for the Notification of the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

Environmental Analysis:

Environmental effects that might result from the implementation of the U.S. Navy's proposed action or the alternatives under consideration have been analyzed in the Draft EIS/OEIS. Resources evaluated include sediments and water quality, air quality, marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety.

AFTT Study Area:

The Study Area covers approximately 2.6 million square nautical miles and encompasses the at-sea portions of the range complexes and testing ranges shown on the map included here. The Study Area includes only the at-sea components of the range complexes and testing ranges, with the exception of the Narragansett Bay, lower Chesapeake Bay, St. Andrew Bay, and pierside locations. The remaining inland waters and land-based portions of the range complexes are not a part of the Study Area, and will be or already have been addressed under separate NEPA documentation. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area as indicated on the map.

Enclosure (1)

Figure 8-5: Stakeholder Letter for the Notification of the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

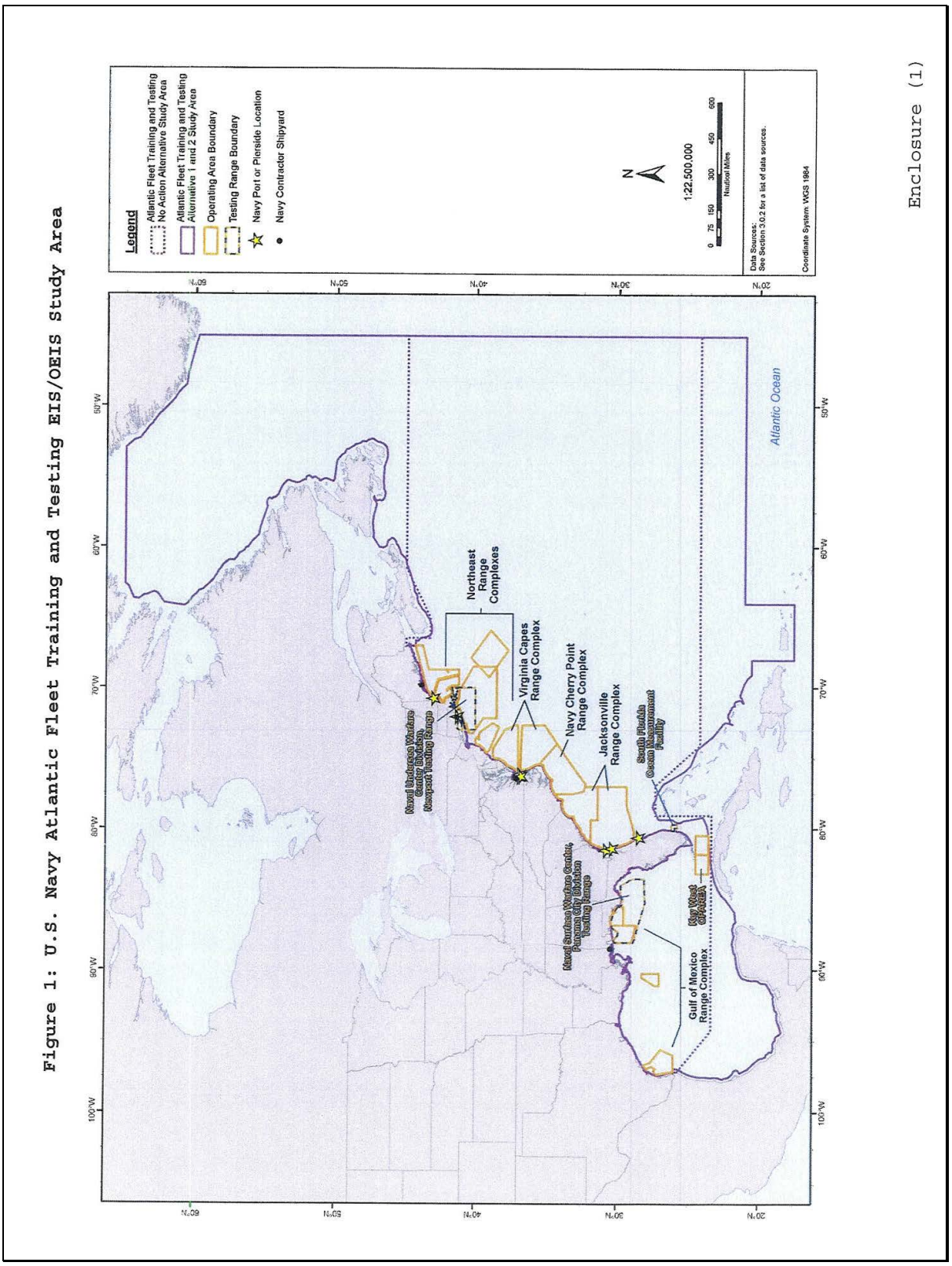


Figure 8-5: Stakeholder Letter for the Notification of the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

8.3.1.2 Postcards

Postcards were sent to individuals, agencies, and organizations per request. The postcards acted as formal notification of the Notice of Availability of the AFTT Draft EIS/OEIS and announcement of public meetings. An example of the Notice of Availability postcard is shown in Figure 8-6.

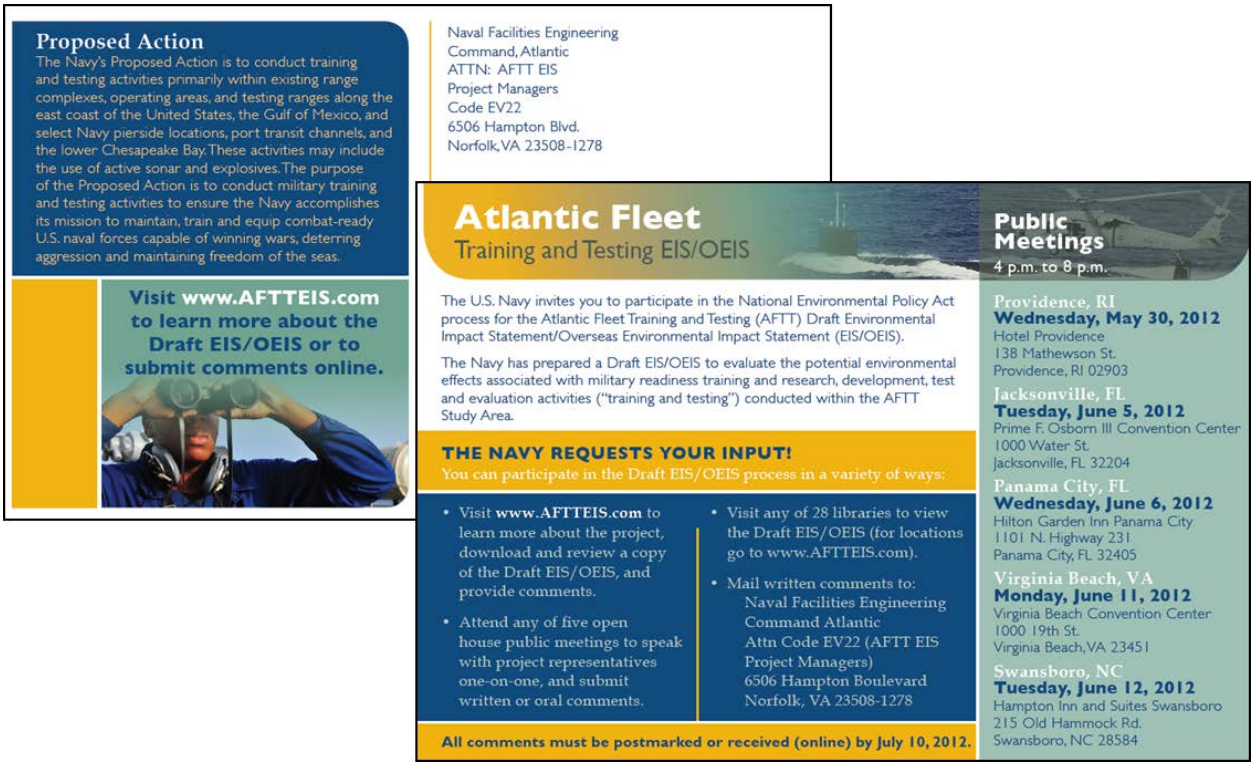


Figure 8-6: Postcard for the Notification of Availability of the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement and Announcement of Public Meetings

8.3.1.3 Press Releases

Press releases to announce the public meetings for the Draft EIS/OEIS were released on 29 May 2012. The press release provided a description of the Proposed Action, address of the project website, duration of the comment period, and information on the public meetings. The release also provided information on the availability of the Navy Environmental Media Officer to meet with media in advance of the meetings. An example of the press release can be found in Figure 8-7.

MEDIA ADVISORY

Public Affairs Office
Commander, U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, Va. 23551-2487
(757) 836-3600

FOR IMMEDIATE RELEASE

Press Release 38.1-12
29 May 2012

Navy to Hold Public Meetings on Atlantic Fleet Training and Testing Draft EIS/OEIS

NORFOLK, Va. — The U.S. Navy encourages the public to attend an open house public meeting to learn about and provide comments on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for Navy training and testing activities conducted in the Atlantic Fleet Training and Testing (AFTT) Study Area.

The AFTT region covers approximately 2.6 million square nautical miles and encompasses the at-sea portions of Navy range complexes and research, development, testing and evaluation ranges along the Atlantic and Gulf coasts of the United States.

Public meetings are being held to inform the public about the Navy's Proposed Action and to obtain comments on the Draft EIS/OEIS and the adequacy and accuracy of the analysis. The public meetings are scheduled from 4 p.m. to 8 p.m., and will be conducted as an open house information session. Navy representatives will be available to provide information about the Proposed Action and address questions related to the Draft EIS/OEIS. Locally the meeting will be held:

Wednesday, May 30, 2012: Hotel Providence, 139 Mathewson St., Providence, R.I.

Navy Invites Public Comment

The Navy is accepting comments throughout the 60-day comment period, from May 11, 2012 to July 10, 2012. All comments must be postmarked or received by **July 10, 2012**, to be considered in the Final EIS/OEIS. Written comments may be submitted via the project website at **www.AFTTEIS.com** or by mail to:

Naval Facilities Engineering Command Atlantic
Attn: Code EV22 (AFTT EIS Project Managers)
6506 Hampton Blvd.
Norfolk, VA 23508-1278

– more –

Figure 8-7: Press Release of Notification of Availability of the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement and Announcement of Public Meetings

Copies of the Draft EIS/OEIS are available online or at one of following public libraries: Providence Public Library, 150 Empire Street, Providence, RI 02903; Public Library of New London, 63 Huntington St., New London, CT 06320; and Boston Public Library, Central Library, 700 Boylston St., Boston, MA 02116. Further details can be found at www.AFTTEIS.com.

The Navy proposes to conduct training and testing activities – which may include the use of active sonar and explosives – primarily within existing range complexes and testing ranges along the east coast of the United States, the Gulf of Mexico, Navy pierside locations, port transit channels, Narragansett Bay, St. Andrew Bay and the lower Chesapeake Bay. The Proposed Action also includes activities such as sonar maintenance and gunnery exercises conducted concurrently with ship transits and which may occur outside Navy range complexes and testing ranges. The Proposed Action includes pierside sonar testing conducted as part of overhaul, modernization, maintenance and repair activities at shipyards and Navy piers, as well as new construction and overhaul at Navy-contracted shipbuilder locations.

The AFTT Draft EIS/OEIS updates the science and analyses needed to continue critical Navy training and testing in the Study Area. The Draft EIS/OEIS combines multiple previous studies into one, thereby incorporating expanded areas, and new science, platforms, and activities including ship shock testing on the east coast. Results from these studies show Navy activities continue to have negligible affects on marine mammal and turtle populations, including endangered species. Monitoring of Navy activities over the past several years supports these conclusions.

– USN –

MEDIA NOTE: A media availability will be held at the above location at 3:30 p.m. Wednesday, May 30. Media interested in attending or in need of additional information should contact Ms. Julie Ann Ripley, Environmental Media Officer at U.S. Fleet Forces Command at 910.381.8385 or julie.a.ripley@navy.mil.

Figure 8-7: Press Release of Notification of Availability of the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement and Announcement of Public Meetings (Continued)

8.3.1.4 Newspaper Advertisements

To announce the Notification of Availability of the Draft EIS/OEIS and public meetings, advertisements were placed in the listed newspapers in the following cities on the dates indicated in Table 8-3. An example of the advertisement is shown in Figure 8-8.

Table 8-3: Newspaper Announcements of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

Portland, Maine *The Portland Press Herald* 11 and 29 May 2012	**New Bedford, Massachusetts** *The Standard Times* 11 and 29 May 2012	**Boston, Massachusetts** *Boston Herald* 11 and 29 May 2012
Providence, Rhode Island *Providence Journal* 11 and 29 May 2012	**Salisbury, Maryland** *The Daily Times* 11 May and 10 June 2012	**Outer Banks, North Carolina** *Outer Banks Sentinel* 16 May and 10 June 2012
Norfolk, Virginia *The Virginian-Pilot* 11 May and 10 June 2012	**Newport News, Virginia** *The Daily Press* 11 May and 10 June 2012	**Jacksonville, North Carolina** *Jacksonville Daily News* 11 May and 11 June 2012
Wilmington, North Carolina *Wilmington Star News* 11 May and 11 June 2012	**Charleston, South Carolina** *Charleston Post and Courier* 11 May and 4 June 2012	**Savannah, Georgia** *Savannah Morning News* 11 May and 4 June 2012
Jacksonville, Florida *Florida Times Union* 11 May and 4 June 2012	**Fort Lauderdale, Florida** *Florida Sun Sentinel* 11 May and 4 June 2012	**Brevard, Florida** *Florida Today* 11 May and 4 June 2012
Panama City, Florida *Panama City News Herald* 11 May and 5 June 2012	**Pensacola, Florida** *Pensacola News Journal* 11 May and 5 June 2012	**New Orleans, Louisiana** *Times-Picayune* 11 May and 5 June 2012
Galveston, Texas *Galveston Daily News* 11 May and 5 June 2012	**Corpus Christi, Texas** *Corpus Christi Caller Times** 11 May and 5 June 2012 ** Printed in English and Spanish*	

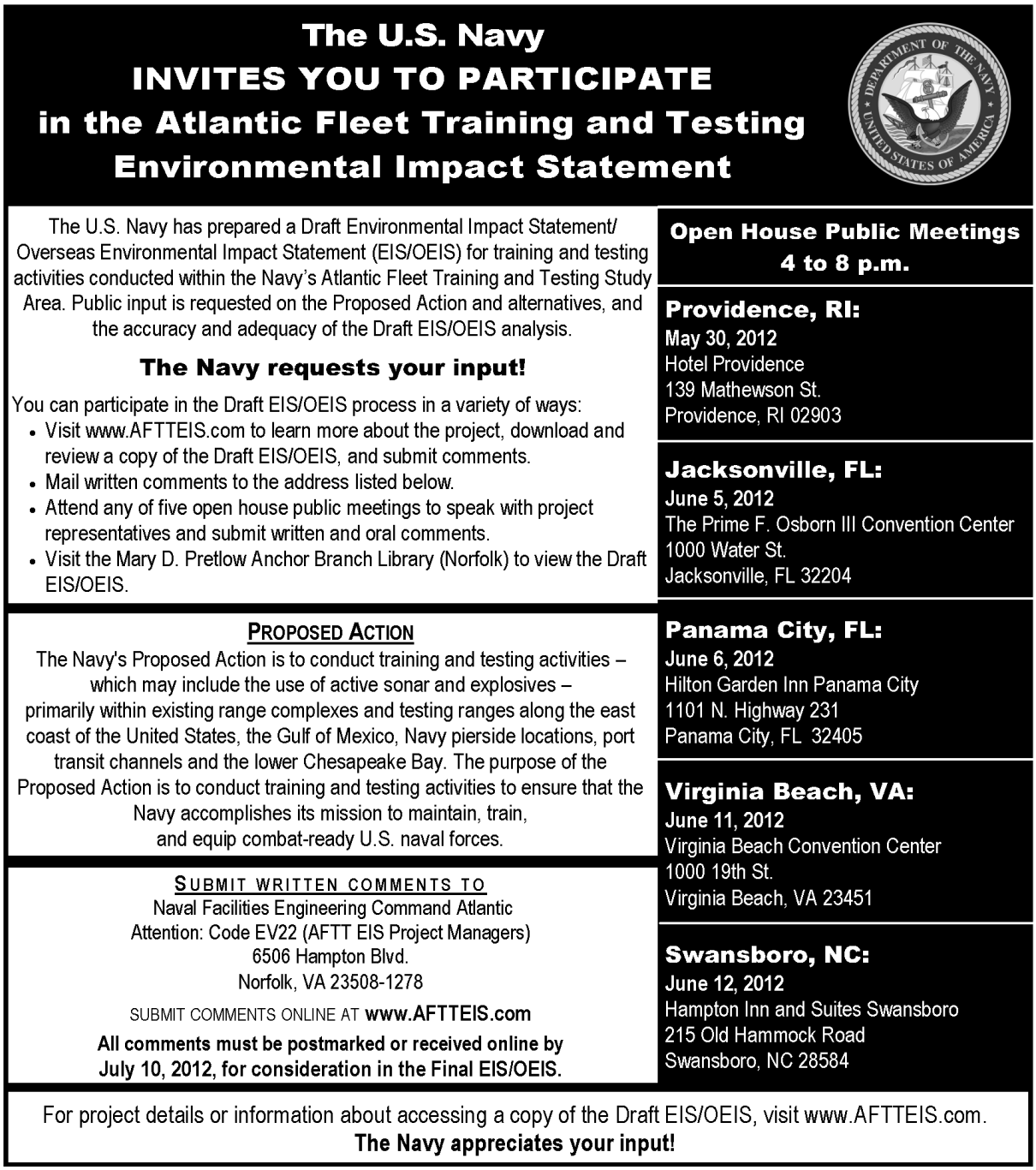


Figure 8-8: Newspaper Announcement of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

8.3.2 PUBLIC MEETINGS

Five public meetings were held on the following dates in the listed cities:

- 30 May 2012 in Providence, Rhode Island
- 5 June 2012 in Jacksonville, Florida
- 6 June 2012 in Panama City, Florida
- 11 June 2012 in Virginia Beach, Virginia
- 12 June 2012 in Swansboro, North Carolina

The meetings were structured in an open-house format, presenting informational posters and written information, with Navy staff and project experts available to answer participants' questions.

8.4 DISTRIBUTION OF THE DRAFT AND FINAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The agencies, individuals, and organizations listed in the sections below received a copy of the AFTT Draft and Final EIS/OEIS. Since release of the Draft EIS/OEIS, points of contact at some of the agencies and organizations changed; therefore, the distribution lists were updated to reflect those changes. Although the points of contact may have changed, the same agencies and organizations received a copy of both the Draft and Final EIS/OEIS. For states not having a clearinghouse, a copy of the EIS/OEIS was sent to the most relevant state agency.

8.4.1 FEDERAL AGENCIES

Electronic copies of the AFTT Draft and Final EIS/OEIS were delivered to the federal agencies listed in Table 8-4.

Table 8-4: Federal Agencies that Received the Draft and Final Environmental Impact Statement/ Overseas Environmental Impact Statement

FEDERAL AGENCIES	
National Marine Fisheries Service (NMFS)	
David Bernhart NOAA Fisheries Service Southeast Regional Office 263 13th Avenue South Saint Petersburg, FL 33701	David Gouviea NOAA Fisheries Service Northeast Regional Office 55 Great Republic Drive Gloucester, MA, 01930-2276
Ms. Helen M. Golde Acting Director, Office of Protected Resources National Marine Fisheries Service National Oceanic and Atmospheric Administration 1315 East-West Highway, SSMC3, Room 13821 Silver Spring, MD 20910-3282	
U.S. Environmental Protection Agency	
John Filippelli Environmental Review Coordinator U.S. Environmental Protection Agency, Region 2 290 Broadway New York, NY 10007-1866	Barbara Rudick Environmental Review Coordinator U.S. Environmental Protection Agency, Region 3 1650 Arch St. Philadelphia, PA 19103-2029
Susan Hedman Regional Administrator U.S. Environmental Protection Agency, Region 5 Ralph Metcalfe Federal Building 77 W. Jackson Blvd. Chicago, IL 60604	Tim Timmermann Environmental Review Coordinator U.S. Environmental Protection Agency, Region 1 5 Post Office Sq., Ste. 100 Boston, MA 02109
Heinz Mueller Chief, National Environmental Protection Act (NEPA) Office U.S. Environmental Protection Agency, Region 4 Atlanta Federal Center 61 Forsyth St., SW MC 9T25 Atlanta, GA 30303	

8.4.2 STATE ELECTED OFFICIALS

Electronic copies of the AFTT Draft and Final EIS/OEIS were delivered to the state governors listed in Table 8-5.

Table 8-5: State Agencies that Received the Draft and Final Environmental Impact Statement/ Overseas Environmental Impact Statement

STATE ELECTED OFFICIALS
Alabama
The Honorable Robert Bentley Governor, State of Alabama Office of the Governor State Capitol, 600 Dexter Ave. Montgomery, AL 36130
Connecticut
The Honorable Dannel P. Malloy Governor, State of Connecticut Office of the Governor State Capitol, 210 Capitol Ave. Hartford, CT 06106
Delaware
The Honorable Jack Markell Governor, State of Delaware Office of the Governor Tatnall Building, William Penn Street, 2nd Fl. Dover, DE 19901
Florida
The Honorable Richard Scott Governor, State of Florida Office of the Governor 400 S. Monroe St. Tallahassee, FL 32399
Georgia
The Honorable Nathan Deal Governor, State of Georgia Office of the Governor 206 Washington Street Suite 203, State Capitol Atlanta, GA 30334
Louisiana
The Honorable Piyush "Bobby" Jindal Governor, State of Louisiana Office of the Governor PO Box 94004 Baton Rouge, LA 70804

STATE ELECTED OFFICIALS
Massachusetts
The Honorable Deval Patrick Governor, Commonwealth of Massachusetts Office of the Governor State House, Rm. 280 Boston, MA 02133
Maryland
The Honorable Martin O'Malley Governor, State of Maryland Office of the Governor 100 State Cir. Annapolis, MD 21401
Maine
The Honorable Paul LePage Governor, State of Maine Office of the Governor 1 State House Sta. Augusta, ME 04333
Mississippi
The Honorable Haley Barbour Governor, State of Mississippi Office of the Governor PO Box 139 Jackson, MS 39205
New Hampshire
The Honorable John Lynch Governor, State of New Hampshire Office of the Governor 107 North Main St. Concord, NH 03301
New Jersey
The Honorable Christopher Christie Governor, State of New Jersey Office of the Governor PO Box 001 Trenton, NJ 08625

STATE ELECTED OFFICIALS
New York
The Honorable Andrew M. Cuomo Governor, State of New York Office of the Governor NYS State Capitol Bldg. Albany, NY 12224
North Carolina
The Honorable Bev Perdue Governor, State of North Carolina Office of the Governor 20301 MSC Raleigh, NC 27699
Rhode Island
The Honorable Lincoln Chafee Governor, State of Rhode Island Office of the Governor 82 Smith St. Providence, RI 02903
South Carolina
The Honorable Nikki Haley Governor, State of South Carolina Office of the Governor 1205 Pendleton St. Columbia, SC 29201
Texas
The Honorable Rick Perry Governor, State of Texas Office of the Governor PO Box 12428 Austin, TX 78711
Virginia
The Honorable Robert McDonnell Governor, Commonwealth of Virginia Office of the Governor 1111 East Broad St., Patrick Henry Bldg. Fl. 3 Richmond, VA, 23219

8.4.3 STATE CLEARINGHOUSES OR AGENCIES

Electronic copies of the AFTT Draft and Final EIS/OEIS were delivered to the state clearinghouses or agencies listed in Table 8-6. For states not having a clearinghouse, a copy of the EIS/OEIS was sent to the most relevant state agency.

Table 8-6: State Clearinghouses or Agencies that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement

STATE CLEARINGHOUSES, APPROPRIATE STATE AGENCY, AND OTHER STATE AGENCIES
Alabama
Lance R. LeFleur Director Alabama Department of Environmental Management PO Box 301463 Montgomery, AL 36130
Connecticut
Karl J. Wagener Executive Director Connecticut Council on Environmental Quality 79 Elm St. Hartford, CT 06106
Delaware
Cathy Wolfe Management Analyst Office of Management and Budget: Budget Development, Planning & Administration Haslet Armory, Fl. 3 122 William Penn St. Dover, DE 19901
Florida
Lauren Milligan Environmental Manager, Clearinghouse Coordination Florida State Clearinghouse: Florida Department of Environmental Protection 3900 Commonwealth Blvd., MS 47 Tallahassee, FL 32399
Georgia
Barbara Jackson Grants Administrator Georgia State Clearinghouse 270 Washington St., SW, Fl. 8 Atlanta, GA 30334
Louisiana
Peggy Hatch Secretary Louisiana Department of Environmental Quality PO Box 4301 Baton Rouge, LA 70821
Maine
Joel Johnson Economics and Demographics Program Maine State Planning Office 38 State House Station Augusta, ME 04333

Table 8-6: State Clearinghouses or Agencies that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

STATE CLEARINGHOUSES, APPROPRIATE STATE AGENCY, AND OTHER STATE AGENCIES
Maryland
Linda P. Janey, J.D. Assistant Secretary, Clearinghouse Communications Maryland State Clearinghouse for Intergovernmental Assistance 301 W. Preston St., Ste. 1101 Baltimore, MD 21201
Massachusetts
Edward M. Lambert, Jr. Commissioner Massachusetts Department of Conservation and Recreation 251 Causeway St., Ste. 900 Boston, MA 02114
Mississippi
Janet Riddell State Clearinghouse Representative Mississippi Department of Finance and Administration 1300 Woolfolk Bldg., Suite E 501 North West Street Jackson, MS 39201
North Carolina
Sheila Green Office of the Secretary, Administrative Assistant North Carolina Department of Administration: State Environmental Review Clearinghouse 1301 MSC Raleigh, NC 27699
New Hampshire
Joanne O. Morin Director New Hampshire Office of Energy and Planning 4 Chenell Drive Concord, NH 03301
New Jersey
Scott Brubaker Director New Jersey Department of Environmental Protection: Office of Permit Coordination and Environmental Review PO Box 423 Trenton, NJ 08625
New York
Joe Martens Commissioner New York State Department of Environmental Conservation 625 Broadway Albany, NY 12233
Rhode Island
Benny Bergantino Senior Planner Rhode Island State Division of Planning 1 Capitol Hill, 3rd Fl Providence, RI 02908

Table 8-6: State Clearinghouses or Agencies that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

STATE CLEARINGHOUSES, APPROPRIATE STATE AGENCY, AND OTHER STATE AGENCIES
South Carolina
Jean Ricard Grants Services and Special Projects South Carolina State Office of State Budget 1201 Main St., Ste. 715, Box 27 Columbia, SC 29201
Texas
Mark Vickery Executive Director Texas Commission on Environmental Quality PO Box 13087, MC 109 Austin, TX 78711
Virginia
Bill Hayden Public Affairs/Media Relations Virginia Department of Environmental Quality 629 E. Main St. PO Box 1105 Richmond, VA 23219
Virgin Islands
Ira Mills Director U.S. Virgin Islands Office of Management and Budget #41 Norre Gade Emancipation Garden Station, 2nd Fl St. Thomas, VI 00802

8.4.4 REPOSITORIES

Electronic copies of the AFTT Draft and Final EIS/OEIS were also delivered to the repositories listed in Table 8-7.

Table 8-7: Repositories that Received the Draft and Final Environmental Impact Statement/ Overseas Environmental Impact Statement

AFTT INFORMATION REPOSITORIES
Alabama
Ben May Main Library 701 Government St. Mobile, AL 36602
Connecticut
Public Library of New London 63 Huntington St. New London, CT 06320
Florida
Bay County Public Library 898 West 11th St. Panama City, FL 32401

Table 8-7: Repositories that Received the Draft and Final Environmental Impact Statement/ Overseas Environmental Impact Statement (Continued)

AFTT INFORMATION REPOSITORIES
Jacksonville Public Library, Main Library 303 N. Laura St. Jacksonville, FL 32202
Walton County Coastal Branch Library 437 Greenway Trail Santa Rosa Beach, FL 32459
West Florida Public Library, Main Library 200 W. Gregory St. Pensacola, FL 32502
West Florida Public Library, Southwest Branch 12248 Gulf Beach Hwy. Pensacola, FL 32507
West Palm Beach Public Library 411 Clematis Street West Palm Beach, FL 33401
Georgia
Camden County Public Library 1410 Hwy. 40 E. Kingsland, GA 31548
Louisiana
East Bank Regional Library 4747 W. Napoleon Ave. Metairie, LA 70001
New Orleans Public Library, Main Library 219 Loyola Ave. New Orleans, LA 70112
Maine
Portland Public Library 5 Monument Sq. Portland, ME 04101
Maryland
Anne Arundel County Public Library, Annapolis Area Branch 1410 West St. Annapolis, MD 21401
Massachusetts
Boston Public Library, Central Library 700 Boylston St. Boston, MA 02116
Mississippi
Meridian-Lauderdale County Public Library 2517 7th St. Meridian, MS 39301
North Carolina
Carteret County Public Library 1702 Live Oak St., Ste. 100 Beaufort, NC 28516

Table 8-7: Repositories that Received the Draft and Final Environmental Impact Statement/ Overseas Environmental Impact Statement (Continued)

AFTT INFORMATION REPOSITORIES
Hatteras Library 57709 Hwy. 12 Hatteras, NC 27943
Havelock-Craven County Public Library 301 Cunningham Blvd. Havelock, NC 28532
Kill Devil Hills Branch Library 400 Mustian St. Kill Devil Hills, NC 27948
New Hanover County Public Library 201 Chestnut St. Wilmington, NC 28401
Onslow County Public Library 58 Doris Ave. E. Jacksonville, NC 28540
Webb Memorial Library and Civic Center 812 Evans St. Morehead City, NC 28557
Rhode Island
Providence Public Library 150 Empire St. Providence, RI 02903
South Carolina
Charleston County Public Library, Main Library 68 Calhoun St. Charleston, SC 29401
Texas
Corpus Christi Public Library, La Retama Library 805 Comanche Corpus Christi, TX 78401
Houston Public Library 500 McKinney St. Houston, TX 77002
Southmost Branch Library 4320 Southmost Blvd. Brownsville, TX 78522
Virginia
Mary D. Pretlow Anchor Branch Library 111 W. Ocean View Ave. Norfolk, VA 23503

8.4.5 FEDERALLY-RECOGNIZED TRIBES

Electronic copies of the Draft and Final EIS/OEIS were sent to the federally-recognized tribes listed in Table 8-8.

Table 8-8: Federally-Recognized Tribes that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement

FEDERALLY-RECOGNIZED TRIBES
Alabama
Buford Rulin Chairman Poarch Band of Creek Indians of Alabama 5811 Jack Springs Rd. Atmore, AL 36502
Connecticut
Rodney Butler Chairman Mashantucket Pequot Tribe of Connecticut PO Box 3130 110 Pequot Trl. Mashantucket, CT 06338
Lynn Malerba Chairwoman Mohegan Indian Tribe of Connecticut 5 Crow Hill Rd. Uncasville, CT 06382
Florida
Colley Billie Chairman Miccosukee Tribe of Indians of Florida Mile Marker 70, U.S. 41 Tamiami Trl. Miami, FL 33144
James E. Billie Chairman Seminole Tribe of Florida 6300 Stirling Rd. Hollywood, FL 33024
Willard Steele Tribal Historic Preservation Officer Seminole Tribe of Florida's Tribal Historic Preservation Office 34735 West Boundary Rd. Clewiston, FL 33440
Louisiana
Earl Barbry Chairman Tunica-Biloxi Indian Tribe of Louisiana 151 Melacon Dr. Marksville, LA 71351
John Paul Darden Chairman Chitimacha Tribe of Louisiana PO Box 661 155 Chitimacha Loop Charenton, LA 70523

Table 8-8: Federally-Recognized Tribes that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

FEDERALLY-RECOGNIZED TRIBES
Louisiana (Cont'd)
Kevin Sickey Chairman Coushatta Tribe of Louisiana PO Box 818 Elton, LA 70532
Beverly Smith Chief Jena Band of Choctaw Indians, Louisiana PO Box 14 Jena, LA 71342
Maine
Reubin Cleaves Tribal Governor Passamaquoddy Tribe – Pleasant Point Reservation PO Box 343 Perry, ME 04667
Brenda Commander Tribal Chief Houlton Band of Maliseet Indians of Maine 88 Bell Road Littleton, ME 04730
Kirk Francis Tribal Chief Penobscot Tribe of Maine 12 Wabanaki Way Indian Island, ME 04468
Richard Getchell Tribal Chief Aroostook Band of Micmac Indians of Maine 7 Northern Rd. Presque Isle, ME 04769
Joseph Socobasin Tribal Governor Passamaquoddy Tribe – Indian Township Reservation PO Box 159 Indian Township, ME 04668
Massachusetts
Cheryl Andrews-Maltais Tribal Council Chairwoman Wampanoag Tribe of Gay Head of Massachusetts 20 Black Brook Rd. Aquinnah, MA 02535
Cedric Cromwell Chairman Mashpee Wampanoag Tribe, Massachusetts 483 Great Neck Rd., S Mashpee, MA 02649

Table 8-8: Federally-Recognized Tribes that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

FEDERALLY-RECOGNIZED TRIBES
Mississippi
Phyliss J. Anderson Tribal Chief Mississippi Band of Choctaw Indians, Mississippi 101 Industrial Rd. Choctaw, MS 39350
North Carolina
Michell Hicks Chief Eastern Band of Cherokee Indians of North Carolina PO Box 460 498 Tsali Blvd Cherokee, NC 28719
New York
Dyani Brown Chairperson Shinnecock Indian Nation P.O. Box 5006 Southampton, NY 11969
Mark Garrow Chief Saint Regis Mohawk Tribe, New York 412 State Rte. 37 Akwesasne, NY 13655
Ray Halbritter Nation Representative Oneida Nation of New York 2037 Dream Catcher Plz. Oneida, NY 13421
Clint Halftown Council of Chiefs Cayuga Nation of New York 2540 SR-89 Seneca Falls, NY 13148
Randy Hart Chief Saint Regis Mohawk Tribe, New York 412 State Rte. 37 Akwesasne, NY 13655
Leo Henry Chief Tuscarora Nation of New York 5616 Walmore Rd. Lewiston, NY 14092
Roger Hill Chief Tonawanda Band of Seneca Indians of New York 7027 Meadville Rd. Basom, NY 14013

Table 8-8: Federally-Recognized Tribes that Received the Draft and Final Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

FEDERALLY-RECOGNIZED TRIBES
Ron Lafrance, Jr. Chief Saint Regis Mohawk Tribe, New York 412 State Rte. 37 Akwesasne, NY 13655
Robert Porter President Seneca Nation of New York William Seneca Bldg. 12837 Rte. 438 Irving, NY 14081
Irving Powless, Jr. Chief Onondaga Nation of New York 102 W. Conklin Ave. Nedrow, NY 13120
Rhode Island
Matthew Thomas Chief Sachem Narragansett Indian Tribe of Rhode Island PO Box 268 Charlestown, RI 02813
South Carolina
Bill Harris Chief Catawba Indian Nation 996 Ave. of the Nations Rock Hill, SC 29730
Texas
Carlos Bullock Chairman Alabama-Coushatta Tribes of Texas 571 State Park Rd. 56 Livingston, TX 77351
Bryant J. Celestine Historical Preservation Officer Alabama-Coushatta Tribes of Texas Historic Preservation Office 571 State Park Road 56 Livingston, TX 77351
Juan Garza, Jr. Tribal Council Chairman Kickapoo Traditional Tribe of Texas HCR1 Box 9700 Eagle Pass, TX 78852
Frank Paiz Governor Ysleta del Sur Pueblo of Texas PO Box 17579 117 S. Old Pueblo Rd. El Paso, TX 79907

8.5 NOTIFICATION OF NATIONAL MARINE FISHERIES SERVICE PROPOSED RULE

Individuals who provided contact information during the public comment period for the Draft EIS/OEIS received notification of the NMFS Proposed Rule MMPA comment period (see Appendix E.3 [National Marine Fisheries Service Proposed Rule] for the Navy's response to comments). Notification was provided by letter or e-mail, based on the type of contact information provided. Private individuals who received the notification can be found in Table 8-9. Names of individuals appear as they were provided to the Navy. An example of the letter and e-mail notification can be found in Figure 8-9.

Table 8-9: Private Individuals Who Received Notification of National Marine Fisheries Service Proposed Rule

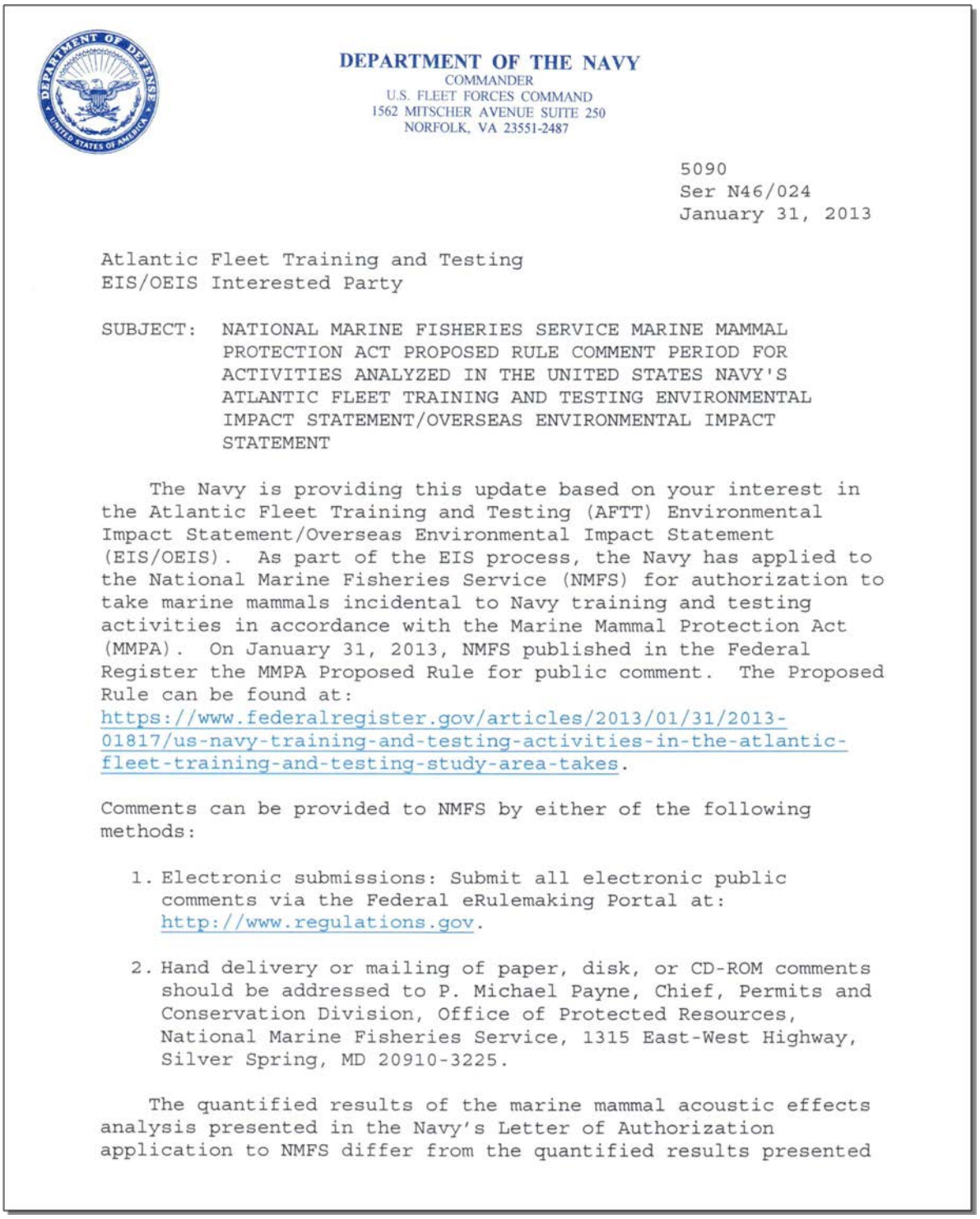
John Abbott	Anne Byers	Jennifer Dowdle
Elizabeth Abrams	Kristin Callis	Bonnie Duncan
Curt Albright	J. Capozzelli	Jahn Dussich
Wendy Alward	Bonnie Card	Sandy Dvorsky
Victoria Anderson	Heather Carpenter	Florence Eaise
Maru Angarita	Katherine Carrus	Christina Engert
Janet Arendacs	Debbie Carter	Maureen Engh
Steve Armstrong	Janice Chalifoux	Amy Evans
Stephen Augustine	Michael Chapman	Amanda Evans
Paula Avila	Carey Cherivtch	Judith Fairly
Donya Ayers-Bell	William and Martha Cherry	Lance Fanguy
Alexander Baggett	Linda Churchwell	Bruno Felix
Bill Baker	Christine Cina	Fabiana Fiesmann
Jessi Baker	Annette Cole	Barbara Fitzpatrick
Terry Baresh	Ron Cole	Flo Flowing
Melanie Barnet	Christine Coniglio	John Flynn
Mary Barnich	Vicki Cooper	Jack Foreman
Linn Barrett	Naila Costa	Kate Freeman
Marina Barry	Erica Cranden	Jarrett Gable
Gary Barton	Alexi Curington	Holly Gallo
Lawrence Baskett	Kim Daly	Lynn Garman
Jodi Bauter	Donald Dankert	Diana George
Amanda Beard-White	Mary P. Daoust	Julie Goldman
Eric Bernthal	Angelika Davis	Elizabeth Gray
Lisa Bigger	Kim Davis	Cynthia Greb
Blythe Bostock	Mary De Mars	Tamarleigh Grenfell
Denise Boulet	Elisse De Sio	Anke Groeber
Patricia Bourland	Margherite Desanto	Lance Groth
Kathy Braidhill	Fonda Dichiara	Valerie Haak
Thomas Brown	Henry Dipasquale	Barbara Haddad
Gina Brown	Steve Disch	Elizabeth Hale
Jennifer Brown	Amy Donovan	Elizabeth Hall
Jennifer Bruns	Katherine Dorothy	Melody Halligan
Serena Burnett	David Dow	Sharlene Harrison-Hinds

Table 8-9: Private Individuals Who Received Notification of National Marine Fisheries Service Proposed Rule (Continued)

Oriana Kalama	Victoria Martin	Laura Pereira
Leinaala Kalama-Dutro	Edith Maxey	Virginia Perry
Barbara Kann	Thomas Mazorlig	Rosalind Peterson
Diane Kastel	Vicki McCallister	June Polasek
Gunta Kaza	Melinda McComb	Leslie Porter
Teresa Keller	Candice McConnell	Rebecca Portman
Greg Kelly	Julie McDaniel	Caroline Power
Kimberly Kelly	Ben McKinley	Jean Public
Angela Kemper	Kevin McMillen	Cathy Pupo
Natasha Keogh	Katherine McRory	Tracy Purcell
Igor Khomyakov	Margit Meissner-Jackson	Sherry Ramsey
Dawn Kirch	Susan Menconi	Rhonda Rance
Paula Kislak, Dvm	Kelly Micklo	Joanna Randazzo
William Knight	Olof Minto	Jill Ray
Ana Koopmans	Melissa Minton	Nicholas Read
Tracy Korhonen	Joy Mitchem	Leanne Redmon
Debbie Kozin	Darlene Moak	Jedde Regante
Janna Kruse	Heather Mohan	Kathleen Reier
Marjorie Laird	Sandra Moreland	Valerie Retter
Charlotte Landini	Douglas Morrison	Renate Riffe
Dawn Lauer	Marica Mueller	Sharon Riley
Christopher Law	Sue Murphy	Cathy Ritacco
Marc Lemiere	Kris Murphy	Suzanne Rivell
Rita Lemkuil	Jill Nelson	Tricia Rizzi
Heidi Lett	Dawn Nelson	Frederick Rose
Ted Lewis	Maureen Newton	Julie Rosenwinkel
Valerie Loe	Joshua Normandin	Christine Roth
Micah Loggie	Magda Novak	Camille Rousseau
Trina Lopatka	Samantha Novak	Barbara B. Ruge
Joan Lorenz	Carolyn O'brien	James Ruhle
Mary Lotts	Yolanda Ochoa	James Ruhle
Meredith Loughlin	Lynn O'Dowd	Tamara Santelli
Doris Maat	Eugene Okeeffe	Francisco Santos
Melinda Macinnis	Jill Olson	Marylou Schmidt
Doug Maesk	Jeanette Owen	Maria Schultz
Karen Maish	Charlene Ozell	Dorene Schutz
L Makely	Rosemary Packard	Debra Scott
Ann Malone	Kathy Patterson	Robert Seat
Risa Mandell	Jennifer Pechenik	Robert Seat
Frank Mangione	Richard Pendarvis	Deborah Seemayer-Lannotti
Liz Marshall	Ruth Pennington	Evi Seidman

Table 8-9: Private Individuals Who Received Notification of National Marine Fisheries Service Proposed Rule (Continued)

Beverly Bernice Hartley Wilhite	Stephen Smith	Deborah S Van Damme
Sarah Hays	Elaine Smythe	Jean-François Van Den Broeck
Joyce Heid	Mark Songer	Holland Vandieren
Kirsi Hepworth	Ina Sparka	Annette Vd Berg
Randy Herz	Joyce Stanley	Rutily Vincent
Brittany Herz	Carol Stewart	Maria Vint
Heather Hintz	Kevon Storie	Kara Vlach-Lasher
Larry Hirsch	Amanda Stovall	Wendy Vogelgesang
B. Holden	Cristina Stoyle	Evelyn Vollmer
Barbara Holtz	Marguerite Strobel	Jennifer Vuillermet
John Hotvedt	Robin Sullivan	Diane Wacker
Kim Howell	Kathleen Summers	Cindy Wargo
Traci Hunt	Abbey Sutherland	John Webb
Sonia Hurt	Charles Swanson	Janet Weeks
Cheryl Huvard	Mindy Sweeny	Andrew Weinstein
Jenny Jackman	Sarah Swingle	Anita Welych
Nancy Jenkins	Dorene Szeker	Amy Wheeler
Jan Johnson	Heather Tallent	Eleanor White
Sam Jomes	Christina Tallman	Lisa Wilkerson
Aaron Joslin	Deborah & Thomas Taylor	Leanne Williams
Jodi Jubran	Sandra Taylor	Edith Wilson
Warren Senders	Geisa Teixeira	Denise Wilson
Harriet Shalat	Miguel Angel Tejada	Sean Wise
Theresa Sheridan	Stephanie Terry	Jennifer Wiseman
John Shippey	Cecelia Theis	Jessica Woodward
Charlotte A. Shockley	Monika Thelen	Susan Woodward
Anna Sillanpaa	Terry Thompson	Thomas Wright
Sharon Silva	Pam Thompson	Tricia Wyse
Chevy Singh	Kevin Tierney	Patricia Yager Delagrange
Susan Siragusa-Ortman	Don Timmerman	Pasha Yushin
Kathleen Smith	Nan Towle	Cleia Zinser
C. Smith	Karen Valerio	



DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/024
January 31, 2013

Atlantic Fleet Training and Testing
EIS/OEIS Interested Party

SUBJECT: NATIONAL MARINE FISHERIES SERVICE MARINE MAMMAL PROTECTION ACT PROPOSED RULE COMMENT PERIOD FOR ACTIVITIES ANALYZED IN THE UNITED STATES NAVY'S ATLANTIC FLEET TRAINING AND TESTING ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The Navy is providing this update based on your interest in the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). As part of the EIS process, the Navy has applied to the National Marine Fisheries Service (NMFS) for authorization to take marine mammals incidental to Navy training and testing activities in accordance with the Marine Mammal Protection Act (MMPA). On January 31, 2013, NMFS published in the Federal Register the MMPA Proposed Rule for public comment. The Proposed Rule can be found at: https://www.federalregister.gov/articles/2013/01/31/2013-01817/us-navy-training-and-testing-activities-in-the-atlantic-fleet-training-and-testing-study-area-takes.

Comments can be provided to NMFS by either of the following methods:

1. Electronic submissions: Submit all electronic public comments via the Federal eRulemaking Portal at: http://www.regulations.gov.

2. Hand delivery or mailing of paper, disk, or CD-ROM comments should be addressed to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910-3225.

The quantified results of the marine mammal acoustic effects analysis presented in the Navy's Letter of Authorization application to NMFS differ from the quantified results presented

Figure 8-9: Notification of the National Marine Fisheries Service Proposed Rule

5090
Ser N46/024
January 31, 2013

in the AFTT Draft EIS/OEIS. Modifications to the requested take numbers outlined in the AFTT Draft EIS/OEIS are presented in the Proposed Rule and are a result of consultation with NMFS, as well as refinements to training and testing modeling inputs and minor changes to Navy training and testing as a result of emerging requirements. In consultation with NMFS, the Navy has made post-model adjustments to further refine the numerical analysis of acoustic effects so as to include animal avoidance of sound sources, avoidance of areas of activity before use of a sound source or explosive, and implementation of mitigation.

All comments received by NMFS on the Proposed Rule that address (1) refinement to the modeling inputs for training and testing; (2) emerging training and testing requirements; and (3) post-model quantification based on animal avoidance of sound sources and mitigation will be reviewed and addressed by the Navy in the AFTT Final EIS/OEIS.

For more information about the AFTT EIS/OEIS, please visit: http://aftteis.com/.

Sincerely,

G. L. Edwards

G. L. EDWARDS
Director
Environmental Readiness Division
By direction

2

Figure 8-9: Notification of the National Marine Fisheries Service Proposed Rule (Continued)

[redacted]

From: Atlantic Fleet Training and Testing EIS/OEIS <do-not-reply=aftteis.com@mail179.us4.mcsv.net> on behalf of Atlantic Fleet Training and Testing EIS/OEIS <do-not-reply@aftteis.com>
Sent: Thursday, January 31, 2013 7:16 PM
To: [redacted]
Subject: Atlantic Fleet Training and Testing EIS/OEIS Proposed Rule Notification

Dear AFTT EIS/OEIS Interested Party,

The Navy is providing this update based on your interest in the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). As part of the EIS process, the Navy has applied to the National Marine Fisheries Service (NMFS) for authorization to take marine mammals incidental to Navy training and testing activities in accordance with the Marine Mammal Protection Act (MMPA). On January 31, 2013, NMFS published in the Federal Register the MMPA Proposed Rule for public comment. The Proposed Rule can be found at:
http://aftteis.us6.list-manage.com/track/click?u=a15c167b01e85293585c92bce&id=0bc90ee5e7&e=11cdfa2dfd

Comments can be provided to NMFS by either of the following methods:

1. Electronic submissions: Submit all electronic public comments via the Federal eRulemaking Portal at: http://aftteis.us6.list-manage.com/track/click?u=a15c167b01e85293585c92bce&id=37fecdc4f7&e=11cdfa2dfd.

2. Hand delivery or mailing of paper, disk, or CD-ROM comments should be addressed to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910-3225.

The quantified results of the marine mammal acoustic effects analysis presented in the Navy's Letter of Authorization application to NMFS differ from the quantified results presented in the AFTT Draft EIS/OEIS. Modifications to the requested take numbers outlined in the AFTT Draft EIS/OEIS are presented in the Proposed Rule and are a result of consultation with NMFS, as well as refinements to training and testing modeling inputs and minor changes to Navy training and testing as a result of emerging requirements. In consultation with NMFS, the Navy has made post-model adjustments to further refine the numerical analysis of acoustic effects so as to include animal avoidance of sound sources, avoidance of areas of activity before use of a sound source or explosive, and implementation of mitigation.

All comments received by NMFS on the Proposed Rule that address (1) refinement to the modeling inputs for training and testing; (2) emerging training and testing requirements; and (3) post-model quantification based on animal avoidance of sound sources and mitigation will be reviewed and addressed by the Navy in the AFTT Final EIS/OEIS.

For more information about the AFTT EIS/OEIS, please visit www.AFTTEIS.com http://aftteis.us6.list-manage.com/track/click?u=a15c167b01e85293585c92bce&id=5a14f68cb0&e=11cdfa2dfd

==========

You are receiving this email because you commented on the Draft AFTT EIS/OEIS on the aftteis.com website.

Unsubscribe [redacted] from this list:
http://aftteis.us6.list-manage1.com/unsubscribe?u=a15c167b01e85293585c92bce&id=6e70ff4faa&e=11cdfa2dfd&c=c946b12c44

1

Figure 8-9: Notification of the National Marine Fisheries Service Proposed Rule (Continued)

Atlantic Fleet Training and Testing
Final Environmental Impact Statement / Overseas Environmental Impact Statement

Volume 4 — Appendices
August 2013

Lead Agency
Department of the Navy

Cooperating Agency
National Marine Fisheries Service

Action Proponents
United States Fleet Forces
Naval Air Systems Command
Naval Sea Systems Command
Office of Naval Research

For Additional Information
NAVFAC Atlantic
Attn: EV22LD (AFTT EIS/OEIS Project Manager)
6506 Hampton Boulevard
Norfolk, VA 23508-1278
Phone: (757) 322-4645

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APPENDIX A

NAVY ACTIVITIES DESCRIPTIONS

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APPENDIX A NAVY ACTIVITIES DESCRIPTIONS

The Navy has been conducting military readiness activities throughout the northwestern Atlantic Ocean and Gulf of Mexico for decades. The tempo and types of training and testing activities have fluctuated within the Atlantic Fleet Training and Testing (AFTT) Study Area (Study Area) due to changing requirements, the introduction of new technologies, the dynamic nature of international events, advances in warfighting doctrine and procedures, and force structure changes. Such developments have influenced the frequency, duration, intensity, and location of required training and testing.

A.1 TRAINING ACTIVITIES

The Navy's training activities are organized generally into eight primary mission areas and a miscellaneous category (Other Training) that includes those activities that do not fall within a primary mission area, but are an essential part of Navy training. In addition, because the Navy conducts a number of activities within larger training exercises, descriptions of those larger exercises are also included here. It is important to note that these larger exercises are comprised entirely of individual activities described in the primary mission areas.

A.1.1 ANTI-AIR WARFARE TRAINING

Anti-air warfare is the primary mission area that addresses combat operations by air and surface forces against hostile aircraft. Navy ships[1] contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled cannon for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft cannon. Anti-air warfare training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. Anti-air warfare training includes surface-to-air gunnery, surface-to-air and air-to-air missile exercises, and aircraft force-on-force combat maneuvers.

[1] The terms 'ship' and 'vessel' are used interchangeably throughout the document.

A.1.1.1 Air Combat Maneuver

Activity Name	Activity Description	
Anti-Air Warfare		
Air Combat Maneuver (ACM)	Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.	
Long Description	Basic flight maneuvers in which aircrew engage in offensive and defensive maneuvering against each other. During air combat maneuver engagements, no ordnance is fired, however countermeasures such as chaff and flares may be used. These maneuvers typically involve two aircraft; however, based upon the training requirement, air combat maneuver exercises may involve over a dozen aircraft.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (F/A-18, F-35, F-5) **Systems**: None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 hours	**Location***: VACAPES: W-72, W-386 Navy Cherry Point: W-122 (Areas 1, 8, 15, 16) JAX: W-132, W-133, W-134, W-157 (Areas 3X, 4X), W-158, W-159 Key West: W 174 A/B/C/E/F/G, W-465 A/B, Bonefish ATCAA
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic**: Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). No munitions fired. Flare and chaff may be used. All flare and chaff accounted for in flare exercise and chaff exercise events.	

A.1.1.2 Air Defense Exercise

Activity Name	Activity Description	
Anti-Air Warfare		
Air Defense Exercises (ADEX)	Aircrew and ship crews conduct defensive measures against threat aircraft or missiles.	
Long Description	Aircrew and ship personnel perform measures designed to defend against attacking threat aircraft or missiles or reduce the effectiveness of such attack. This exercise involves full detection though engagement sequence. Aircraft operate at varying altitudes and speeds. This exercise may include air intercept control exercises where aircraft controllers on ships, in fixed-wing aircraft or at land based locations, use search radars to track and direct friendly aircraft to intercept the threat aircraft, and detect to engage exercises where personnel on ships use search radars to detect, classify, and track enemy aircraft or missiles up to the point of engagement.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (F/A-18, F-35, E-2), surface ships (all) **Systems**: None **Ordnance/Munitions:** None **Targets:** Other aircraft; unmanned drones **Duration:** 1–4 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point: W-122 JAX: W-132, W-133, W-134, W-157, W-158, W-159 GOMEX: W-151, W-155
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). No weapons are fired.	

A.1.1.3 Gunnery Exercise (Air-to-Air) – Medium-Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Air-to-Air) Medium-caliber (GUNEX [A-A]) – Medium-caliber	Aircrews defend against threat aircraft with cannons (machine gun).	
Long Description	Fighter jet aircrews defend against threat aircraft with cannons (machine gun). An event involves two or more fighter jet aircraft and a target banner towed by a contracted aircraft (e.g., Lear jet). The banner target is recovered after the event.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (F/A-18, F-35) **Systems:** None **Ordnance/Munitions:** Medium-caliber (non-explosive) **Targets:** Towed banner **Duration:** 1–2 hours	**Location*:** VACAPES: W-72A, W-72B, W-386 Navy Cherry Point: W-122 (Area 9,10, 11, 12) JAX: W-157A, W-133 (Area 2X) Key West: W-174A
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material (non-explosive projectiles) strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Medium-caliber projectiles; casings	
Detailed Military Expended Materials Information	Projectiles; casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Only non-explosive munitions are used. Target is recovered.	

A.1.1.4 Missile Exercise (Air-to-Air)

Activity Name	Activity Description	
Anti-Air Warfare		
Missile Exercise (Air-to-Air) (MISSILEX [A-A])	Aircrews defend against threat aircraft with missiles.	
Long Description	An event involves two or more jet aircraft and a target. Missiles are either high-explosive warheads or non-explosive practice munitions. The target is either an unmanned aerial target drone, a tactical air-launched decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by boat or helicopter; tactical air-launched decoys and illumination flares are expended and not recovered. These events typically occur at high altitudes. Anti-air missiles may also be employed when training against threat missiles.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (F/A-18, F-35) **Systems**: None **Ordnance/Munitions:** Air-to-air missiles: AIM-7, AIM-9, AIM-120, AIM-132 (non-explosive and high-explosive) **Targets:** BQM-34, BQM-74 (Figure A-1), tactical air-launched decoy (Figure A-3), LUU-2 illumination flare (Figure A-2), ADM-141 ITALD **Duration:** 1–2 hours	**Location***: VACAPES: W-72B, W-386 Navy Cherry Point: W-122 JAX: W-132, W-133, W-134, W-157, W-158 Key West: W-174A, W-174B, W-174F
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (target and missile fragment); aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Military expended materials (missile fragments, parachutes, flare casings, target fragments)	
Detailed Military Expended Materials Information	Missile and target fragments; parachutes; flare casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All missiles are explosive (Alternatives 1 and 2) and all missiles explode at high altitude. All propellant and explosives are consumed. Assume 1.5 flares per MISSILEX event.	

Figure A-1: BQM-74 (Aerial Target)

Figure A-2: LUU-2B/B Illuminating Flare (Aerial Target)

Figure A-3: Tactical Air-Launched Decoy (Aerial Target)

A.1.1.5 Gunnery Exercise (Surface-to-Air) – Large-Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Surface-to-Air) – Large-Caliber (GUNEX [S-A]) – Large-Caliber	Surface ship crews defend against threat aircraft or missiles with large-caliber guns.	
Long Description	Surface ship crews defend against threat aircraft or missiles with guns to disable or destroy the threat. An event involves one ship and a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Large-caliber guns fire projectiles, either non-explosive, or high-explosive (configured to explode in air), to disable or destroy the threat before it reaches the ship. The target is towed by a commercial air services jet.	
Information Typical to the Event	**Platform**: Surface ship (DDG, FFG, LCS, CG); fixed-wing aircraft **Systems**: None **Ordnance/Munitions:** Large-caliber: 5-inch gun, 76 mm, 57 mm (non-explosive under No Action Alternative and high-explosive under Alternatives 1 and 2) **Targets:** Towed targets behind aircraft. **Duration:** 1–2 hours	**Location*:** VACAPES: W-386, W-72 JAX: Gunnery boxes AA, BB
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; vessel noise; weapons firing noise; in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectile fragments; target fragments	
Detailed Military Expended Materials Information	Projectiles; projectile fragments; target fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All projectiles under the No Action Alternative are assumed to be non-explosive. All projectiles under Alternatives 1 and 2 are assumed to be high-explosive. All projectiles explode well above surface.	

A.1.1.6 Gunnery Exercise (Surface-to-Air) – Medium-Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Surface-to-Air) – Medium-Caliber (GUNEX [S-A]) – Medium-Caliber	Surface ship crews defend against threat aircraft or missiles with medium-caliber guns.	
Long Description	Surface ship crews defend against threat aircraft or missiles with guns to disable or destroy the threat. An event involves one ship and a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Medium-caliber guns fire projectiles, typically non-explosive, to disable or destroy the threat before it reaches the ship. The target is towed by a commercial air services jet.	
Information Typical to the Event	**Platform**: Surface ships (all); fixed-wing aircraft **Systems**: None **Ordnance/Munitions:** Medium-caliber (non-explosive) **Targets:** Towed targets behind aircraft **Duration:** 1–2 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point JAX: Gunnery areas: AA, BB Other AFTT Areas: Outside of established ranges where ships may conduct unit level training events while in transit
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectiles; casings	
Detailed Military Expended Materials Information	Projectiles; casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All projectiles are non-explosive. Close-In Weapon System employed in all events. Pre-scheduled events occur in typical VACAPES/JAX locations. Routine Close-In Weapon System maintenance related firing can occur throughout the Study Area.	

A.1.1.7 Missile Exercise (Surface-to-Air)

Activity Name	Activity Description	
Anti-Air Warfare		
Missile Exercise (Surface-to-Air) (MISSILEX [S-A])	Surface ship crews defend against threat missiles and aircraft with missiles.	
Long Description	Surface ship crews defend against threat missiles and aircraft with ship launched missiles. The event involves a simulated threat aircraft or anti-ship missile which is detected by the ship's radar. Ship launched anti-air missiles are fired (high-explosive) to disable or destroy the threat. The target typically is a remote controlled drone. Anti-air missiles may also be used to train against land attack missiles.	
Information Typical to the Event	**Platform**: Surface ships (all) **Systems**: None **Ordnance/Munitions:** Surface-to-air missiles (Sea Sparrow, Standard Missile SM-2, Rolling Airframe Missile [high-explosive]) **Targets:** Unmanned drone: BQM-34, BQM-74 **Duration:** 1–2 hours	**Location***: Northeast VACAPES: W-72, W-386 (Air D, G, H, K) Navy Cherry Point: W-122 JAX: W-132, W-133, W-134, W-157, W-158, W-159 GOMEX: OPAREAs
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; weapons firing noise; in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missile fragments); vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments	
Detailed Military Expended Materials Information	Missile fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Assumes that all anti-air missiles are high-explosive. Missile explodes well above surface. All explosive and propellant are consumed. Targets are typically not destroyed and unmanned drones are recovered.	

A.1.2 AMPHIBIOUS WARFARE TRAINING

Amphibious warfare is a type of naval warfare involving the utilization of naval firepower and logistics, and Marine Corps landing forces to project military power ashore. Amphibious warfare encompasses a broad spectrum of activities involving maneuver from the sea to objectives ashore, ranging from reconnaissance or raid missions involving a small unit, to large-scale amphibious operations involving over one thousand Marines and Sailors, and multiple ships and aircraft embarked in a strike group.

Amphibious warfare training includes tasks at increasing levels of complexity, from individual, crew, and small unit events to large task force exercises. Individual and crew training include the operation of amphibious vehicles and naval gunfire support training. Small-unit training activities include shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises involve ship-to-shore maneuver, shore bombardment and other naval fire support, and air strike and close air support training.

A.1.2.1 Naval Surface Fire Support Exercise – Land-Based Target

Activity Name	Activity Description	
Amphibious Warfare		
Naval Surface Fire Support Exercise – Land-Based Target (FIREX [Land])	Surface ship crews use large-caliber guns to fire on land-based targets in support of forces ashore.	
Long Description	Surface ship crews use large-caliber (main battery) guns to support forces ashore. One or more ships position themselves up to six nautical miles (nm) from the target area and a land-based spotter relays type and exact location of the target. After observing the fall of the shot, the spotter relays any adjustments needed to reach the target. Once the rounds are on target, the spotter requests a sufficient number to effectively destroy the target. This exercise occurs on land ranges where high-explosive and non-explosive practice ordnance is authorized and is often supported by target shapes such as tanks, truck, trains, or aircraft on the ground.	
Information Typical to the Event	**Platform**: Surface combatant ships (CG, DDG) **Systems**: None **Ordnance/Munitions:** Large-caliber (5-inch rounds, explosive and non-explosive) **Targets:** Land target **Duration:** 1–2 hours	**Location**: Navy Cherry Point: Firing point from sea is Area 15B. Impact occurs at G-10 Impact Area, Camp Lejeune.
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Casings	
Assumptions Used for Analysis	Projectile impact is on land. This event can only be conducted in Navy Cherry Point, as the G-10 range is the only east coast location that can support Naval Surface Fire Support Exercises on a land-based target.	

A.1.2.2 Naval Surface Fire Support Exercise At Sea

Activity Name	Activity Description	
Amphibious Warfare		
Naval Surface Fire Support Exercise – At Sea (FIREX [At Sea])	Surface ship crews use large-caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds are scored by passive acoustic hydrophones located at or near the target area.	
Long Description	Surface ship crews use large-caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds are scored by passive acoustic hydrophones located at or near the target area. The portable scoring system is comprised of sonobuoys (Integrated Maritime Portable Acoustic Scoring and Simulation buoys) set in a pre-designed pattern at specific intervals, which are retrieved after the exercise. An onboard scoring system provides a realistic presentation, such as a land mass with topography, to the ship's combat system. This virtual land target area overlays the sonobuoy array. The ship fires its ordnance into the target area and the acoustic noise resulting from the impact of the round landing in the water is detected by the sonobuoys. The global positioning system position and bearing of the impact is transmitted to the ship and the onboard scoring system triangulates the exact point of impact of the round, allowing the exercise to be conducted as if the ship were firing at an actual land target. Surface ship crews use large-caliber (main battery) guns to support forces ashore.	
Information Typical to the Event	**Platform**: Surface combatant ships (CG, DDG), rigid hull inflatable boats (for recovering buoys) **Systems**: None **Ordnance/Munitions:** Large-caliber (5-inch rounds) explosive and non-explosive practice munitions **Targets:** Integrated Maritime Portable Acoustic Scoring and Simulation buoys **Duration:** 1–2 hours of firing, 8 hours total	**Location***: VACAPES: 5C/D, 7C/D, 8C/D, 1C1/2 Navy Cherry Point: Area 4/5, 13/14 JAX: Surface Gunnery Areas BB, CC GOMEX: Pensacola OPAREA W-151 A/B and W-155A
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E5); vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles and projectile fragments); vessel strike **Entanglement:** None **Ingestion:** Projectile fragments	
Detailed Military Expended Materials Information	Projectiles and projectile fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Events occur greater than 12 nm from shore. Non-explosive practice munitions may be used when Integrated Maritime Portable Acoustic Scoring and Simulation buoys can detect projectile splash. High-explosives will be used during all other events. Assume all explosive rounds detonate on impact with water surface.	

A.1.2.3 Marine Expeditionary Unit Certification Exercise

Activity Name	Activity Description	
Amphibious Warfare		
Marine Expeditionary Unit (MEU) Certification Exercise (CERTEX)	Amphibious Ready Group exercises are conducted to validate the Marine Expeditionary Unit's readiness for deployment and include small boat raids; visit, board, search, and seizure training; helicopter and mechanized amphibious raids; and a non-combatant evacuation operation.	
Long Description	Marine Corps amphibious forces move from amphibious ships at sea, by watercraft or aircraft, and introduce a landing force, establish a beachhead, and occupy the area or move further inland for an extended period. The amphibious assault conducted by a Marine expeditionary unit involves employment of the advance force, combat, combat support, and combat service support units in close coordination with the expeditionary strike group and carrier strike group. The landing is conducted in waves and is focused on concentrating forces quickly in order to establish the beachhead. A typical event involves two reinforced companies from the battalion landing team coming ashore via landing crafts and amphibious assault vehicles. Follow-on waves include fire support assets, armored units, and service support elements. This exercise generally occurs during a composite training unit exercise.	
Information Typical to the Event	**Platform**: Surface ships; amphibious vehicles; fixed-wing aircraft; rotary-wing aircraft **Systems**: None **Ordnance/Munitions:** Small-caliber (non-explosive)**** **Targets:** None **Duration:** Up to 3 weeks	**Locations:** Navy Cherry Point: Onslow Bay
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Amphibious Readiness Group Major Training Event ****Weapons firing during this event is discussed in appropriate activity descriptions (gunnery exercise, etc.).	

A.1.2.4 Amphibious Assault

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Assault	Forces move ashore from ships at sea for the immediate execution of inland objectives.	
Long Description	Landing forces embarked in ships, landing crafts, or helicopters launch an attack from the sea onto a hostile shore. Amphibious assault is conducted for the purposes of prosecuting further combat operations, obtaining a site for an advanced naval or airbase, or denying the enemy use of an area. Unit Level Training exercises involve one or more amphibious ships, and their associated watercraft and aircraft, to move personnel and equipment from ship to shore without the command and control and supporting elements involved in a full scale event. The goal is to practice loading, unloading, and movement and to develop the timing required for a full-scale exercise.	
Information Typical to the Event	**Platform**: Amphibious and landing ships (LHA, LHD, LPD, LSD); amphibious vehicles, rotary-wing aircraft **Systems**: None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 weeks	**Locations:** Navy Cherry Point: Onslow Bay
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Typical event:1–3 amphibious ships (LHA or LHD, LPD, LSD); 2–8 landing craft (landing craft, air cushioned; landing craft, utility); 4–14 amphibious assault vehicles; up to 22 aircraft (MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines).	

A.1.2.5 Amphibious Raid/Humanitarian Assistance Operations

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Raid/Humanitarian Assistance Operations	Small unit forces move swiftly from ships at sea for a specific short term mission. These are quick operations with as few personnel as possible.	
Long Description	Small unit forces swiftly move from amphibious ships at sea into hostile territory for a specific mission, including a planned withdrawal. Raids are conducted to inflict loss or damage, secure information, create a diversion, confuse the enemy, or capture or evacuate individuals or material. Amphibious raid forces are kept as small as possible to maximize stealth and speed of the operation. An event may employ assault amphibian vehicle units, small boat units, small unit live-fire and non-live-fire operations. Surveillance or reconnaissance unmanned surface and aerial vehicles may be used during this event. Events are also conducted to train in the delivery of humanitarian assistance to remote locations or areas requiring assistance after natural disasters.	
Information Typical to the Event	**Platform**: Amphibious assault ships (LHA, LHD), amphibious transport dock and dock landing ships (LPD, LSD); amphibious vehicles (landing craft, air cushioned, and amphibious assault vehicles); small boats (rigid hull inflatable boats) **Systems**: Unmanned surface and aerial vehicles **Ordnance/Munitions:** Non-explosive practice munitions **Targets:** None **Duration:** 4–8 hours	**Locations:** Navy Cherry Point: Onslow Bay JAX: Naval Station Mayport
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Firing of weapons during these events is accounted for in gunnery exercises, surface to surface activities. Events in JAX are conducted at Seminole Beach, Naval Station Mayport.	

A.1.3 STRIKE WARFARE TRAINING

Strike warfare includes training of fixed-wing fighter/attack aircraft or rotary wing aircraft in delivery of precision guided munitions, non-guided munitions, rockets, and other ordnance against land targets in all weather and light conditions. Training events typically involve a simulated strike mission with a flight of four or more aircraft. The strike mission may simulate attacks on "deep targets" (i.e., those geographically distant from friendly ground forces), or may simulate close air support of targets within close range of friendly ground forces. Laser designators from aircraft or ground personnel may be employed for delivery of precision guided munitions. Some strike missions involve no-drop events in which prosecution of targets is simulated, but video footage is often obtained by onboard sensors.

A.1.3.1 High-Speed Anti-Radiation Missile Exercise (Air-to-Surface)

Activity Name	Activity Description	
Strike Warfare		
High-Speed Anti-Radiation Missile Exercise (Air-to-Surface) (HARMEX [A-S])	Aircrews launch a High-Speed Anti-Radiation Missile against threat radar sites.	
Long Description	Aircrews detect radar signals from a simulated threat radar site and launch a High-Speed Anti-Radiation Missile (high-explosive) to destroy or disable the threat radar site. One or more fighter jets approach the threat radar site from high altitude. Once the target is located with onboard sensors, the aircrew launches a High-Speed Anti-Radiation Missile at the electronic signal. At-sea events train against a target vessel or a specially configured target barge that has a tower with an electronic emitter that the missile will seek after being fired from the launch aircraft.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (e.g., F/A-18, EA-6B, EA-18G) **Systems**: None **Ordnance/Munitions:** High-Speed Anti-Radiation Missile: high-explosive **Targets:** Barge with an electronic emitter **Duration:** 1–2 hours	**Location***: VACAPES: W-72, W-386 (Air E, F, I, J) Navy Cherry Point: W-122
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; Vessel noise; in-air explosives **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike; military expended material strike (missile fragments); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments	
Detailed Military Expended Materials Information	Missile fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). High-explosive missiles will explode well above the water's surface. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.1.4 ANTI-SURFACE WARFARE TRAINING

Anti-surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons and sensors in operations directed against enemy surface ships or boats. Aircraft-to-surface Anti-surface warfare is conducted by long-range attacks using air-launched cruise missiles, precision guided munitions, or aircraft cannon. Anti-surface warfare also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in anti-surface warfare includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Gunnery and missile training generally involves expenditure of ordnance against a towed target. A sinking exercise is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver high-explosive ordnance on a deactivated vessel, which is deliberately sunk.

Anti-surface warfare also encompasses maritime security, that is, the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in visit, board, search and seizure exercises.

A.1.4.1 Maritime Security Operations

Activity Name	Activity Description	
Anti-Surface Warfare		
Maritime Security Operations (MSO)	Helicopter and surface ship crews conduct a suite of maritime security operations (e.g., visit, search, board, and seizure; maritime interdiction operations; force protection; and anti-piracy operations).	
Long Description	Helicopter and surface ship crews conduct a suite of maritime security operations (e.g., visit search, board, and seizure; maritime interdiction operations; force protection; and anti-piracy operation). These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles. The entire exercise may last two to three hours. Vessel visit, board, search, and seizure: Military personnel from ships and aircraft board suspect vessels, potentially under hostile conditions. Maritime interdiction operations: Ships and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels. Oil platform defense: Naval personnel train to defend oil platforms, or other similar at sea structures Warning shot/disabling fire: Naval personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop. Ship force protection: Ship crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure ships are protected against attack. Anti-piracy training: Naval personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate "mother ships"), and multiple small, maneuverable, and fast crafts.	
Information Typical to the Event	**Platform**: Surface ship (any); helicopters; small boats; high speed vessels; unmanned vehicles (surface and aerial) **Systems**: None **Ordnance/Munitions:** Small-caliber (non-explosive) **Targets:** Range support vessel; high performance boats; unmanned vessels **Duration:** Up to 3 hours	**Location:** All OPAREAs and littoral areas proximate to homeports
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small-caliber projectiles; casings	
Detailed Military Expended Materials Information	Small-caliber projectiles; casings (see note below in assumptions)	

Activity Name	Activity Description
Assumptions Used for Analysis	Firing of weapons during these events accounted for in gunnery exercises, surface to surface activities. This occurs during approximately 20 percent of Maritime Security Operations events. Maritime security operations is a broad term used to describe activities intended train naval forces in the skills necessary to protect naval vessels from small boat attack, counter piracy and drug operations (maritime interdiction operations and visit, board, search, and seizure), and protect key infrastructure (e.g., oil platforms). The term "maritime security operations" needs to remain broad as naval forces need to be able to tailor training events to respond to emergent threats. Maritime security operations events typically do not involve live fire of weapons. All maritime security operations events involve vessel movement, sometimes at high rates of speed (naval vessels maneuvering to overtake suspect vessel or small boats (targets) closing in and maneuvering around naval vessels), and some event involve helicopters and boarding parties. Maritime security operations training events are conducted proximate to naval homeports (Norfolk, Jacksonville) including during times of transit in and out of port, as well as during major training events.

A.1.4.2 Maritime Security Operations – Anti-Swimmer Grenades

Activity Name	Activity Description	
Anti-Surface Warfare		
Maritime Security Operations (MSO) – Anti-Swimmer Grenades	Boat crews engage in force protection activities by using anti-swimmer grenades to defend against hostile divers	
Long Description	Boat crews engage in force protection activities by using anti-swimmer grenades to defend against hostile divers. Boat crews train to maneuver boats in specific search patterns, while surveying the area for evidence of SCUBA activity. Crews train in the safe handling and use of anti-swimmer grenades to counter the diver threat.	
Information Typical to the Event	**Platform**: Boats **Systems**: None **Ordnance/Munitions:** Anti-swimmer grenades (high-explosive) **Targets:** None **Duration:** Typically 1 hour	**Location*:** Northeast VACAPES: W-50, R-6606 Navy Cherry Point JAX: Charleston underwater detonation boxes GOMEX: Corpus Christi underwater detonation boxes Event could occur proximate to any homeport.
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E2); vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (grenade fragments) **Entanglement:** None **Ingestion:** Grenade fragments	
Detailed Military Expended Materials Information	Fragments from high-explosive grenades	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Events will usually be conducted in established underwater detonation areas.	

A.1.4.3 Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber (GUNEX – S-S – [Ship]) Small-Caliber	Ship crews engage surface targets with ship's small-caliber guns designed to provide close range defense against patrol boats, smaller boats, swimmers, and floating mines.	
Long Description	This exercise involves ship crews engaging surface targets at sea with small-caliber (.50 caliber or smaller) weapons. Ships use small-caliber weapons to practice defensive marksmanship, typically against stationary floating targets. The target may be a 10-foot diameter red balloon (Killer Tomato, see Figure A-4), a 50 gallon steel drum, or other available target, such as a cardboard box. Some targets are expended during the exercise and are not recovered. Ship crew qualifications conducted at sea employ stationary targets on deck. Small-caliber projectiles fired during these events will be expended in the water. Shipboard protection systems utilizing small-caliber projectiles will train against high speed mobile targets.	
Information Typical to the Event	**Platform:** Surface ships **Systems:** None **Ordnance/Munitions:** Small-caliber projectiles (non-explosive) **Targets:** Recoverable or expendable floating target (stationary or towed); remote controlled high-speed targets (Figure A-5) **Duration:** 2–3 hours	**Location:** AFTT Study Area beyond 3 nm from shoreline
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (projectile; target) **Entanglement:** None **Ingestion:** Small-caliber projectiles; casings; target fragments	
Detailed Military Expended Materials Information	Small-caliber projectiles; casings; target fragments	
Assumptions Used for Analysis	Small-caliber gun rounds per event: 1,000–3,000 non-explosive practice munitions The majority of the activity will occur proximate to Navy homeports in Jacksonville, Florida and Norfolk, Virginia.	

Figure A-4: "Killer Tomato" Stationary Floating Target

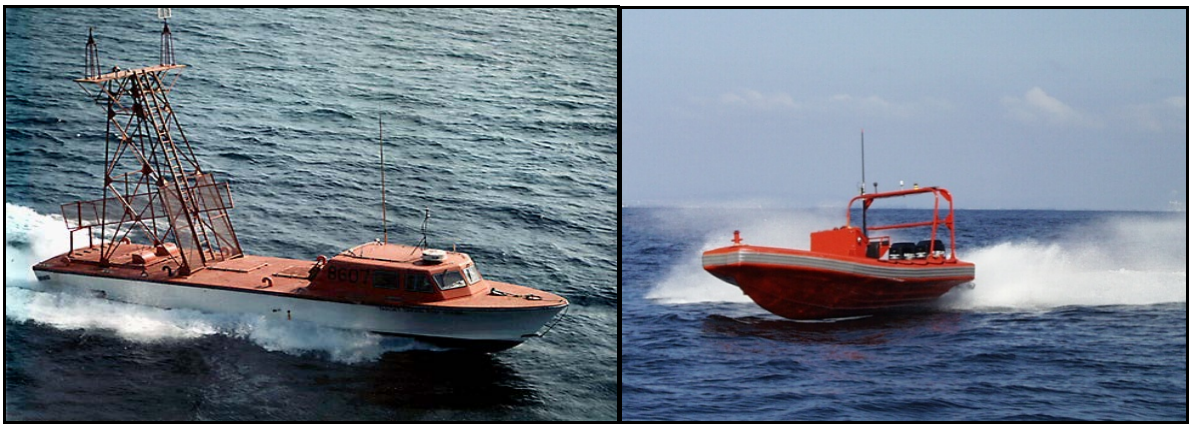

Figure A-5: QST-35 Seaborne Powered Target (on Left) and High-Speed Maneuvering Surface Target (on Right)

A.1.4.4 Gunnery Exercise Surface-to-Surface (Ship) – Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Medium-Caliber (GUNEX – S-S [Ship]) – Medium-Caliber	Ship crews engage surface targets with ship's medium-caliber guns designed to provide close range defense against patrol boats, smaller boats, swimmers, and floating mines.	
Long Description	This exercise involves ship crews engaging surface targets at sea with medium-caliber (larger than .50 caliber up to 56 mm) weapons. Ships use medium-caliber weapons to practice defensive marksmanship, typically against stationary floating (a 10-foot diameter red balloon [Killer Tomato]) and high speed mobile targets. Some targets are expended during the exercise and are not recovered. Shipboard protection systems (Close-In Weapon System) utilizing medium-caliber projectiles will train against high speed mobile targets.	
Information Typical to the Event	**Platform**: Surface ships **Systems**: None **Ordnance/Munitions:** Medium-caliber (high-explosive or non-explosive) **Targets:** Recoverable or expendable floating targets (stationary or towed); remote controlled high speed targets **Duration:** 2–3 hours	**Location*:** VACAPES: OPAREA, W-386, W-72 Cherry Point: OPAREA JAX: OPAREA, typically within Surface Gunnery Areas AA, BB, CC GOMEX: Typically Pensacola and Panama City OPAREAs Other AFTT Areas: Outside of established ranges where ships may conduct unit level training events while in transit
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1; E2); vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** vessel and in-water device strike, military expended material strike (medium-caliber projectiles and casings, projectile fragments, and target fragments) **Entanglement:** None **Ingestion:** Medium-caliber projectiles and casings; target fragments; projectile fragments	
Detailed Military Expended Materials Information	Medium-caliber projectiles and casings; target fragments; projectile fragments Approximately 200 medium-caliber rounds are used per event. One target used per event. Approximately 50 percent of targets are “Killer Tomatoes” (usually recovered). Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as steel drums.	
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds.	

A.1.4.5 Gunnery Exercise Surface-to-Surface (Ship) – Large-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Large-Caliber **(GUNEX – S-S [Ship]) – Large-Caliber**	Ship crews engage surface targets with ship's large-caliber guns designed to provide defense against ships, patrol boats, smaller boats.	
Long Description	This exercise involves ships' gun crews engaging surface targets at sea with their main battery large-caliber (typically 57 mm, 76 mm, and 5-inch) guns. Targets include the QST-35 seaborne powered target, high-speed maneuverable surface target, or a specially configured remote controlled water craft. Some targets are expended during the exercise and are not recovered. The exercise proceeds with the target boat approaching from about 10 nm distance. The target is tracked by radar and when within a predetermined range, it is engaged first with large-caliber "warning shots." As threats get closer, all weapons may be used to disable the threat. This exercise may involve a single firing ship or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training event. Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance. During all events, either high-explosive or non-explosive rounds may be used. High-explosive rounds can either be fused for detonation on impact (with water surface or target) or for proximity to the target (in air detonation).	
Information Typical to the Event	**Platform**: Surface ships (e.g., CG, DDG, LCS, FFG) **Systems**: None **Ordnance/Munitions:** Large-caliber (high-explosive and non-explosive) **Targets:** Remote controlled high speed targets **Duration:** Up to 3 hours	**Location*:** VACAPES: OPAREA, W-386, W-72 Cherry Point: OPAREA JAX: OPAREA, typically within Surface Gunnery Areas AA, BB, CC GOMEX: Typically Pensacola, Panama City OPAREAs Other AFTT Areas: Outside of established ranges where ships may conduct unit level training events while in transit
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E3; E5); vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (projectile) **Entanglement:** None **Ingestion:** Target fragments; projectile fragments	
Detailed Military Expended Materials Information	Large-caliber projectiles; casings; target fragments; projectile fragments	

Activity Name	Activity Description
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Activity always occurs beyond 3 nm of the shoreline. For analytical purposes, assume all high-explosive rounds are fused to detonate upon impact with water surface or target. After impacting the water, the high-explosive rounds are expected to detonate within 3 feet (ft.) of the surface. Non-explosive rounds and fragments from the high-explosive rounds will sink to the bottom of the ocean. For Alternative 2, analysis considers the introduction of (2) kinetic weapon-equipped ships being introduced to the fleet. Increases in events (6) and projectiles expended (240) reflect the likely training requirements of this new weapon system. Assume each non-explosive projectile will be up to 5 inches in diameter and 30 inches in length, and each firing will also expend a metallic sleeve used to convey the projectile down the gun barrel. All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds.

A.1.4.6 Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber **(GUNEX – S-S [Boat]) – Small-Caliber**	Boat crews engage surface targets with small-caliber weapons.	
Long Description	Boat crews engage surface targets with small-caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or near shore land targets with small-caliber (up to and including .50 caliber) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform**: Boats **Systems**: None **Ordnance/Munitions:** Small-caliber (non-explosive) **Targets:** Recoverable or expendable floating targets **Duration:** 1 hour	**Location*:** Northeast: OPAREAs VACAPES: W-50, R-6606 Cherry Point: OPAREA JAX: Charleston OPAREA GOMEX: Panama City OPAREA, Corpus Christi OPAREA Other AFTT Areas: Outside of established ranges
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; military expended material strike (projectile) **Entanglement:** None **Ingestion:** Projectiles; casings; target fragments	
Detailed Military Expended Materials Information	Projectiles; casings; target fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). The majority of events will occur proximate to naval stations. Events will occur relatively nearshore due to short range of boats and safety concerns. Events mostly occur within 3 nm of the shoreline, but can occur further from shore.	

A.1.4.7 Gunnery Exercise Surface-to-Surface (Boat) – Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Medium-Caliber (GUNEX – S-S (Boat)) – Medium-Caliber	Small boat crews engage surface targets with medium-caliber weapons.	
Long Description	Boat crews engage surface targets with medium-caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or near shore land targets with medium-caliber (up to and including 40 mm) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform**: Boats **Systems**: None **Ordnance/Munitions:** Medium-caliber (explosive and non-explosive) **Targets:** Recoverable or expendable floating targets (stationary or towed) **Duration:** 1 hour	**Location*:** Northeast VACAPES: W-50C, R-6606 Navy Cherry Point: W-122 JAX: Charleston OPAREA, underwater detonation boxes North and South GOMEX: Panama City OPAREA, underwater detonation Box E3, Corpus Christi
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1; E2); vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); vessel strike; in-water device strike **Entanglement:** None **Ingestion:** Projectile and target fragments; projectiles; casings	
Detailed Military Expended Materials Information	Projectiles; casings; target fragments; projectile fragments One target is used per event, typically a stationary target such as a 50-gallon (189 liter) steel drum.	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds. Most events will involve boat crews training with MK 203 40 mm grenade launchers. The majority of events will occur proximate to naval stations.	

A.1.4.8 Missile Exercise Surface-to-Surface

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Surface-to-Surface) (MISSILEX [S-S])	Surface ship crews defend against surface threats (ships or boats) with missiles.	
Long Description	Surface ships launch missiles at surface maritime targets with the goal of destroying or disabling enemy ships or boats. After detecting and confirming a surface threat, the ship will fire a precision guided anti-surface missile. Events with destroyers and cruisers will involve long range (over the horizon) Harpoon (or similar) anti-surface missiles. While past Harpoon events occurred during sinking exercises, the requirement exists for non-sinking exercise events to certify ship crews. If a sinking exercise target is unavailable, a towed sled would likely be used. Events with littoral combat ships will involve shorter range anti-surface missiles. Events with littoral combat ships would be to certify ship's crew to defend against "close in" (less than 10 miles from shore) surface threats. These exercises are live fire, meaning that a missile is fired down range. Anti-surface missiles could be equipped with either high-explosive or non-explosive warheads.	
Information Typical to the Event	**Platform**: Surface ships (CG, DDG, LCS) **Systems**: None **Ordnance/Munitions:** Surface-to-surface and anti-ship missiles (explosive and non-explosive) **Targets:** High speed surface targets; towed sleds **Duration:** 2–4 hours	**Location*:** VACAPES: Typically W-386 (Air K), W-72 JAX: Typically W-157A/W-159A (Missile Laser Training Area)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E10); vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (missile, target fragments, and missile fragment) **Entanglement:** None **Ingestion:** Missile fragments; target fragments	
Detailed Military Expended Materials Information	Missiles; missile fragments; target fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Assume one missile and one target are used per event. While missiles could explode above the water's surface after contacting the target, analysis assumes all warheads explode at or just below the water's surface. All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds.	

A.1.4.9 Gunnery Exercise Air-to-Surface – Small-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – Small-Caliber **(GUNEX [A-S]) – Small-Caliber**	Helicopter aircrews, including embarked personnel, use small-caliber guns to engage surface targets.	
Long Description	Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Each gunner will engage the target with small-caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform**: Helicopter **Systems**: None **Ordnance/Munitions:** Small-caliber (non-explosive) **Targets:** Recoverable or expendable floating targets (stationary or towed); remote high speed target **Duration:** 1 hour	**Location*:** VACAPES: W-72A (Air 1A), W-50C Navy Cherry Point: W-122 (1/2/3/8/9/10/15/16/17) JAX: W-132, W-133, W-134, W-157, W-158
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike; military expended material strike (projectiles); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectiles; target fragments; casings	
Detailed Military Expended Materials Information	Projectiles; casings; target fragments One target used per event; expendable smoke floats (50 percent), stationary targets (45 percent), or remote controlled targets (5 percent)	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Most events will occur proximate to naval stations where H-60 helicopters are homebased and target services are available (Norfolk, Virginia; Jacksonville, Florida).	

A.1.4.10 Gunnery Exercise Air-to-Surface – Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – Medium-Caliber **(GUNEX [A-S]) – Medium-Caliber**	Fixed-wing and helicopter aircrews, including embarked personnel, use small- and medium-caliber guns to engage surface targets.	
Long Description	Fighter and helicopter aircrew, including embarked personnel, engage surface targets with medium-caliber guns. Targets simulate enemy ships, boats, and floating/near-surface mines. Fighter aircraft descend on a target firing high-explosive or non-explosive practice munitions medium-caliber projectiles. Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Crew will engage the target with medium-caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (F/A-18, F-35); helicopter (H-60) **Systems**: None **Ordnance/Munitions:** Medium-caliber (non-explosive and explosive) **Targets:** Recoverable or expendable floating targets (stationary or towed); remote high speed target **Duration:** 1 hour	**Location*:** VACAPES: W-386 (Air K) Navy Cherry Point: W-122 JAX: Gunnery areas AA, BB GOMEX: Pensacola OPAREA, W-155 hotbox
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1; E2); aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile); in-water device strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectile and target fragments	
Detailed Military Expended Materials Information	Projectiles; casings; projectile and target fragments One target used per event; expendable smoke float (50 percent), stationary target (45 percent), or remote controlled target (5 percent).	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Most medium-caliber air to surface gunnery exercises will be with non-explosive training projectiles. High-explosive rounds will supplement when non-explosive training projectiles are not available. All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds.	

A.1.4.11 Missile Exercise Air-to-Surface – Rocket

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Air-to-Surface)-Rocket (MISSILEX [A-S]) – Rocket	Fixed-wing and helicopter aircrews fire both precision-guided and unguided rockets against surface targets.	
Long Description	Fighter, maritime patrol aircraft, and helicopter aircrews fire both precision-guided and unguided rockets against surface targets. Aircraft involved may be unmanned. Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch high-explosive or non-explosive practice munitions precision guided rockets. Helicopters designate an at-sea surface target with a laser or optics for precision guided high-explosive or non-explosive practice munitions rockets.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (e.g., F/A-18, F-35, P-8, unmanned aerial vehicles); helicopters (H-60, Fire Scout) **Systems**: None **Ordnance/Munitions:** Rockets (explosive or non-explosive) **Targets:** Recoverable floating targets (stationary or towed) **Duration:** 1 hour	**Location*:** VACAPES: W-386 (Air K), W-72A JAX: W-157A/W-159A (Missile Laser Training Area) GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E5); aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** In-water device strike; military expended material strike (rocket, rocket and target fragments); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Target fragments; rocket fragments	
Detailed Military Expended Materials Information	Rockets; target fragments; rocket fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Assume all explosive rockets detonate in the water. Assume all rockets under the No Action Alternative are non-explosive. Assume all rockets under Alternatives 1 and 2 are explosive. Rockets may be used in conjunction with force protection events. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.1.4.12 Missile Exercise Air-to-Surface

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Air-to-Surface) (MISSILEX [A-S])	Fixed-wing and helicopter aircrews fire precision-guided missiles against surface targets.	
Long Description	Fighter, maritime patrol aircraft, and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets. Aircraft involved may be unmanned. Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch high-explosive precision guided missiles. Helicopters designate an at-sea surface target with a laser or optics for precision guided high-explosive or non-explosive practice munitions missile. Helicopter launched missiles typically pass through the targets "sail" and, if explosive, detonate at or just below the water's surface.	
Information Typical to the Event	**Platform**: Fixed-wing aircraft and helicopters **Systems**: None **Ordnance/Munitions:** Air-to-surface missiles (high-explosive) **Targets:** Recoverable floating targets (stationary or towed); remotely operated targets **Duration:** 1 hour	**Location*:** VACAPES: Typically W-386 (Air K), W-72A Navy Cherry Point: Typically W-122 (16,17) JAX: Typically W-157A, W-159A (Missile Laser Training Area)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E6; E8); aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** In-water device strike; military expended material strike (missile fragment); aircraft strike (birds only) **Entanglement:** Guidance wire*** **Ingestion:** Missile fragments; target fragments	
Detailed Military Expended Materials Information	Missile fragments; target fragments; guidance wire***	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Assume one missile and one target are used per event. While missiles could explode above the water's surface after contacting targets, analysis assumes that all warheads explode at or just below the water's surface. ***In the Navy Cherry Point Range Complex, up to 8 TOW missiles could be used annually as part of this activity. Each TOW missile would have an associated guidance wire. No other missiles in this activity have a guidance wire associated with them. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.1.4.13 Bombing Exercise Air-to-Surface

Activity Name	Activity Description	
Anti-Surface Warfare		
Bombing Exercise (Air-to-Surface) (BOMBEX [A-S])	Fixed-wing aircrews deliver bombs against surface targets.	
Long Description	Bombing exercises (air-to-surface) involve training of strike fighter aircraft in delivery of bombs against surface maritime targets. Fixed-wing aircraft conduct bombing exercises against stationary floating targets (e.g., MK 58 smoke buoy). An aircraft clears the area, deploys a smoke buoy or other floating target, and then delivers high-explosive or non-explosive practice munitions bomb(s) on the target. A range boat may be used to deploy targets for an aircraft to attack. Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive. The following munitions may be employed by strike fighter aircraft in the course of bombing exercises. Unguided munitions include non-explosive sub scale bombs (MK 76 and BDU-45); explosive and non-explosive general purpose bombs (MK 80 series); MK 20 cluster bomb (explosive, non-explosive). Precision-guided munitions include laser-guided bombs (explosive, non-explosive); laser-guided training rounds (non-explosive); Joint Direct Attack Munition (explosive, non-explosive).	
Information Typical to the Event	**Platform**: Fixed-wing aircraft (e.g., F/A-18, F-35, P-8) **Systems**: None **Ordnance/Munitions:** Bombs (high-explosive, non-explosive) **Targets:** Expendable floating targets (e.g., smoke float) **Duration:** 1 hour	**Location*:** VACAPES: W-386 (Air K, 7D, 8C), W-72A/B Navy Cherry Point: W-122 JAX: 157A/B, W-158A/B GOMEX: Pensacola OPAREA, W-151 A/C, W-155B
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E8; E9; E10; E12); aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Military expended material strike (non-explosive bomb); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Bomb fragments; target fragments; smoke floats	
Detailed Military Expended Materials Information	Bombs; bomb fragments; target fragments; smoke floats	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Approximately 90 percent of non-explosive bombs are sub-scale bombs such as the MK 76 and BDU-48. The in-air low energy laser stressor was used in analysis of potential impacts on human resources. 1 MK 58 per event	

A.1.4.14 Laser Targeting

Activity Name	Activity Description	
Anti-Surface Warfare		
Laser Targeting	Fixed-wing, helicopter, and ship crews illuminate enemy targets with lasers.	
Long Description	Fixed-wing and helicopter aircrew and shipboard personnel illuminate enemy targets with lasers for engagement by aircraft with laser guided bombs or missiles. This exercise may be conducted alone or in conjunction with other events utilizing precision guided munitions, such as anti-surface missiles and guided rockets. Events where weapons are fired are addressed in the appropriate activity (e.g., air-to-surface missile exercise) Lower powered lasers may also be used as non-lethal deterrents during maritime security operations (force protection).	
Information Typical to the Event	**Platform**: Ships; boats; fixed-wing aircraft and helicopters **Systems**: None **Ordnance/Munitions:** None unless conducted with other events (e.g., missile exercise) **Targets:** None **Duration:** 1–2 hours	**Location*:** VACAPES: W-386 (Air K), W-72A JAX: W-132 W-133, W-134, W-157, W-158
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Laser targeting for missile/rocket guidance will occur in areas where these events also occur. Use of lasers as force protection non-lethal deterrents will primarily occur proximate to Navy homeports (Norfolk, Virginia and Jacksonville, Florida). The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.1.4.15 Sinking Exercise

Activity Name	Activity Description	
Anti-Surface Warfare		
Sinking Exercise (SINKEX)	Aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a deactivated ship, which is deliberately sunk using multiple weapon systems.	
Long Description	Ship personnel and aircrew deliver high-explosive ordnance on a seaborne target, (large deactivated vessel), which is deliberately sunk using multiple weapon systems. A sinking exercise is typically conducted by aircraft, surface ships, and submarines in order to take advantage of the ability to fire high-explosive ordnance on a full size ship target. The target is typically a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards. The location is greater than 50 nm from shore and in water depths greater than 6,000 ft. Ship, aircraft, and submarine crews attack with coordinated tactics and deliver high-explosive ordnance to sink the target. Non-explosive practice munitions may be used during the initial stages to extend target life. Typically, the exercise lasts for 4 to 8 hours and possibly over 1 to 2 days, however it is unpredictable and ultimately ends when the ship sinks.	
Information Typical to the Event	**Platform**: Ships; aircraft; submarines **Systems**: None **Ordnance/Munitions:** Potentially all available (explosive and non-explosive) **Targets:** Decommissioned ship made environmentally safe for sinking (according to U.S. Environmental Protection Agency standards) **Duration:** 4–8 hours, possibly over 1–2 days. The duration of the event is unpredictable and the event ultimately ends when the ship sinks.	**Location:** Other AFTT Areas: sinking exercise box
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E3, E5, E8, E9, E10, E11, and E12); vessel noise; aircraft noise; weapons firing noise **Energy**: None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles, projectile fragments); vessel strike; aircraft strike (birds only) **Entanglement:** Guidance wires **Ingestion:** Munitions fragments; small-caliber projectiles; casings	
Detailed Military Expended Materials Information	Munitions fragments; non-explosive ordnance; guidance wires; casings; ship hulk (decommissioned ships made environmentally safe for sinking according to U.S. Environmental Protection Agency standards)	
Standard Operating Procedures and Mitigations		

Activity Name	Activity Description
Assumptions Used for Analysis	Events occur greater than 50 nm from shore and in water depths greater than 6,000 ft. The participants and assets could include: • 1 full-size target ship hulk • 1–5 CG, DDG, or FFG ships • 1–10 F/A-18, or maritime patrol aircraft • 1 or 2 HH-60H, MH-60, or SH-60B helicopters • 1 E-2 aircraft for Command and Control • 1 submarine • 1–3 range clearance aircraft • 2–4 Harpoon surface-to-surface or air-to-surface missiles • 2–8 air-to-surface Maverick missiles • 2–16 MK 82 general purpose bombs • 2–4 Hellfire air-to-surface missiles • 1 or 2 SLAM-ER air-to-surface missiles • 50–500 rounds 5-inch and 76 mm gun • 1–2 MK 48 heavyweight submarine-launched torpedo • 2–10,000 rounds .50 caliber and 7.62 mm • Assume 2 guidance wires expended per event

A.1.5 ANTI-SUBMARINE WARFARE TRAINING

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination, in operations to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, locate mines, and identify, track, and target submarines. Passive sonar "listens" for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine).

Active sonar transmits pulses of sound that travel through the water, reflect off objects, and return to a receiver. By knowing the speed of sound in the water and the time taken for the sound wave to travel to the object and back, active sonar systems can quickly calculate direction and distance from the sonar platform to the underwater object. Active sonar is necessary to detect and track submarines that do not emit detectable levels of noise, either because of noise reduction design features or because of the presence of overwhelming background noise levels.

The Navy's anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated anti-submarine warfare training exercises involving active sonar are conducted in coordinated, at-sea operations during multi-dimensional training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against "enemy" submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multi-dimensional battlespace.

A.1.5.1 Tracking Exercise/Torpedo Exercise – Submarine

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Tracking Exercise/Torpedo Exercise – Submarine (TRACKEX/ TORPEX – Sub)	Submarine crews search for, track, and detect submarines. Exercise torpedoes may be used during this event.	
Long Description	Submarine crews search for, detect, and track a threat submarine to develop firing position to launch a torpedo. A single submerged submarine operates at slow speeds and various depths while using its hull mounted or towed array sonar to track a threat submarine. Passive sonar is used almost exclusively. Non-explosive exercise torpedoes can be fired, and active sonar can be used during this training event. Tracking exercise/torpedo exercise – submarine could occur anywhere throughout the AFTT Study Area. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the submarine launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas (OPAREAs) depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** One or more submarines; support craft; rotary-wing aircraft **Systems:** Mid-frequency (primarily passive) and high-frequency sonars **Ordnance/Munitions:** Exercise torpedoes (non-explosive torpedo exercise only) **Targets:** MK 30 **Duration:** 8 hours **Typical Event Area Dimensions:** 30 x 40 nm	**Location*:** Northeast VACAPES Navy Cherry Point JAX (includes Undersea Warfare Training Range) Gulf of Mexico** Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar; e.g., ASW4, MF3); high-frequency sonar (e.g., HF3, heavyweight torpedo; TORP2); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (torpedo accessories); aircraft strike (birds only) **Entanglement:** Guidance wires **Ingestion:** None	
Detailed Military Expended Materials Information	Torpedo accessories (guidance wires, ballast weights, flex tubing)	

Activity Name	Activity Description
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). ** Gulf of Mexico refers to the body of water. Torpedoes are recovered. Guidance wire has a low breaking strength. Weights and flex tubing sink rapidly. Tracking exercise and torpedo exercise can occur in all locations. Other AFTT Areas events typically refer to those events that occur while vessels are in transit. For the No Action Alternative, 72 torpedoes total for all events. For Alternative 1 and Alternative 2, 80 torpedoes for all events.

A.1.5.2 Tracking Exercise/Torpedo Exercise – Surface

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Tracking Exercise/ Torpedo Exercise – Surface (TRACKEX/ TORPEX – Surface)	Surface ship crews search for, track, and detect submarines. Exercise torpedoes may be used during this event.	
Long Description	Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. A surface ship operates at slow speeds while employing hull mounted or towed array sonars. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is either an MK 39 Expendable Mobile Anti-Submarine Warfare Training Target, MK 30 Recoverable Training Target, or live submarine. Tracking exercise/torpedo exercise – surface could occur anywhere throughout the AFTT Study Area. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the ship launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, such as the Undersea Warfare Training Range, but it may be conducted in other OPAREAs depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** One or more ships and submarines; support craft; rotary-wing aircraft **Systems:** Mid-frequency sonars, Nixie **Ordnance/Munitions:** Exercise torpedoes (non-explosive torpedo exercise only) **Targets:** MK 39 or MK 30 **Duration:** 2–4 hours **Typical Event Area Dimensions:** 30 x 40 nm	**Location*:** Northeast VACAPES Navy Cherry Point JAX (includes Undersea Warfare Training Range) Gulf of Mexico** Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar; high-frequency sonar (hull-mounted sonar, lightweight torpedo; e.g., ASW1, ASW3, ASW4; MF1, MF2, MF3, MF4, MF5, MF11, MF12; HF1; TORP1); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	One MK 39 Expendable Mobile Anti-Submarine Warfare Training Target; torpedo accessories (ballast weights) from exercise torpedoes; sonobuoys; parachutes	

Activity Name	Activity Description
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). ** Gulf of Mexico refers to the body of water. Torpedoes are recovered. Tracking exercise and torpedo exercise can occur in all locations. A submarine may provide service as the target except for torpedo exercise events. Other AFTT Areas events typically refer to those events that occur while vessels are in transit. For the No Action Alternative, 18 torpedoes total for all events. For Alternative 1 and Alternative 2, 18 torpedoes for all events.

A.1.5.3 Tracking Exercise/Torpedo Exercise – Helicopter

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Tracking Exercise/ Torpedo Exercise-Helicopter (TRACKEX/ TORPEX – Helo)	Helicopter crews search for, track, and detect submarines. Recoverable air launched torpedoes may be employed against submarine targets.	
Long Description	This exercise involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys are typically employed by a helicopter operating at altitudes below 3,000 ft. (914 m). Both passive and active sonobuoys are employed. The dipping sonar is employed from an altitude of about 50 ft. (15 m) after the search area has been narrowed based on the sonobuoy search. Both passive and active sonar are employed. The anti-submarine warfare target used for this exercise will likely be a MK 39 Expendable Mobile Anti-Submarine Warfare Training Target or a live submarine. A MK 30 recoverable target may be used if available. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and ships, including a major range event. The tracking exercise becomes a torpedo exercise when the helicopter launches an exercise torpedo. The exercise torpedo is recovered by a special recovery helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, such as the Undersea Warfare Training Range, but it may be conducted in other OPAREAs depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft; helicopters; surface ships **Systems:** Mid-frequency helicopter dipping sonar; sonobuoys **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** Expendable Mobile Anti-Submarine Warfare Training Target or MK 30 **Duration:** 2–4 hours **Typical Event Area Dimensions:** 20 x 30 nm	**Location:** VACAPES Navy Cherry Point JAX: includes Undersea Warfare Training Range Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (sonobuoy, dipping sonar, lightweight torpedo; e.g., ASW4; MF4, MF5; TORP1); aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion**: Parachutes	
Detailed Military Expended Materials Information	1 MK 39 (expendable target); if target is air-dropped, 1 parachute per target (no more than 432/year); torpedo accessories (ballast weights/parachutes) from exercise torpedoes; sonobuoys with parachutes	

Activity Name	Activity Description
Assumptions Used for Analysis	Tracking exercise and torpedo exercise can occur in all locations. For the No Action Alternative, 18 torpedoes total for all events. For Alternative 1 and Alternative 2, 18 torpedoes for all events.

A.1.5.4 Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Tracking Exercise/ Torpedo Exercise-Maritime Patrol Aircraft (TRACKEX/ TORPEX – MPA)	Maritime patrol aircraft crews search for, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.	
Long Description	This exercise involves fixed-wing maritime patrol aircraft employing sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 ft. (914 m). However, sonobuoys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK 39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK 30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and ships, including a major range event. The tracking exercise becomes a torpedo exercise when the aircraft launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other OPAREAs depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** One or more aircraft, one or more surface ships **Systems:** Sonobuoys **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK 30, MK 39; submarine **Duration:** 2–8 hours **Typical Event Area Dimensions:** Up to 60 x 60 nm	**Location:** Northeast VACAPES Navy Cherry Point JAX: includes Undersea Warfare Training Range Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (sonobuoy, lightweight torpedo; e.g., MF5; TORP1); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only); vessel strike; in-water device strike; military expended material strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	One MK 39 (expendable target); torpedo accessories (ballast weights/parachutes) from exercise torpedoes; sonobuoys with parachutes	

Activity Name	Activity Description
Assumptions Used for Analysi	** Gulf of Mexico refers to the body of water. If target is air-dropped, one parachute per target (no more than 752/year). Tracking exercise and torpedo exercise can occur in all locations. A submarine may provide service as the target except for torpedo exercise events. Other AFTT Areas events typically refer to those events that occur while vessels are in transit.

A.1.5.5 Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Tracking Exercise/ Torpedo Exercise– Maritime Patrol Advanced Extended Echo Ranging Sonobuoys (TRACKEX–MPA Sonobuoy)	Maritime patrol aircraft crews search for, detect, and track submarines with extended echo ranging sonobuoys. Recoverable air launched torpedoes may be employed against submarine targets.	
Long Description	This exercise involves fixed-wing maritime patrol aircraft employing Improved Extended Echo Ranging and Multistatic Active Coherent sonobuoy systems to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. The Improved Extended Echo Ranging events use the SSQ-110A sonobuoy as an impulsive source, while the Multistatic Active Coherent events utilize the SSQ-125 sonobuoy as a tonal source. Each exercise would include the use of approximately 10 SSQ-110A or SSQ-125 sonobuoys. The anti-submarine warfare target used for this exercise may be a MK 39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK 30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and ships, including a major range event.	
Information Typical to the Event	**Platform:** One maritime patrol aircraft **Systems:** Improved Extended Echo Ranging and Multistatic Active Coherent sonobuoy systems **Ordnance/Munitions:** None **Targets:** MK 30, MK 39 **Duration:** 2–8 hours **Typical Event Area Dimensions:** 60 x 60 nm	**Location:** Northeast VACAPES Navy Cherry Point JAX: includes Undersea Warfare Training Range Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (sonobuoy; e.g., ASW2); underwater explosives (E4); aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only); military expended material strike **Entanglement:** Parachutes **Ingestion:** Parachutes; sonobuoy fragments	
Detailed Military Expended Materials Information	One MK 39 (expendable target); sonobuoys with parachutes (estimate of 3,200)	
Assumptions used for Analysis	** Gulf of Mexico refers to the body of water. If target is air-dropped, one parachute is used per target (no more than 320/year).	

A.1.5.6 Anti-Submarine Warfare Tactical Development Exercise

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Warfare Tactical Development Exercise	Multiple ships, aircraft, and submarines coordinate their efforts to search for, detect, and track submarines with the use of all sensors. Anti-Submarine Warfare Tactical Development Exercise is a dedicated anti-submarine warfare event.	
Long Description	Multiple ships, aircraft, and submarines coordinate their efforts to search for, detect, and track submarines with the use of all sensors. Anti-Submarine Warfare Tactical Development Exercise is a fleet training exercise involving surface ships, submarines, and aircraft. Active and passive sonar and sonobuoys are used to conduct anti-submarine warfare training exercises. The purpose of the exercise is to assess fleet anti-submarine warfare performance and capability among various units operating together in a specific threat environment.	
Information Typical to the Event	**Platform:** Surface ships; submarines; fixed-wing aircraft; helicopters **Systems:** Hull mounted sonar; dipping sonar; sonobuoys **Ordnance/Munitions:** None **Targets:** Expendable Mobile Anti-Submarine Warfare Training Targets **Duration:** 5–7 days **Typical Event Area Dimensions:** 30 x 30 nm	**Location:** JAX (includes Undersea Warfare Training Range)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** sonar (hull-mounted sonar, dipping sonar, sonobuoys; e.g., ASW4; HF1; MF1, MF2, MF3, MF4, MF5); acoustic countermeasures (e.g., ASW3); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	One MK 39 (expendable target); sonobuoys; countermeasures	
Assumptions Used for Analysis	Air-launched sonobuoys will have a parachute.	

A.1.5.7 Integrated Anti-Submarine Warfare Course

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Integrated Anti-Submarine Warfare Course (IAC)	Multiple ships, aircrafts, and submarines integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track a threat submarine to launch a torpedo.	
Long Description	Integrated Anti-Submarine Warfare Course is a tailored course of instruction designed to improve Sea Combat Commander and strike group integrated anti-submarine warfare warfighting skill sets. Integrated Anti-Submarine Warfare Course is a coordinated training scenario that typically involves five surface ships, two to three embarked helicopters, a submarine and one maritime patrol aircraft searching for, locating, and attacking one submarine. The scenario consists of two 12-hour events that occur five times per year. The submarine may practice simulated attacks against the ships while being tracked. Hull mounted, towed array and dipping sonar is employed by ships and helicopters. The submarine also periodically operates its sonar.	
Information Typical to the Event	**Platform**: Surface ships; fixed-wing aircraft; helicopters; submarines; unmanned vehicles **Systems**: Hull mounted; towed array; dipping sonars; sonobuoys **Ordnance/Munitions:** Sonobuoys **Targets:** Expendable Mobile Anti-Submarine Warfare Training Targets **Duration:** 2–5 days (two 12-hour events) **Typical Event Area Dimensions:** 120 x 60 nm	**Location:** VACAPES Navy Cherry Point JAX Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (dipping sonar, hull-mounted sonar, sonobuoys; e.g., ASW4; HF1; MF1, MF2, MF3, MF4, MF5, MF6); acoustic countermeasures (e.g., ASW2, ASW3); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	Countermeasures	
Assumptions Used for Analysis	Two MK 39 targets may be used in place of an actual submarine target. Air deployed sonobuoys will each have a parachute. ** Gulf of Mexico refers to the body of water.	

A.1.5.8 Group Sail

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Group Sail	Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search for, detect, and track a threat submarine. Group Sails are not dedicated anti-submarine warfare events and involve multiple warfare areas.	
Long Description	Multiple ships and helicopters integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track a threat submarine to launch a torpedo. Group Sail is an intermediate training exercise primarily intended to introduce coordinated operations after unit level training and prior to composite training. This event stresses planning, coordination, and communications during multiple warfare training scenarios. Two or more ships and up to two helicopters searching for, locating, and attacking one submarine. Typically, one ship and helicopter are actively prosecuting while the other ship and helicopter are repositioning. Simultaneously, the submarine may practice simulated attacks against the ships. Multiple acoustic sources may be active at one time.	
Information Typical to the Event	**Platform**: Submarine; helicopters; surface ships **Systems**: Hull mounted sonar; towed array and dipping sonar; sonobuoys (some explosive sonobuoys may be used) **Ordnance/Munitions:** None **Targets:** Expendable Mobile Anti-Submarine Warfare Training Targets **Duration:** 2–3 days **Typical Event Area Dimensions:** 30 x 30 nm	**Location:** VACAPES Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (hull mounted sonar, towed array, dipping sonar, sonobuoys; e.g., ASW2; HF1; MF1, MF2, MF3, MF4, MF5, MF6); acoustic countermeasures (e.g., ASW3); vessel noise; aircraft noise; underwater explosives (E4) **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes; sonobuoy fragments	
Detailed Military Expended Materials Information	Sonobuoys; parachutes; countermeasures; sonobuoy fragments	
Assumptions Used for Analysis	While preference will be to train against an actual submarine, or MK 30 recoverable target, assume only MK 39 expendable targets will be used. One MK 39 Expendable Mobile Anti-Submarine Warfare Training Target may be used in place of an actual submarine target.	

A.1.5.9 Submarine Command Course Operations

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Submarine Command Course (SCC)	Train prospective submarine Commanding Officers to operate against surface, air, and subsurface threats.	
Long Description	Train prospective Commanding Officers on submarines to operate against each other to locate and conduct simulated attacks. Submarine Command Course is a Commander, U.S. Submarine Forces requirement to provide training to prospective submarine commanders in rigorous and realistic scenarios. This training assesses prospective commanding officers' abilities to operate in numerous hostile environments, encompassing surface ships, aircraft, as well as other submarines. The course incorporates anti-submarine warfare tracking exercise, anti-submarine warfare torpedo exercise.	
Information Typical to the Event	**Platform:** One or more submarines; surface ships; fixed-wing aircraft; rotary-wing aircraft **Systems:** Mid-frequency (primarily passive) and high-frequency sonars **Ordnance/Munitions:** Exercise torpedoes (torpedo exercise only) **Targets:** MK 30 **Duration:** 3–5 days (at-sea portion) **Typical Event Area Dimensions:** 30 x 40 nm	**Location:** Northeast JAX Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency hull-mounted sonar (MF1, MF2, MF3), helicopter dipping sonar (MF4), sonobuoy (MF5), mid-frequency acoustic countermeasures (ASW3, ASW4), high-frequency hull-mounted sonar (HF1), lightweight torpedo (TORP1), heavyweight torpedo (TORP2) **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Guidance wires; parachutes **Ingestion:** Torpedo accessories (ballast weights); parachutes	
Detailed Military Expended Materials Information	Torpedo accessories (guidance wire, ballast weights, flex tubing); sonobuoys (parachutes); countermeasures	
Assumptions used for Analysis	Torpedoes are recovered. Guidance wire is brittle and breaks easily. Weights sink rapidly. For Alternatives 1 and 2, the anti-submarine warfare portion of this event is incorporated in Tracking Exercise/Torpedo Exercise Submarine.	

A.1.5.10 Anti-Submarine Warfare for Composite Training Unit Exercise

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Warfare for Composite Training Unit Exercise (COMPTUEX)	Anti-submarine warfare activities conducted during a Composite Training Unit Exercise.	
Long Description	Intermediate level battle group exercise designed to create a cohesive strike group prior to deployment or Joint Task Force Exercise. Typically seven surface ships, helicopters, maritime patrol aircraft, two submarines, and various unmanned vehicles. Each strike group performs a rehearsal called Composite Training Unit Exercise before deployment. Prior to the Composite Training Unit Exercise, each ship and aircraft in the strike group trains in their specialty. The Composite Training Unit Exercise is an intermediate-level strike group exercise designed to forge the group into a cohesive fighting team. Composite Training Unit Exercise is normally conducted during a 2 to 3 week period prior to a Joint Task Force Exercise and consists of an 18 day schedule of event driven exercise, and a 3 day Final Battle Problem. The Composite Training Unit Exercise is an integration phase, at-sea, major range event. For the Carrier Strike Group, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. For the expeditionary strike group/amphibious readiness group, this exercise integrates amphibious ships with their associated air wing, surface ships, submarines, and the Marine expeditionary unit. Live-fire operations that may take place during composite training unit exercise include long-range air strikes, naval surface fire support, and surface-to-air, surface-to-surface, and air-to-surface missile exercises. The Marine expeditionary unit also conducts realistic training based on anticipated operational requirements and to further develop the required coordination between Navy and Marine Corps forces. Special operations training may also be integrated with the exercise scenario.	
Information Typical to the Event	**Platform**: Surface ships, fixed-wing aircraft, helicopters, submarines, unmanned vehicles **Systems**: All sonars **Ordnance/Munitions:** All ship and aircraft weapons, explosive sonobuoys **Targets:** All surface, air, and anti-submarine warfare targets (Expendable Mobile Anti-Submarine Warfare Training Targets) **Duration:** 21 days **Typical event area dimensions:** 60 x 120 nm	**Location:** VACAPES Navy Cherry Point JAX Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (hull-mounted sonar, dipping sonar, sonobuoys, towed arrays; e.g., ASW2, ASW4; HF1; MF1, MF2, MF3, MF4, MF5, MF6, MF12); acoustic countermeasures (e.g., ASW3); vessel noise; aircraft noise; underwater explosives (E4) **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes; countermeasures; sonobuoy fragments	
Detailed Military Expended Materials Information	One MK 39 (expendable target); each air deployed sonobuoy will have a parachute; countermeasures.	

Activity Name	Activity Description
Assumptions Used for Analysis	** Gulf of Mexico refers to the body of water. For Composite Training Unit Exercise only the anti-submarine warfare activities were analyzed as a Composite Training Unit Exercise. Other warfare area training conducted during the Composite Training Unit Exercise was analyzed as unit level training (gunnery exercise, missile exercise, etc.).

A.1.5.11 Anti-Submarine Warfare for Joint Task Force Exercise/Sustainment Exercise

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Warfare for Joint Task Force Exercise (JTFEX)/ Sustainment Exercise (SUSTAINEX)	Anti-submarine warfare activities conducted during a Joint Task Force Exercise / Sustainment Exercise	
Long Description	**Joint Task Force Exercise** This is the culmination of training and preparation for deployment. This exercise requires U.S. naval forces to integrate all assets to accomplish missions in a multi-threat, multi-dimensional environment. The exercise serves as the ready-to-deploy certification for the Navy-Marine team, requiring tests of critical plans, synchronized employment of available assets and realistic training with live ordnance. Joint Task Force Exercise is normally 10 days long, not including a 3-day in-port force protection exercise, and is the final at-sea exercise for the Carrier Strike Group or Expeditionary Strike Group prior to deployment. Joint Task Force Exercise occurs three to four times per year. **Sustainment Exercise** The requirement to conduct post-deployment training, and maintenance. This ensures that the components of a strike group maintain an acceptable level of readiness after returning from deployment. A sustainment exercise is designed to challenge the strike group in all warfare areas. This exercise is similar to a Composite Training Unit Exercise but of shorter duration.	
Information Typical to the Event	**Platform**: Surface ships; fixed-wing aircraft; helicopters; submarines, unmanned vehicles **Systems**: All sonars **Ordnance/Munitions:** All ship and aircraft weapons, explosive sonobuoys may be used **Targets:** All surface, air, and anti-submarine warfare targets (Expendable Mobile Anti-Submarine Warfare Training Targets) **Duration:** 10 days **Typical event area dimensions:** Up to 180 x 180 nm	**Location:** VACAPES Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (hull mounted sonar, dipping sonar, towed arrays, sonobuoys; e.g., ASW2, ASW4; HF1; MF1, MF2, MF3, MF4, MF5, MF6, MF12); acoustic countermeasures (e.g., ASW3); underwater explosives (E4); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike**: Vessel strike; in-water device strike; military expended material strike; aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes; countermeasures; sonobuoy fragments	
Detailed Military Expended Materials Information	One MK 39 (expendable target); countermeasures	
Assumptions Used for Analysis	Sonobuoys: each air deployed sonobuoy will have a parachute. For Joint Task Force Exercise/Sustainment Exercise only the anti-submarine warfare activities were analyzed as a Joint Task Force Exercise/Sustainment Exercise. Other warfare area training conducted during the Joint Task Force Exercise/Sustainment Exercise was analyzed as unit level training (gunnery exercise, missile exercise, etc.).	

A.1.6 ELECTRONIC WARFARE

Electronic warfare is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

A.1.6.1 Electronic Warfare Operations

Activity Name	Activity Description	
Electronic Warfare (EW)		
Electronic Warfare Operations (EW OPS)	Aircraft and surface ship crews attempt to control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions.	
Long Description	Aircraft and surface ship crews attempt to control critical portions of the electromagnetic spectrum used by enemy systems to degrade or deny their ability to defend its forces from attack or recognize an emerging threat early enough to take defensive actions. Electronic warfare operations can be active or passive, offensive or defensive. Fixed-wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface ships detect and evaluate enemy electronic signals from enemy aircraft or missile radars, evaluate courses of action concerning the use of passive or active countermeasures, then use ship maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft; helicopters; surface ships **Systems:** None **Ordnance/Munitions:** None **Targets:** Land based fixed/mobile threat emitters **Duration:** 1–2 hours	**Location*:** VACAPES: W-386 (Air K), W-72 Navy Cherry Point: W-122 JAX: W-132, W-133, W-134, W-157, W-158
Potential Impact Concerns (Information regarding deconstruct categories and stressors)	**Acoustic:** Vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). All chaff and flares involved in this event are covered under chaff exercises and flare exercises, respectively.	

A.1.6.2 Counter Targeting Flare Exercise

Activity Name	Activity Description	
Electronic Warfare (EW)		
Counter Targeting – Flare Exercise (FLAREX)	Fixed-wing aircraft and helicopters crews defend against an attack by deploying flares to disrupt threat infrared missile guidance systems.	
Long Description	Fixed-wing aircraft and helicopter crews deploy flares to disrupt threat infrared missile guidance systems to defend against an attack. Aircraft detect electronic targeting signals from threat radars or missiles or a threat missile plume when launched and dispense flares and immediately maneuver to defeat the threat. This exercise trains aircraft personnel in the use of defensive flares designed to confuse infrared sensors or infrared homing missiles, thereby causing the sensor or missile to lock onto the flares instead of the real aircraft. Typically an aircraft will expend five flares while operating above 3,000 ft. Flare exercises are often conducted with chaff exercises, rather than as a stand-alone exercise.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft; helicopters **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point: W-122 (1,8,15,16) JAX: W-157A (Area 3X, 4X) GOMEX: Panama City OPAREA, W-151 A/B Key West: W-174 A/B/C/E/F/G, W-465 A/B, Bonefish ATCAA
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Expended components of flares (pistons)	
Detailed Military Expended Materials Information	Flares	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Approximately 5 flares per aircraft	

A.1.6.3 Counter Targeting Chaff Exercise – Ship

Activity Name	Activity Description	
Electronic Warfare (EW)		
Counter Targeting Chaff Exercise (CHAFFEX) – Ship	Surface ship crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.	
Long Description	Surface ship crews deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack. Surface ship crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the vessel clears away from the threat. The typical event duration is approximately 1.5 hours. Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed to create a target that will lure enemy radar and weapons system away from the actual friendly platform. Ships may also train with advanced countermeasure systems, such as the MK 53 Decoy Launching System (Nulka).	
Information Typical to the Event	**Platform:** Surface ships **Systems:** None **Ordnance/Munitions:** None **Targets:** MK 53 **Duration:** 1.5 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point: W-122 (1, 8, 15, 16) JAX: W-157A (Area 3X, 4X) GOMEX: W-151 A/B, W-155 A/B
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Expended components of chaff (end caps, pistons, chaff)	
Detailed Military Expended Materials Information	Chaff; chaff canisters; end caps; pistons; MK 53 decoys	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Assume half of the events use decoys	

A.1.6.4 Counter Targeting Chaff Exercise – Aircraft

Activity Name	Activity Description	
Electronic Warfare (EW)		
Counter Targeting Chaff Exercise (CHAFFEX) – Aircraft	Fixed-wing aircraft and helicopter crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.	
Long Description	Fixed-wing aircraft and helicopter crews deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack. Fixed-wing aircraft and helicopter crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the aircraft clears away from the threat. Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed to create a target that will lure enemy radar and weapons system away from the actual friendly platform.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft; helicopters **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1.5 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point: W-122 (1, 8, 15, 16) JAX: W-157A (Area 3X, 4X) GOMEX: W-151 A/B, W-155 A/B Key West: W-174 A/B/C/E/F/G, W-465 A/B
Potential Impact Concerns (Information regarding deconstruct categories and stressors)	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Expended components of chaff (end caps, pistons, chaff)	
Detailed Military Expended Materials Information	Chaff cartridges; plastic end caps; pistons	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Chaff is usually expended while conducting other training activities, such as air combat maneuvering.	

A.1.7 MINE WARFARE

Mine warfare is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of or a contact with an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. Mine warfare training includes mine countermeasures exercises and mine laying exercises.

A.1.7.1 Mine Countermeasure Exercise – Ship Sonar

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Countermeasures Exercise (MCM) – Ship Sonar	Littoral combat ship crews detect and avoid mines while navigating restricted areas or channels using active sonar.	
Long Description	Surface ship crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. Littoral Combat Ship utilizes unmanned surface vehicles and remotely operated vehicles to tow mine detection (hunting) equipment. Systems will operate from shallow zones of greater than 40 ft. to deep water. Events could be embedded in major training events.	
Information Typical to the Event	**Platform:** Surface ships (Littoral Combat Ships); unmanned vehicles **Systems:** AN/AQS-20, Remote Minehunting System, AN/AQS-24 **Ordnance/Munitions:** None **Targets:** Minefields; temporary mines; or no targets (training to deploy/operate gear). **Duration:** 1.5–4 hours	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C, 7D, Air G, lower Chesapeake Bay JAX: Carrier Strike Group mine training area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonation boxes) GOMEX: Panama City mine warfare areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (mine-hunting sonar; HF4); vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; seafloor devices **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	No military expended material use is anticipated. Temporarily placed mines will be recovered.	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). No explosives are to be used. Constraints: Assume system will be operated in areas free of obstructions, and will be towed well above the seafloor. Towed system will be operated in a manner to avoid entanglement/damage. Events will take place in water depths of 40 ft. and greater. Existing placed mine shapes to be used. There is the potential for temporary placement of mine shapes.	

A.1.7.2 Mine Neutralization – Explosive Ordnance Disposal

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Neutralization/ Explosive Ordnance Disposal (EOD)	Personnel disable threat mines. Explosive charges are used.	
Long Description	Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit. Personnel detect, identify, evaluate, and neutralize mines in the water with an explosive device and may involve detonation of one or more explosive charges from 10 to 60 pounds of TNT equivalent. These operations are normally conducted during daylight hours for safety reasons. Time delay fuses may be used for these events.	
Information Typical to the Event	**Platform:** Helicopters, small boats **Systems:** None **Ordnance/Munitions:** Underwater detonation charges **Targets:** Minefields **Duration:** Up to 4 hours	**Location*:** VACAPES: W-50 and proximate to W-50 VACAPES: Little Creek Navy Cherry Point: Underwater detonation area JAX: Charleston underwater detonation boxes GOMEX: Panama City OPAREA Key West: UNDET Test Site H, UNDET Box, EA-1
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1; E4; E5; E6; E7; E8); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only); seafloor devices **Entanglement:** None **Ingestion:** Target fragments	
Detailed Military Expended Materials Information	Target fragments; mooring blocks	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Time delayed fuses may be used (up to 10 minutes) for charges up to 20 lb. net explosive weight. Charge placed anywhere in water column, including bottom. Mine shapes will be recovered. Events in Little Creek range from events with 120 charges of under 1 lb. net explosive weight to events that include a single charge of approximately 25 lb. net explosive weight.	

A.1.7.3 Underwater Mine Countermeasure Raise, Tow, Beach and Exploitation Operations

Activity Name	Activity Description	
Mine Warfare (MIW)		
Underwater Mine Countermeasure (UMCM) Raise, Tow, Beach and Exploitation Operations	Personnel locate mines, perform mine neutralization, raise and tow mines to the beach, and conduct exploitation operations for intelligence gathering.	
Long Description	Navy divers, typically explosive ordnance disposal personnel, locate mines using unmanned underwater vehicle, marine mammals, or other diver search techniques. Mines are then neutralized, or prevented from working as they are intended to. Explosive ordnance disposal personnel ensure the neutralization measures are effective and the shapes are safe to bring to the beach. A lift balloon is attached to the line and slowly tows the shape to the beach. The final step, exploitation, is intelligence gathering, identifying the mine and how it works, and then disassembling it or disposing of it.	
Information Typical to the Event	**Platform:** Helicopters; small boats; unmanned underwater vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** Minefields **Duration:** Up to 4 hours	**Location*:** VACAPES: W-50, R-6606, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group mine warfare training area (seaspace radiating from Onslow Beach, Camp Lejeune) JAX: Carrier Strike Group mine training area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonations boxes) GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; aircraft strike (birds only); seafloor device strike (mine placement) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Mooring blocks	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). No underwater detonations are performed. Events primarily conducted in W-50 and beaches at Dam Neck. Mine shapes are recovered as part of the event.	

A.1.7.4 Airborne Mine Countermeasure – Towed Mine Neutralization

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Mine Countermeasures (AMCM) -towed mine neutralization	Ship crews, helicopter aircrews tow systems (e.g., Organic Airborne and Surface Influence Sweep, MK 104/105) through the water which are designed to disable or trigger mines.	
Long Description	Helicopter/ship crews and unmanned surface vehicle/unmanned underwater vehicle operators use towed devices to trigger mines that are designed to detonate when they detect ships/submarines by engine/propeller sounds or magnetic (steel construction) signature. Towed devices can also employ cable cutters to detach floating moored mines. Training may be conducted with non-explosive training mineshapes. Devices used include the following: Organic Airborne and Surface Influence Sweep (OASIS), a towed device that imitates the magnetic and acoustic signatures of naval ships and submarines; MK 105 sled, which creates a magnetic field used to trigger mines, and can be used in conjunction with the MK 103 cable cutter system and the MK 104 acoustic countermeasure; AN/SPU-1/W (magnetic orange pipe), a magnetic pipe that is used to trigger magnetically influenced mines.	
Information Typical to the Event	**Platform:** surface vessel (Littoral Combat Ship); unmanned surface vehicle; helicopters **Systems:** None **Ordnance/Munitions:** Cable cutters **Targets:** Existing minefields; temporary placed mines; or no targets (training to deploy/operate gear) **Duration:** Typically 1.5–4 hours	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C, 7D, Air G, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group mine warfare training area (seaspace radiating from Onslow Beach, Camp Lejeune) JAX: Carrier Strike Group mine training area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonation boxes) GOMEX: Panama City mine warfare areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; aircraft noise **Energy:** Electromagnetic **Physical Disturbance and Strike:** Vessel strike; in-water device strike; aircraft strike (birds only); seafloor device strike (bottom placed mine shapes) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Devices are towed from helicopters, ships, unmanned surface vehicles and unmanned underwater vehicles. Mechanical sweeping (cable cutting), acoustic and magnetic influence sweeping. Cable cutters utilize an insignificant charge (similar to a shotgun shell). Acoustic sweeps generate ship type noise via a mechanical system. Towing systems though minefields (or without mines, to train to deploy, tow, and recover) may involve instrumented mines. Mine shapes will be recovered.	

A.1.7.5 Airborne Mine Countermeasure – Mine Detection

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Mine Countermeasures – Mine Detection	Ship crews or helicopter aircrews detect mines using towed or laser mine detection systems (e.g., AN/AQS-20, Airborne Laser Mine Detection System).	
Long Description	Helicopter crews use towed and airborne devices to detect, locate, and classify potential mines. Towed devices employ active acoustic sources, such as high-frequency and side scanning sonar. These devices are similar in function to systems used to map the seafloor or locate submerged structures/items. Airborne devices utilize laser systems to locate mines located below the surface. Devices used include the AN/AQS-20/A, towed minehunting sonar used to detect and classify bottom and floating/moored mines in deep and shallow water, and the Airborne Laser Mine Detection System, developed to detect and classify floating and near-surface, moored mines.	
Information Typical to the Event	**Platform:** Helicopters; unmanned surface vehicles; unmanned underwater vehicles **Systems:** Airborne Laser Mine Detection System, AN/AQS-20A, AN/AQS-24A **Ordnance/Munitions:** None **Targets:** Existing minefields; temporary placed mines; or no targets (training to deploy/operate gear) **Duration:** Typically 1.5–4 hours	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C 7D, Air G, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group Mine Warfare Training Area (seaspace radiating from Onslow Beach, Camp Lejeune) JAX: Carrier Strike Group Mine Training Area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonation boxes) GOMEX: Panama City mine warfare areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (mine detection systems; HF4); vessel noise; aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike; in-water device strike; aircraft strike (birds only); seafloor device strike (bottom placed mine shapes) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Sonar mine detection systems towed from helicopters, ships, and unmanned surface vehicles are used. Airborne laser systems are used to detect mine shapes. Laser systems are similar to commercial LIDAR. The in-air low energy laser stressor was used in analysis of potential impacts on human resources. Mine shapes may be deployed via ship and will be recovered.	

A.1.7.6 Mine Countermeasure – Mine Neutralization, Small- and Medium-Caliber

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Countermeasures – Mine Neutralization, Small- and Medium-Caliber	Ship crews or helicopter aircrews disable mines by firing small- and medium-caliber projectiles.	
Long Description	Ship and helicopter crews utilize small- and medium-caliber weapons to neutralize potential mines. Weapons may employ laser detection and targeting systems. Small- and medium-caliber projectiles are non-explosive and neutralize mines by breaching casing, causing the mine to flood or detonate.	
Information Typical to the Event	**Platform:** Helicopters; surface vessels **Systems:** None **Ordnance/Munitions:** Small-caliber and medium-caliber (non-explosive) **Targets:** Existing minefields; temporarily placed mines **Duration:** Typically 1.5–4 hours	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C, 7D, Air G, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group Mine Warfare Training Area (seaspace radiating from Onslow Beach, Camp Lejeune beach) JAX: Carrier Strike Group Mine Training Area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston UNDET boxes)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise; weapons firing noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike; in-water device strike; military expended material strike (projectiles); seafloor device strike (bottom placed mine shapes); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small-caliber projectiles; medium-caliber projectiles; casings	
Detailed Military Expended Materials Information	Small-caliber projectiles; medium-caliber projectiles; casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.1.7.7 Mine Countermeasure Mine Neutralization – Remotely Operated Vehicle

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicles	Ship crews or helicopter aircrews disable mines using remotely operated underwater vehicles.	
Long Description	Ship and helicopter crews utilize remotely operated vehicles to neutralize potential mines. Remotely operated vehicles will use sonar and optical systems to locate and target mine shapes. Explosive mine neutralizers may be used during live fire events.	
Information Typical to the Event	**Platform:** Helicopters; ships **Systems:** Acoustic mine targeting system **Ordnance/Munitions:** Neutralizers (explosive and non-explosive) **Targets:** Existing minefields; temporarily placed mines **Duration:** 1.5–4 hours	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C, 7D, Air G, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group Mine Warfare Training Area (seaspace radiating from Onslow Beach, Camp Lejeune) JAX: Carrier Strike Group Mine Training Area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonation boxes) GOMEX: Panama City mine warfare areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E4); vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; in-water device strike; sea floor device strike (bottom placed mine shapes); aircraft strike (birds only) **Entanglement:** Fiber optic cable **Ingestion:** Neutralizer fragments	
Detailed Military Expended Materials Information	Neutralizer fragments; fiber optic cables	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Acoustic sources associated with remotely operated vehicle mine neutralization systems do not require quantitative analysis. See Section 2.3.7.2 (Source Classes Qualitatively Analyzed).	

A.1.7.8 Mine Laying

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Laying	Fixed-wing aircraft and submarine crews drop/launch non-explosive mine shapes.	
Long Description	Fixed-wing aircraft lay offensive or defensive mines for a tactical advantage for friendly forces. Fixed-wing aircraft lay a precise minefield pattern for specific tactical situations. The aircrew typically makes multiple passes in the same flight pattern, and drop one or more training shapes per pass (four shapes total). Training shapes are non-explosive and are recovered when possible.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (F/A-18, P-3, P-8, F-35) **Systems:** None **Ordnance/Munitions:** Non-explosive mine shapes; "quickstrike" mines **Targets:** None **Duration:** 1 hour	**Location*:** VACAPES: W-72A (Area 13, Area 20 or W-72A surface grids 1A1 and 1A3) Navy Cherry Point: W-122 Area 15 JAX: W-157A and W-158A
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive mine shapes); aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Non-explosive mine shapes	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Mine laying is similar to a non-explosive bombing exercise. These events primarily occur during major training exercises. While mine shapes will be recovered if possible, assume they will not for the analysis. Mine laying will typically take place in waters less than 100 ft. in depth. Assume 12 mine shapes are used per event.	

A.1.7.9 Coordinated Unit Level Helicopter Airborne Mine Countermeasures Exercises

Activity Name	Activity Description	
Mine Warfare (MIW)		
Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises	A detachment of helicopters and crews train as a unit in the use of airborne mine countermeasures, such as towed mine detection and neutralization systems.	
Long Description	Naval aircrews train, as a squadron, in the use of various airborne mine countermeasures. Systems employed include towed mine detection systems, mechanical (cable cutting) mine sweeps, magnetic and acoustic mine sweeps, and other airborne systems and sensors. Mine shapes will be used. If necessary, permanently placed mine shapes will be supplemented with approximately 24 additional, temporarily placed mine shapes. Training mine shapes could be bottom placed, moored, or floating.	
Information Typical to the Event	**Platform:** Helicopters **Systems:** Various airborne mine countermeasures **Ordnance/Munitions:** None **Targets:** Permanent and temporary mine shapes **Duration:** Multiple days	**Location*:** VACAPES: W-50, surface grid 13, 1A1, 1A2, 6, 7C, 7D, Air G, lower Chesapeake Bay Navy Cherry Point: Amphibious Ready Group Mine Warfare Training Area (seaspace radiating from Onslow Beach, Camp Lejeune) JAX: Carrier Strike Group Mine Training Area (surface grids 26 B through D [Warning Areas 158A and 158E] and areas proximate to Charleston underwater detonation boxes) GOMEX: Panama City Mine Warfare Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (mine hunting; HF4); aircraft noise **Energy:** Electromagnetic (magnetic influence mine sweeping) **Physical Disturbance and Strike:** Vessel strike; in-water device strike; seafloor device strike (bottom placed mine shapes); aircraft strike (birds only) **Entanglement:** Fiber optic cable **Ingestion:** None	
Detailed Military Expended Materials Information	If used during an event, remotely operated mine neutralizer systems could expend fiber optic cable. Projectiles (medium-caliber) could be used, similar to mine countermeasures – mine neutralization small- and medium-caliber events.	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Multiple helicopters conduct airborne mine countermeasure training using an assortment of mine warfare gear similar to unit level events, except that a squadron trains together. Assume up to 24 temporary mine shapes will be deployed to support each of these events.	

A.1.7.10 Civilian Port Defense

Activity Name	Activity Description	
Mine Warfare (MIW)		
Civilian Port Defense-MIW	Civilian port defense activities are maritime security operations conducted for military and civilian ports and harbors.	
Long Description	Naval forces provide mine warfare capabilities to Department of Homeland Security sponsored events. The three pillars of mine warfare, airborne (helicopter), surface (ships and unmanned vehicles), and undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic U.S. ports remain free of mine threats. Various mine warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional mine warfare techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Marine mammal systems may be used during the exercise. Event locations and scenarios will vary according to Department of Homeland Security strategic goals and evolving world events. The purpose of AFTT analysis is to ensure adequate Marine Mammal Protection Act (MMPA) authorizations are in place to support the use of acoustic mine detection sensors. Additional analysis and regulatory engagement will be conducted as appropriate before the actual events begin.	
Information Typical to the Event	**Platform:** Surface ships, boats, helicopters **Systems:** Unmanned underwater and surface vehicles, various mine detection sensors (AN/AQS-20, AN/AQS-24) **Ordnance/Munitions:** High-explosive charges **Targets:** Temporary mine shapes **Duration:** Multiple days	**Location:** Waters around: Earle, New Jersey; Groton, Connecticut; Hampton Roads, Virginia; Morehead City and Wilmington, North Carolina; Kings Bay, Georgia; Jacksonville, Florida; and Beaumont and Corpus Christi, Texas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (mine hunting; HF4); underwater explosives (E2; E4); vessel noise; aircraft noise **Energy:** Electromagnetic (magnetic influence mine sweeping) **Physical Disturbance and Strike:** Vessel strike; in-water device strikes; seafloor device strike (bottom placed mine shapes); aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Explosives may be used if required for scheduled mine neutralization events. This EIS/OEIS provides programmatic analysis for acoustic effects only. Mine shapes will be recovered. While goal is to conduct once per year, alternating east/west coast, assume that an east coast event will occur every other year with a total of three per five year period.	

A.1.8 MAJOR EXERCISES

A major training event is comprised of several "unit level" range exercises conducted by several units operating together while commanded and controlled by a single commander. These exercises typically employ an exercise scenario developed to train and evaluate the strike group in naval tactical tasks. In a major training event, most of the operations and activities being directed and coordinated by the strike group commander are identical in nature to the operations conducted during individual, crew, and smaller-unit training events. In a major training event, however, these disparate training tasks are conducted in concert, rather than in isolation.

Major range events are listed below.

A.1.8.1 Composite Training Unit Exercise

The Composite Training Unit Exercise is an Integration Phase, at-sea, major range event. For the Carrier Strike Group, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. For the expeditionary strike group, this exercise integrates amphibious ships with their associated air wing, surface ships, submarines, and Marine expeditionary unit. Live-fire operations that may take place during composite training unit exercise include long-range air strikes, Naval surface fire support, and surface-to-air, surface-to-surface, and air-to-surface missile exercises. The Marine expeditionary unit also conducts realistic training based on anticipated operational requirements and to further develop the required coordination between Navy and Marine Corps forces. Special operations training may also be integrated with the exercise scenario. Marine mammal systems may be used during the exercise. The composite training unit exercise is typically 21 days in length. The exercise is conducted in accordance with a schedule of events, which may include two one-day, scenario-driven, “mini” battle problems, culminating with a scenario-driven three-day Final Battle Problem. Composite training unit exercise occurs three to four times per year.

A.1.8.2 Joint Task Force Exercise

The Joint Task Force Exercise is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the Carrier Strike Groups and Expeditionary Strike Groups. For an Expeditionary Strike Group, the exercise incorporates an Amphibious Ready Group Certification Exercise for the amphibious ships and a Special Operations Capable Certification for the Marine expeditionary unit. When schedules align, the joint task force exercise may be conducted concurrently for an Expeditionary Strike Group and Carrier Strike Group. Joint task force exercise emphasizes mission planning and effective execution by all primary and support warfare commanders, including command and control, surveillance, intelligence, logistics support, and the integration of tactical fires. Joint task force exercises are complex scenario-driven exercises that evaluate a strike group in all warfare areas. Marine mammal systems may be used during the exercise. Joint task force exercise is normally 10 days long, not including a three-day in-port force protection exercise, and is the final at-sea exercise for the Carrier Strike Group or Expeditionary Strike Group prior to deployment. Joint task force exercise occurs three to four times per year.

A.1.8.3 Sustainment Exercise

Included in the Fleet Response Training Plan is a requirement to conduct post-deployment training, and maintenance. This ensures that the components of a strike group maintain an acceptable level of readiness after returning from deployment. A sustainment exercise is an exercise designed to challenge the strike group in all warfare areas. Marine mammal systems may be used during the exercise. This exercise is similar to a composite training unit exercise but of shorter duration.

A.1.9 OTHER TRAINING ACTIVITIES

A.1.9.1 Search and Rescue

Activity Name	Activity Description	
Other Training Exercises		
Search and Rescue (SAR)	Helicopter crews rescue military personnel at sea.	
Long Description	Helicopter crews rescue military personnel at sea. Helicopters fly below 3,000 ft. and locate personnel to be rescued. Smoke floats are expended.	
Information Typical to the Event	**Platform:** Helicopters (H-60); small boats **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–3 hours	**Location:** JAX: Proximate to Naval Station Mayport beaches and St. Johns River
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.1.9.2 Precision Anchoring

Activity Name	Activity Description	
Other Training Exercises		
Precision Anchoring	Ships train by releasing of anchors in designated locations.	
Long Description	Ship crews choose the best available anchoring sites. The ship then uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.	
Information Typical to the Event	**Platform:** All surface ships **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 1 hour	**Location:** VACAPES: Established anchorages JAX: Established anchorages GOMEX: Established anchorages
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, seafloor device strike (anchor) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions used for Analysis		

A.1.9.3 Elevated Causeway System

Activity Name	Activity Description	
Other Training Exercises		
Elevated Causeway System (ELCAS)	A temporary pier is constructed off of the beach. Piles are driven into the sand and then later removed.	
Long Description	A pier is constructed off of the beach. The pier is designed to allow for offload of materials and equipment from supply ships. Piles are driven into the sand with an impact hammer. Causeway platforms are then hoisted and secured onto the piles with hydraulic jacks and cranes. It is assembled by joining standard causeway sections together and can be assembled in 10 days. The pier, including associated piles, is removed at the conclusion of training.	
Information Typical to the Event	**Platform:** Boats **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Multiple days	**Location:** VACAPES: Joint Expeditionary Base – Little Creek and Joint Expeditionary Base – Fort Story Navy Cherry Point: Camp Lejeune
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Pile driving and removal **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	This EIS/OEIS is providing programmatic analysis of acoustic impacts from pile driving only.	

A.1.9.4 Submarine Navigation

Activity Name	Activity Description	
Other Training Exercises		
Submarine Navigation (SUB NAV)	Submarine crews operate sonar for navigation and object detection while transiting in/out of port during reduced visibility.	
Long Description	Submarine crews train to operate sonar for navigation. The ability to navigate using sonar is critical for object detection while transiting in/out of port during periods of reduced visibility. During this activity the submarine will be surfaced.	
Information Typical to the Event	**Platform:** Submarines **Systems:** High-frequency submarine sonar system **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 hours	**Location:** Northeast: Submarine Base Groton, Portsmouth Naval Shipyard VACAPES: Naval Station Norfolk JAX: Naval Station Mayport, Port Canaveral
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (submarine high-frequency system; HF1); hull-mounted sonar (e.g., MF3) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.1.9.5 Submarine Under Ice Certification

Activity Name	Activity Description	
Other Training Exercises		
Submarine Under Ice Certification	Submarine crews train to operate under ice. Ice conditions are simulated during training and certification events.	
Long Description	Submarine crews train to operate under ice. Ice conditions are simulated during training and certification events. A single exercise is comprised of 36 hours of training, spread out over 5 days in 6-hour training sessions.	
Information Typical to the Event	**Platform:** Submarine **Systems:** Submarine high-frequency sources **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 6 hours	**Location*:** Northeast: OPAREAs VACAPES: OPAREA Navy Cherry Point: OPAREA JAX: OPAREAs
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (submarine sources; HF1) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.1.9.6 Surface Ship Object Detection

Activity Name	Activity Description	
Other Training Exercises		
Surface Ship Object Detection	Surface ship crews operate sonar for navigation and object detection while transiting in/out of port during reduced visibility.	
Long Description	Surface ships locate underwater objects that may impede transit in/out of port during periods of reduced visibility. Object detection and navigational training is conduced while transiting in and out of port using either the AN/SQS-53 or AN/SQS-56 in the Kingfisher mode. This training is conducted primarily in the shallow water shipping lanes off the coasts but may be conducted adjacent to any Navy port.	
Information Typical to the Event	**Platform:** Surface ships **Systems:** Hull mounted sonar systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 hours	**Location*:** VACAPES: Naval Station Norfolk JAX: Naval Station Mayport
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar; MF1K; MF2K), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.1.9.7 Surface Ship Sonar Maintenance

Activity Name	Activity Description	
Other Training Exercises		
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	Pierside and at-sea maintenance of sonar systems	
Long Description	This scenario consists of surface ships performing periodic maintenance to the surface ship sonar while in port or at sea. This maintenance takes up to 4 hours. Surface ships operate active sonar systems for maintenance while in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant.	
Information Typical to the Event	**Platform:** Surface ships **Systems:** Hull mounted sonar systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 4 hours	**Location*:** VACAPES: Naval Station Norfolk, OPAREA Navy Cherry Point: OPAREA JAX: Naval Station Mayport, OPAREAs GOMEX: OPAREAs Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar; MF1, MF2), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Other AFTT Areas refers to areas outside of existing range complexes and testing ranges.	

A.1.9.8 Submarine Sonar Maintenance

Activity Name	Activity Description	
Other Training Exercises		
Submarine Sonar Maintenance (in OPAREAs and Ports)	Pierside and at-sea maintenance of sonar systems.	
Long Description	A submarine performs periodic maintenance on the AN/BQQ-10 sonar system while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport however, sonar maintenance could occur anywhere as the system's performance may warrant.	
Information Typical to the Event	**Platform:** Submarines **Systems:** High-frequency submarine sonar system **Ordnance/Munitions:** None **Targets:** None **Duration:** From 45 minutes to 1 hour	**Location*:** Northeast: Submarine Base Groton, Portsmouth Naval Shipyard VACAPES: Naval Station Norfolk Navy Cherry Point JAX: Naval Station Mayport, Port Canaveral Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (submarine sonars; MF3) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Other AFTT Areas refers to areas outside of existing range complexes and testing ranges.	

A.1.9.9 Undersea Warfare Training Range

Activity Name	Activity Description	
Specific Training Range		
Undersea Warfare Training Range (USWTR)	Anti-submarine warfare training will occur at the Undersea Warfare Training Range in the JAX OPAREA.	
Long Description	Anti-submarine warfare training will occur at the Undersea Warfare Training Range in the JAX OPAREA. The Undersea Warfare Training Range is an instrumented sea space, equipped with cables and hydrophones. This capability allows for real time tracking of anti-submarine warfare exercise participants, the assessment of tactics employed and crew proficiency. The ability to provide detailed feedback to the trainees greatly improves the training value of the anti-submarine warfare exercise.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft; helicopters; surface ships, submarines **Systems:** Mid-frequency helicopter dipping, hull mounted, towed sonar; sonobuoys; Nixie **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** Expendable Mobile Anti-Submarine Warfare Training Target or MK 30 **Duration:** Not Applicable	**Location:** JAX: Undersea Warfare Training Range
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Various sonar systems (sonobuoy, dipping sonar, torpedo guidance, hull mounted and towed); aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike; aircraft strike (birds only); vessel and in-water device strike **Entanglement:** Parachutes, guidance wires **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	MK 39 Expendable Mobile Anti-Submarine Warfare Training Targets Torpedo accessories (ballast weights) from exercise torpedoes, sonobuoys, parachutes	
Assumptions Used for Analysis	Torpedoes are recovered. Guidance wire has a low breaking strength. Weights and flex tubing sink rapidly. Typical Undersea Warfare Training Range Events: Approximate number of tracking exercise/torpedo exercises annually • Helicopter, 214 events • Maritime patrol aircraft, 100 events • Maritime patrol multi-static active coherent sonobuoys, 43 events • Surface, 102 events • Submarine, 16 events	

A.2 NAVAL AIR SYSTEMS COMMAND TESTING ACTIVITIES

Naval Air Systems Command events will closely follow fleet primary mission areas, such as the testing of airborne mine warfare and anti-submarine warfare weapons and systems. Naval Air Systems Command events include, but are not limited to, the testing of new aircraft platforms, weapons, and systems that have not been integrated into fleet training events, such as directed energy weapons and the Joint Strike Fighter. In addition to testing new platforms, weapons, and systems, Naval Air Systems Command also conducts lot acceptance testing of airborne weapons and sonobuoys in support of the fleet. These types of events do not fall within one of the fleet primary mission areas; however, in general, most Naval Air Systems Command testing events in terms of their potential environmental effects are similar to fleet training events.

While many of these systems will eventually be used by the fleet during normal training and will be addressed in this EIS/OEIS for those fleet activities, testing and development activities involving the same or similar systems as will be used by operational fleet units may be used in different locations and manners than when actually used by operational fleet units. Hence, the analysis for testing events and training of fleet units may differ.

A.2.1 ANTI-AIR WARFARE

A.2.1.1 Air Combat Maneuver Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air Combat Maneuver	Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.	
Long Description	Air combat maneuver is the general term used to describe an air-to-air test event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during air combat maneuver activities.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** F-35 (2 flight hours/event at 5 days/week); F/A-18 A-D or E/F variants (1.5 flight hours/event), E/A-18G (2 flight hours/event)	**Location:** VACAPES Navy Cherry Point JAX GOMEX AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	2 chaff flares per event (all chaff and flare expenditures are captured under Chaff Test and Flare Test, respectively)	

A.2.1.2 Air Platform/Vehicle Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air Platform/Vehicle Test	Test performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform or vehicle. No weapons are released during an air platform/vehicle test.	
Long Description	The air platform/vehicle test describes the testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform/vehicle. Integration of non-weapons system in-flight refueling tests are also conducted as part of an air platform/vehicle test. Test results are compared against design and performance specifications for compliance. The test results are also used to define stability and controllability characteristics and limitations and to improve and update existing analytical and predictive models. A wide variety of fixed-wing and rotary-wing aircraft, including unmanned aerial systems would undergo air platform/vehicle testing. No weapons are released during an air platform/vehicle test. Aircraft may employ laser detection for targeting systems and trailing antenna. Events may involve two or more fighter jet aircraft and a towed target tractor by a contracted aircraft (e.g., Lear jet for laser targeting tests).	
Information Typical to the Event	**Platform:** Fixed and rotary-wing aircraft, includes unmanned aerial systems **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–8 flight hours/event	**Location*:** VACAPES: W-386, W-387A, W-72A, W-72B, but could include other warning/restricted areas JAX Key West GOMEX AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Military expended material strike (fuel tanks or similar), aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Fuel tanks, carriages, dispensers, or similar types of support systems on aircraft may be jettisoned depending on test	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). It is estimated that 2–4 fuel tanks are expended per event; however this can vary based on requirements. Fuel tanks may contain water to simulate different fuel levels. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.2.1.3 Air Platform Weapons Integration Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air Platform Weapons Integration Test	Test performed to quantify the compatibility of weapons with the aircraft from which they would be launched or released. Mostly non-explosive weapons or shapes are used.	
Long Description	The air platform eeapons integration test describes the testing performed to quantify the compatibility of weapons with the aircraft from which they would be released. Tests evaluate the compatibility of the weapon and its carriage, suspension, and launch equipment with the performance and handling characteristics of the designated aircraft. Additional tests assess the ability of the weapon to separate or launch safely from the aircraft at combat velocities, including at supersonic speeds. Test results are compared against design specifications for compliance. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.	
Information Typical to the Event	**Platform:** Fixed and rotary-wing aircraft **Systems:** Gun systems integration, Air Intercept Missile (AIM) Missile Series (e.g., AIM-9x) and Advanced Medium Range Air-to-Air Missile (AMRAAM); AGM-114R, MK 46, MK 54, 20 mm **Ordnance/Munitions:** Missiles, rockets, small- and medium-caliber projectiles, bombs (non-explosive) **Targets:** Drones, such as the BQM-74 and 34, may be used as targets for weapon and mission system test events. Surface targets will also be used as needed for proposed test events. **Duration:** F/A-18 A-D or F/A-18 E/F (1.5 flight hours/event), E/A-18G (2 flight hours/event); F-35 (1.5–2.5 hrs./event), MH-60 (2.5 flight hours/event)	**Location*:** VACAPES: W-386, W-72A, R-6604
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles, missiles, rockets, bombs); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small projectiles, medium projectiles, casings	
Detailed Military Expended Materials Information	• Small-caliber projectiles • Medium-caliber projectiles • Non-explosive rockets and missiles • Non-explosive bombs • Weapons carriage, suspension, and launch equipment	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). Estimate 2–4 weapons carriages expended per event	

A.2.1.4 Air-to-Air Weapons System Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air-to-Air Weapons Systems Test	Test to evaluate the effectiveness of air-launched weapons against designated airborne targets.	
Long Description	The air-to-air weapons systems test evaluates the performance of air-launched weapons systems against airborne targets, such as the BQM-34, a high performance target simulating a strike fighter aircraft. During an air-to-air weapons systems test, a strike fighter aircraft locates, tracks, and in some tests fires on an airborne target used to simulate another strike fighter aircraft using non-explosive ordnance. Fixed-wing or rotary-wing aircraft may be used. No testing of explosive weapons is planned.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** Electronic combat systems; Air Intercept Missile, Missile Series (e.g., AIM-9) and Advanced Medium Range Air-to-Air Missile; modified aircraft system or aircraft gun that typically fires non-explosive rounds **Ordnance/Munitions:** Missiles, small- and medium-caliber projectiles (non-explosive) **Targets:** BQM-34, BQM-74, GQM 163 Coyote, Tactical Air-Launched Decoys, and paraflares **Duration:** F/A-18 A-D or F/A-18 E/F (1.5 flight hours/event); E/A-18G (2 hours/event); F-35 (2 flight hours/event); 2.5 flight hours/event) MH-60	**Location*:** VACAPES: W-386, W-72, R-6604
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strikes (projectiles, missiles); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small-caliber projectiles, medium-caliber projectiles, casings	
Detailed Military Expended Materials Information	Small-caliber projectiles, medium-caliber projectiles, casings, missiles, target fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). All chaff and flare expenditure in this event is captured under Chaff Test and Flare Test, respectively.	

A.2.1.5 Air-to-Air Missile Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air-to-Air Missile Test	Test to evaluate the effectiveness of air-launched missiles against designated airborne targets. Fixed-wing aircraft will be used.	
Long Description	This event is similar to the training event missile exercise (air-to-air). Tests are a type of air-to-air weapons system test in which air-to-air missiles (non-explosive) are fired from fixed-wing aircraft against unmanned aerial drones such as BQM-34 and BQM-74.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, includes aerial drones **Systems:** Air Intercept Missiles (e.g., AIM-9) and Advanced Medium Range Air-to-Air Missile (AMRAAM) (e.g., AIM-120 AMRAAM) **Ordnance/Munitions:** Air Intercept Missile and Advanced Medium Range Air-to-Air Missile (non-explosive) **Targets:** BQM-34, BQM-74, GQM-163 Coyote, Tactical Air-Launched Decoys, ITALD, and paraflares **Duration:** F/A-18 A-D or F/A-18 E/F (1.5 flight hours/event); E/A-18G (2 hours/event); F-35 (2 flight hours/event)	**Location*:** VACAPES: W-386, W-72, R-6604
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended materials strike (missile, parachutes); aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes; flare pistons	
Detailed Military Expended Materials Information	Missiles, flare pistons, parachutes from paraflares	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). All chaff and flare expenditure in this event is captured under Chaff Test and Flare Test, respectively, with the exception of paraflares used as targets. Assume one paraflare per missile.	

A.2.1.6 Air-to-Air Gunnery Test – Medium-Caliber

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Air-to-Air Gunnery Test – Medium-Caliber	Test to evaluate the effectiveness of air-to-air guns against designated airborne targets. Fixed-wing aircraft may be used.	
Long Description	This event is similar to the training event gunnery exercise air-to-air. An air-to-air gunnery test involves the firing of guns from fixed-wing aircraft against a towed aerial banner which serves as the target. Non-explosive rounds are fired and the targets fired upon are unmanned aerial drones.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18 A-D F/A-18E/F, E/A-18G **Systems:** Gun systems **Ordnance/Munitions:** Medium-caliber projectiles (non-explosive) **Targets:** BQM-34, BQM-74, GQM 163 Coyote **Duration:** F/A-18 A-D/ or F/A-18E/F (1.5 flight hours/event); E/A-18G (2 flight hours/event)	**Location*:** VACAPES: W-386, W-72, R-6604
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Medium-caliber projectiles; casings	
Detailed Military Expended Materials Information	Medium-caliber projectiles, casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.1.7 Intelligence, Surveillance, and Reconnaissance Test

Activity Name	Activity Description	
Anti-Air Warfare (AAW)		
Intelligence, Surveillance, and Reconnaissance Test	Aircrews use all available sensors to collect data on threat vessels.	
Long Description	An anti-air warfare intelligence, surveillance, and reconnaissance test involves evaluating communications capabilities of fixed-wing and rotary-wing aircraft, including unmanned systems that can carry cameras, sensors, communications equipment, or other payloads. New systems are tested at sea to ensure proper communications between aircraft and ships. Several unmanned aerial systems are planned for testing, including the Broad Area Maritime Surveillance system, Fire Scout vertical take-off and landing tactical unmanned air vehicle, and the Unmanned Combat Air System Aircraft Carrier Demonstration Unmanned Aerial System. Unmanned Aerial Systems are remotely piloted or self-piloted aircraft. Tactical unmanned aerial systems are designed to support tactical commanders with near-real-time imagery intelligence at ranges up to 200 kilometers. Most small to mid-sized unmanned systems, such as Small Tactical Unmanned Aerial System/Tier II, act as eyes in the sky, relaying raw imagery back to military personnel on the ground. The data are then processed, analyzed, and shared up and down the chain of command. New technology systems, such as the MK XII-Mode 5, provide combat identification friend or foe and are used for aircraft and ship-based communications.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft, Broad Area Maritime Surveillance system, Fire Scout vertical take-off and landing tactical unmanned air vehicle, and the Unmanned Combat Air System Aircraft Carrier Demonstration; Small Tactical Unmanned Aerial System/Tier II **Systems:** MK XII-Mode 5 **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–20 flight hours/event	**Location:** VACAPES Navy Cherry Point JAX AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.2.2 ANTI-SURFACE WARFARE

Surface Warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons, sensors, and operations directed against enemy surface vessels. Naval Air Systems Command Surface Warfare tests include various air-to-surface missile, gunnery, and bombing tests.

A sinking exercise is a specialized Fleet training event that provides an opportunity for Naval Air Systems Command aircrew along with ship and submarine crews to deliver high-explosive ordnance on a deactivated vessel that has been cleaned and environmentally remediated. The vessel is deliberately sunk using multiple weapons systems. A Naval Air Systems Command testing event may take place in conjunction with a sinking exercise to test aircraft or aircraft systems in the delivery of high-explosive ordnance on a surface target.

A.2.2.1 Air-to-Surface Missile Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Air-to-Surface Missile Test	This event is similar to the training event missile exercise air-to-surface. Test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test.	
Long Description	Similar to a missile exercise air-to-surface, an air to surface missile test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test. Air-to-surface missile tests can include high-explosive, non-explosive, or non-firing (captive air training missile) weapons. Both stationary and mobile targets would be utilized during testing, and some operational tests would use explosive missiles (i.e., high-explosive warhead). All developmental testing will use non-explosive (i.e., non-explosive warhead) with a live motor. Naval Air Systems Command plans to conduct integration testing of the MH-60 helicopters and the joint air to ground missile. Both stationary and mobile targets would be used during testing. Approximately 25 percent of some operational tests could use explosive missiles (i.e., high-explosive warhead). All developmental testing will use non-explosive missiles. Similar integration tests would be conducted with the MH-60 and the Hellfire air to ground missile. Approximately 25 percent of these tests could involve explosive missiles. P-3 and P-8 fixed-wing aircraft plan to conduct software and weapons verification testing with Harpoon or JSOW (or equivalent) missiles. Some explosive missiles are planned for use.	
Information Typical to the Event	**Platform:** Fixed-wing and rotary-wing aircraft **Systems:** **Ordnance/Munitions:** Joint air to ground missile, Hellfire air-to-ground missile (explosive), Harpoon, JSOW (non-explosive), captive air training missile **Targets:** Stationary and mobile surface marine targets **Duration:** P-3 or P-8 (4 flight hours/event); MH-60 (2 flight hours/event)	**Location*:** VACAPES: W-386 (85 percent), W-72 (10 percent), RR-6604 (5 percent)] JAX GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E6; E10); aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missiles), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments; target fragments	

Activity Name	Activity Description
Detailed Military Expended Materials Information	Missiles, missile fragments, target fragments
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). 2 air-to-surface missiles/event, 25 percent which will be high-explosive.

A.2.2.2 Air-to-Surface Gunnery Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Air-to-Surface Gunnery Test	This event is similar to the training event gunnery exercise air-to-surface. Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapons system.	
Long Description	Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meets required specifications or to train aircrew in the operation of a new or enhanced weapons system. Non-explosive practice munitions are typically used during this type of test; however, a small number of high-explosive rounds may be used during final testing. Rounds that may be used include 7.62 mm, 20 mm, 30 mm, 0.30 caliber, and 0.50 caliber gun ammunition.	
Information Typical to the Event	**Platform:** Fixed-wing and rotary-wing aircraft **Systems:** MH-60: GAU-17 (7.62 mm), GAU-21 (0.50 cal), M197 (20 mm), M230 (30 mm), M240 (7.62 mm) **Ordnance/Munitions:** Small- and medium-caliber projectiles (e.g., 7.62 mm, 20 mm, 30 mm, 30 mm supercavitating, non-explosive and explosive) **Targets:** Stationary and mobile surface maritime targets may be used **Duration:** F-35 (2 flight hours/event); F/A-18 A-D and F/A-18 E/F (2 hours/event) MH-60 (2.5 flight hours/event)	**Location*:** VACAPES: W-386 (85 percent), W-72 (10 percent), RR-6604 (5 percent) JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1); aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small- and medium-caliber projectiles, casings, target fragments, projectile fragments	
Detailed Military Expended Materials Information	Projectiles, casings, target fragments, projectile fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). All projectiles under the No Action Alternative are non-explosive. Assume all Alternative 1 and 2 events include the use of some explosive rounds.	

A.2.2.3 Rocket Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Rocket Test	Rocket tests evaluate the integration, accuracy, performance, and safe separation of guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter or from a fixed-wing strike aircraft.	
Long Description	Rocket tests are conducted to evaluate the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter or from a fixed-wing strike aircraft. Rocket tests would involve the release of primarily live motor/non-explosive warhead rockets. Some high-explosive warhead rockets would be tested, and during a jettison test, rockets with a non-explosive motor and non-explosive warhead would be jettisoned along with the rocket launcher. Rocket tests are also conducted to train aircrew on the use of new or enhanced weapons systems. Rocket types may include variations of the Hydra-70 rocket developed under the Advanced Precision Kill Weapons System program or similar munitions developed under Low-cost Guided Imaging Rocket program as well as MEDUSA rockets. All rockets planned for testing are 2.75-inch rockets. Some rocket tests may be conducted in conjunction with upgrades to or integration of the Forward Looking Infrared targeting system.	
Information Typical to the Event	**Platform:** Fixed-wing or rotary-wing (MH-60) aircraft, Fire Scout vertical take-off unmanned aerial vehicle **Systems:** **Ordnance/Munitions:** 2.75 in. Hydra-70 (or similar) (explosive and non-explosive) **Targets:** Stationary and mobile surface maritime targets may be used **Duration:** MH-60 (2.5 flight hours/event); F/A-18 variants (1.5 flight hours/event), F-35 (2 flight hours/event)	**Location*:** VACAPES: W-386 (Air G, Air H) JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E5); aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Military expended material strike (rockets); aircraft strike (birds only) **Entanglement:** None **Ingestion:** Rocket fragments, target fragments	
Detailed Military Expended Materials Information	Rockets; rocket fragments, target fragments; rocket launchers	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). Under the No Action Alternative, all rockets are non-explosive. Multiple rockets fired/event, 25 percent of which will be high-explosive. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.2.2.4 Air-to-Surface Bombing Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Air-to-Surface Bombing Test	This event is similar to the training event bombing exercise air-to-surface. Strike fighter and maritime patrol aircraft test the delivery of bombs (non-explosive) against surface maritime targets with the goal of evaluating the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced.	
Long Description	Strike fighter and maritime patrol aircraft test the delivery of bombs (non-explosive) against surface maritime targets with the goal of evaluating the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced. Both high-explosive and non-explosive bombs may be released during this type of test; however, the vast majority of releases will be non-explosive bombs and typically include non-explosive general purpose bombs (e.g., MK 82 and MK 83) and guided bomb units (e.g., GBU-12 and GBU-32) of various sizes. Surface targets may also be used.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Bombs (e.g., MK 82, MK 83, GBU-12, GBU-32, non-explosive) **Targets:** Stationary surface maritime targets may be used **Duration:** F-35 (2 flight hours/event); P-8 and P-3 (4 flight hours/event); F/A-18 variants (1.5 flight hours/event); EA-18G (2 flight hours/event)	**Location*:** VACAPES: W-386, W-72
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive bombs); aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Non-explosive bombs	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.2.5 Laser Targeting Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Laser Targeting	Aircrews illuminate enemy targets with lasers.	
Long Description	During a laser targeting test, aircrew use laser targeting devices integrated into aircraft or weapons systems to evaluate targeting accuracy and precision and to train aircrew in the use of newly developed or enhanced laser targeting devices, which are designed to illuminate designated targets for engagement with laser-guided weapons. No weapons are released during a laser targeting test.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft (MH-60); fixed-wing aircraft (P-8) **Systems:** Laser targeting systems, including the Laser Range Designator on the MH-60 helicopters **Ordnance/Munitions:** None **Targets:** None **Duration:** 2.5 flight hours/event	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Aircraft strikes (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.2.2.6 High Energy Laser Weapons Test

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
High Energy Laser Weapon Test	High energy laser weapons tests would evaluate the specifications, integration, and performance of an aircraft mounted, approximately 25 kilowatt high energy laser. The laser is intended to be used as a weapon to disable small surface vessels.	
Long Description	During a high energy laser weapons test, aircrew would evaluate the specifications, integration, and performance of an aircraft mounted, approximately 25 kilowatt high energy laser that is intended to be used as a weapon against stationary and mobile, small surface vessels. The high energy laser would be employed from a hovering or forward flight helicopter (MH-60) and is designed to disable the surface vessel, rendering it immobile. The high energy laser would have a range of up to six kilometers (km). Small boats or other unmanned surface targets would be used during the high energy laser test.	
Information Typical to the Event	**Platform**: MH-60 helicopter **Systems**: High energy laser **Ordnance/Munitions:** None **Targets:** Small Surface Boats **Duration:** MH-60: 2.5 flight hours/event	**Location:** VACAPES
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; vessel noise **Energy:** High energy laser **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Target fragments	
Detailed Military Expended Materials Information	Target fragments	
Assumptions Used for Analysis		

A.2.3 ELECTRONIC WARFARE

A.2.3.1 Electronic System Evaluation

Activity Name	Activity Description	
Electronic Warfare (EW)		
Electronic Systems Evaluation	Test that evaluates the effectiveness of electronic systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, electronic warfare testing will assess the performance of three types of electronic warfare systems: electronic attack, electronic protect, and electronic support.	
Long Description	Electronic systems evaluations are performed to determine the effectiveness of designated electronic warfare systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, electronic warfare testing will assess the performance of three types of electronic warfare systems; specifically, electronic attack, electronic protect, and electronic support. Aircraft electronic attack systems are designed to confuse the enemy or deny the enemy the use of its electronically-targeted weapons systems. The suppression of enemy air defenses and active jamming against hostile aircraft and surface combatant radars are examples of the application of electronic attack. Aircraft electronic protect systems are designed to intercept, identify, categorize, and defeat threat weapons systems that are already targeting that or other friendly aircraft. Aircraft electronic support systems employ passive tactics to intercept, exploit, locate (target), collect, collate, and decipher information from the radio frequency spectrum for the purpose of determining the intentions of the radiating source. Test results are compared against design specifications to evaluate the performance of the actual electronic warfare system. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.	
Information Typical to the Event	**Platform:** Fixed-wing and rotary-wing aircraft **Systems:** Electronic warfare systems (electronic attack, electronic protect, and electronic support) **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–6 flight hours/event	**Location*:** VACAPES: W-386, W-72 GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). All chaff and flare expenditure is captured under Chaff Test and Flare Test, respectively.	

A.2.3.2 Chaff Test

Activity Name	Activity Description	
Electronic Warfare (EW)		
Chaff Test	This event is similar to the training event chaff exercise. Chaff tests evaluate newly developed or enhanced chaff, chaff dispensing equipment, or modified aircraft systems against chaff deployment. Tests may also train pilots and aircrew in the use of new chaff dispensing equipment. Chaff tests are often conducted with flare tests and air combat maneuver events, as well as other test events, and are not typically conducted as standalone tests.	
Long Description	Chaff tests are conducted to evaluate newly developed or enhanced chaff dispensing equipment, to ensure other newly developed or modified aircraft systems are compatible with chaff deployment, and to train pilots and aircrew in the use of new chaff dispensing equipment. Fixed-winged aircraft and helicopters deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack (Electronic Protect deployment). Chaff tests are often conducted with flare tests or air combat maneuver events, as well as other tests, rather than as a standalone test. Weapons are not typically fired during chaff tests. Chaff is employed for a number of different tactical reasons, but the end goal is to create a target that will distract enemy radar and weapon systems away from the friendly platform. Chaff may also be employed offensively (Electronic Attack deployment), such as before a major strike to "hide" inbound striking aircraft. Different chaff types (e.g., RR-129A/AL, RR-144A/AL, and RR-170A/AL) are used by a variety of different Navy aircraft; however all chaff consists of a radar reflector material made of thin, narrow, metallic strips cut in various lengths, and is intended to elicit frequency responses which deceive enemy radars. Chaff is employed for a number of different tactical reasons, but the end goal is to create a target that will distract enemy radar and weapon systems away from the friendly platform. Chaff may also be employed offensively, such as before a major strike to "hide" inbound striking aircraft or ships. Defensive chaff tests are the most common type of chaff test. In most cases, the chaff test is conducted to evaluate systems on the aircraft deploying the chaff, but it is also critical to view the effect of the chaff from the "enemy" perspective so that radar system operators may practice corrective procedures to overcome the chaff jamming effect. Chaff tests are often designed to gain experience and data from both perspectives. Chaff is typically deployed from an aircraft as the aircraft makes evasive maneuvers to defeat a simulated threat missile or threat aircraft. The chaff deploys in a cloud of the highly reflective filaments and deceives the guidance system of an inbound missile, allowing the aircraft to escape the threat. Naval Air Systems Command chaff tests are conducted year-round.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** Chaff (RR-129A/AL, RR-144A/AL, and RR-170A/AL) **Ordnance/Munitions:** None **Targets:** None **Duration:** F/A-18 A/D or F/A-18 E/F (1.5 flight hours/event); EA-18G (2 flight hours/event); MH-60 (2 flight hours/event); CH-53K (14 days/year at 2 flight hours/event); P-3 (4 flight hours/event)	**Location:** VACAPES: W-386, W-72 Navy Cherry Point JAX GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Chaff; end caps; pistons	

Activity Name	Activity Description
Detailed Military Expended Materials Information	Chaff, end caps, pistons, flares
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). Estimated 60–100 chaff canisters per event. All releases from MH-60 would be up to 60 canisters per event.

A.2.3.3 Flare Test

Activity Name	Activity Description	
Electronic Warfare (EW)		
Flare Test	This event is similar to the training event flare exercise. Flare tests evaluate newly developed or enhanced flares, flare dispensing equipment, or modified aircraft systems against flare deployment. Tests may also train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with chaff tests and air combat maneuver events, as well as other test events, and are not typically conducted as stand alone tests.	
Long Description	Flare tests are conducted to evaluate new flares, newly developed or modified flare deployment systems, to ensure that other newly enhanced aircraft systems are compatible with flare deployment, and to train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with chaff tests and air combat maneuver events, as well as other test events, and are not typically conducted as stand-alone tests. During a flare test, flares (and in some cases chaff) are deployed, but no weapons are typically fired. Flare dispensers may also be jettisoned during a flare test intended to assess the safe release of the dispenser in the event of an emergency. Fixed-wing aircraft and helicopters deploy flares as a defensive tactic (electronic protect deployment) to disrupt the infrared missile guidance systems used by heat-seeking missiles, thereby causing the missile to lock onto the flare instead of onto the aircraft and enabling the aircraft to avoid the threat. In a typical scenario, an aircraft may detect the electronic targeting signals emitted from threat radars or missiles, or aircrew may visually identify a threat missile plume when a missile is launched. At a strategically appropriate time, the pilot dispenses flares and immediately maneuvers the aircraft to distract and defeat the threat. During a typical flare test, an aircraft will dispense flares 3,000 ft. above mean sea level and flares are completely consumed while in the air. Aircraft flares use a magnesium extruded flare grain. Flare types commonly deployed during Naval Air Systems Command testing activities include but are not limited to: MJU-57, MJU-49, and MJU-38 for high speed aircraft and MJU-32 for low speed aircraft. Both fixed-wing and rotary-wing aircraft would conduct flare tests.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** Flares: MJU-57, MJU-49, and MJU-38 for high speed aircraft and MJU-32; Joint Allied Threat Assessment System/Common Infrared Countermeasures **Ordnance/Munitions:** None **Targets:** None **Duration:** MH-60 (2.0 flight hours/event; 30 events/year); CH-53K (14 events/year at 2 flight hours/event); F/A-18 A-D or F/A-18 E/F (1.5 flight hours/event) and EA-18G (2 flight hours/event); P-3/ P-8 (4 flight hours/event); F-35 (2 flight hours/event)	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point JAX GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** End caps	
Detailed Military Expended Materials Information	Flares (end caps and pistons), chaff	

Activity Name	Activity Description
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). Flare use from all other events are captured under this activity. Estimated 60–100 flares per event. All releases from MH-60 would be up to 60 flares per event.

A.2.4 ANTI-SUBMARINE WARFARE

Anti-submarine warfare activities involve helicopter and maritime patrol aircraft, ships, and submarines, conducting operations alone or in combination, to enhance or evaluate the ability to locate, track, and neutralize submarines. Anti-submarine warfare tests are intended to evaluate the capabilities of a variety of active and passive sonar systems. Some systems are used to characterize the environment by measuring water depth, for example, whereas others are designed to locate mines and identify, track, and target submarines. Passive sonar systems "listen" for sound by using underwater microphones, called hydrophones, which receive, filter, amplify, and process underwater sound in search of certain acoustic signatures. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of a submarine, to the extent that the submarine generates noise.

Active sonar is the most effective means for locating quiet, modern submarines because active sonar is not dependent on the sound being generated by the submarine. Active sonar transmits pulses of sound that travel through the water, reflect off objects, and return to a receiver. By knowing the speed of sound in water and the time taken for the sound wave to travel to the object and back, active sonar systems can quickly calculate direction and distance from the sonar platform to the underwater object. Being able to accurately track moving submarines is essential to U.S. ship survivability.

Advanced, large-scale anti-submarine warfare events (i.e. anti-submarine warfare coordinated events) involving active sonar are conducted in coordinated, at-sea activities during multidimensional fleet training events involving submarines, ships, fixed-wing aircraft, and helicopters. These integrated training events offer opportunities to conduct testing activities and to train aircrews in the use of new or newly enhanced systems during a large-scale, complex exercise. Coordinated anti-submarine warfare events often involve the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against "enemy" submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multidimensional battlespace.

The torpedoes released during a torpedo employment exercise are non-explosive. No other weapons are fired during anti-submarine warfare tests. Anti-submarine warfare sonar systems are deployed from certain classes of surface ships, submarines, helicopters, and fixed-wing patrol aircraft (Table 2.3-1). Helicopters equipped with dipping sonar or sonobuoys are utilized to locate suspect submarines or submarine targets within the training area. In addition, fixed-wing patrol aircrafts are used to deploy both active and passive sonobuoys to assist in locating and tracking submarines during the duration of the test.

There are three types of active sonar: low-frequency (below 1 kHz), mid-frequency (1 to 10 kHz), and high-frequency (above 10 kHz). Table 2.3-1 (see Chapter 2, Description of Proposed Action and Alternatives) lists the types of sonar and sound sources that Naval Air Systems Command plans to evaluate in the Study Area. There are no plans to test low frequency sound sources.

High-frequency active sonar operates at frequencies greater than 10 kHz. At higher acoustic frequencies, sound rapidly dissipates in the ocean environment, resulting in short detection ranges. High-frequency sonar is used primarily for determining water depth, hunting mines, and guiding torpedoes.

Mid-frequency active sonar operates between 1 and 10 kHz, enabling operators to detect underwater objects at greater distances than with high-frequency active sonar, but at shorter distances than with low-frequency active sonar. Because of this detection ranging capability, mid-frequency active sonar is the Navy's primary tool for conducting anti-submarine warfare. Many anti-submarine warfare experiments and tests have demonstrated that this improved capability for long-range detection of adversary submarines before they are able to conduct an attack is essential to U.S. ship survivability.

Anti-submarine warfare tests include sonobuoy lot acceptance tests, which evaluate the integrity of a series, or lot, of sonobuoys before the lot is turned over to the fleet; dipping sonar tests in both shallow and deep water; torpedo tests (non-explosive warhead); and sonobuoy tests with both coherent (tonal) and incoherent (explosive) sonobuoys. The types of testing sound sources employed by Naval Air Systems Command during anti-submarine warfare sonar tests in the Study Area are identified in Table 2.3-1 and descriptions of anti-submarine warfare tests are provided in the sections below.

A.2.4.1 Anti-Submarine Torpedo Test

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Warfare Torpedo Test	This event is similar to the training event torpedo exercise. Test evaluates anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target.	
Long Description	Similar to a torpedo exercise, an anti-submarine warfare torpedo test evaluates ASW systems onboard rotary-wing (i.e., MH-60 helicopter) and fixed-wing (maritime patrol aircraft-P-8) aircraft and the ability to search for, detect, classify, localize, track and attack a submarine or similar target (e.g., MK 39 EMATT or MK 30). The focus of the anti-submarine warfare torpedo test is torpedoes (e.g., MK 46 or MK 54), but other anti-submarine warfare systems are often used during the test, such as AN/AQS-22 dipping sonar (MH-60) and sonobuoys (e.g., AN/SSQ-62). MK 39 or MK 30 targets simulate a submarine threat and are deployed at varying depths and speeds. If available, tests may be conducted using an actual submarine as the target. This activity can be conducted in shallow or deep waters and aircraft can originate from a land base or from a surface ship. The torpedo test culminates with the release of an exercise torpedo against the target and is intended to evaluate the targeting, release, and tracking process of deploying torpedoes from aircraft. All exercise torpedoes used in testing are either running (EXTORP) or non-running (REXTORP). Eighty five percent of non-explosive torpedoes are recovered. A parachute assembly and guidance wire used for aircraft-launched torpedoes is jettisoned and sinks. Ballast (typically lead weights) may be released from the torpedoes to allow for recovery and sink to the bottom.	
Information Typical to the Event	**Platform:** Fixed-wing and rotary-wing aircraft **Systems:** Torpedoes that may be evaluated: MK 46, MK 54, MK 50, and MK 56; systems used in conjunction with testing torpedoes: AN/AQS-22 dipping sonar (MH-60); sonobuoys (e.g., AN/SSQ-62) **Ordnance/Munitions:** Torpedoes (MK 46, MK 54, MK 50, and MK 56) (non-explosive) **Targets:** MK 39 EMATT, MK 30, submarine **Duration:** MH-60 2 flight hours/event; P-3/P-8 6 flight hours/event	**Location:** VACAPES JAX

Activity Name	Activity Description
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (MF4), sonobuoys (MF5); torpedoes (TORP1); aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike; military expended material strike, aircraft strike (birds only) **Entanglement:** Parachutes, guidance wire **Ingestion:** Parachutes
Detailed Military Expended Materials Information	Torpedo accessories (e.g., parachute assembly, guidance wire), sonobuoys, ballast, targets
Assumptions Used for Analysis	Assume one torpedo accessory package (parachute, ballast, guidance wire) per torpedo Assume one target per torpedo Assume 12 sonobuoys per event Assume 15 percent of torpedoes are not recovered.

A.2.4.2 Kilo Dip

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Kilo Dip	Functional check of the AN/AQS-22 dipping sonar prior to conduct full test or training event on the dipping sonar.	
Long Description	A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. During a functional check, a single MH-60 helicopter would transit to an area designated for dipping sonar testing (i.e., a dip point usually close to shore) and would deploy the AN/AQS-22 sonar transducer assembly via a reel mechanism to a predetermined depth or series of depths while the helicopter hovers over the dip point. Once at the desired depth, the AN/AQS-22 sonar transducer would be activated and would transmit a pulsed, acoustic signal (i.e., ping) for approximately two to four minutes (enough time to check that all systems are functioning properly). After the check is completed, the AN/AQS-22 sonar transducer assembly would be reeled in, and in some instances the helicopter would transit to a second dip point before the procedure is repeated. A kilo dip is a precursor to more comprehensive testing.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft **Systems:** AN/AQS-22 **Ordnance/Munitions:** None **Targets:** None **Duration:** 1.5 flight hours/event	**Location*:** Northeast: Narragansett Bay VACAPES: W-386, W-72 Navy Cherry Point JAX: W-157, W-158, W-159
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (MF4), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.4.3 Sonobuoy Lot Acceptance Test

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Sonobuoy Lot Acceptance test	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the fleet for operational use	
Long Description	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the fleet for operational use. Lot acceptance testing would occur for the following types of sonobuoys: AN/SSQ-62 DICASS, AN/SSQ-110 IEER, AN/SSQ-125 MAC, MK 61 SUS, MK 64 SUS, MK 82 SUS, MK 84 SUS, mini source, and high duty cycle. Some sonobuoys are explosive.	
Information Typical to the Event	**Platform:** Surface vessels, fixed-wing aircraft **Systems:** Sonobuoys (AN/SSQ-62 DICASS, AN/SSQ-110 IEER, AN/SSQ-125 MAC, MK 61 SUS, MK 64 SUS, MK 82 SUS, MK 84 SUS, mini source, and high duty cycle) **Ordnance/Munitions:** None **Targets:** None **Duration:** 6 flight hours/event	**Location:** Key West
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (e.g., ASW2; MF5, MF6), underwater explosives (E3; E4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes; sonobuoy fragments	
Detailed Military Expended Materials Information	Parachutes; sonobuoy fragments	
Assumptions Used for Analysis	Assume one parachute per sonobuoy Assume an average of 80 non-explosive sonobuoys per event; however the number of sonobuoys used in each event may vary	

A.2.4.4 Anti-Submarine Warfare Tracking Test – Helicopter

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Tracking Test – Helicopter	This event is similar to the training event anti-submarine tracking exercise-helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.	
Long Description	Similar to an anti-submarine tracking exercise-helicopter, an anti-submarine tracking test—helicopter evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Typically, one MH-60 helicopter conducts anti-submarine warfare testing using the AN/AQS-22 dipping sonar, tonal sonobuoys (e.g., AN/SSQ-62), passive sonobuoys (e.g., AN/SSQ-53D/E), or explosive sonobuoys (e.g., mini sound-source seeker buoys). Targets (e.g., MK 39 EMATT or MK 30) may also be employed during an anti-submarine event. If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in shallow or deep waters and could initiate from a land base or from a surface ship. Helicopter anti-submarine tests are intended to evaluate the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Some anti-submarine helicopter tracking tests could be conducted as part of an anti-submarine tracking coordinated event with fleet training activities.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft **Systems:** AN/AQS-22 dipping sonar, tonal sonobuoys (e.g., AN/SSQ-62), explosive sonobuoys (e.g., mini sound-source seeker buoys), passive sonobuoys (e.g., AN/SSQ-53),and new development mid-frequency active sonar buoys (follow-on to DICASS) **Ordnance/Munitions:** Explosive sonobuoys; mini sound-source seeker buoys (“mini-buoys”) **Targets:** MK 39, MK 30, submarine **Duration:** 2 flight hours/event	**Location*:** Northeast VACAPES: W-386, W-72 Navy Cherry Point JAX: W-157, W-158, W-159 GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (MF4); sonobuoys (MF5); underwater explosives (E3), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachute; explosive sonobuoy fragments	
Detailed Military Expended Materials Information	• 1 MK 39 or MK 30 target (MK 30 is recovered and reused, MK 39 is not) • If target is air dropped, 1 parachute/target • 0–24 sonobuoys/event (1 parachute/sonobuoy) • Explosive sonobuoy fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.4.5 Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft

Activity Name	Activity Description	
Anti-Submarine Warfare (ASW)		
Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft	The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements	
Long Description	Similar to an anti-submarine warfare tracking exercise-maritime patrol aircraft, an anti-submarine warfare tracking test—maritime patrol aircraft evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8 fixed-wing aircraft conduct anti-submarine warfare testing using tonal sonobuoys (e.g., AN/SSQ-62 DICASS), explosive sonobuoys (e.g., AN/SSQ-110 IEER), passive sonobuoys (e.g., AN/SSQ 53 DIFAR), torpedoes (e.g., MK 46), smoke devices (e.g., MK 58), SUS devices (e.g., MK 61 SUS), flares, and chaff. Targets (e.g., MK 39 EMATT) may also be employed during an anti-submarine warfare scenario. If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in deep (typically beyond 100 ft.) waters and weapons testing could be initiated from a land base or a surface ship. Some anti-submarine warfare maritime patrol aircraft tracking tests could be conducted as part of a coordinated event with fleet training activities.	
Information Typical to the Event	**Platform:** P-3 or P-8 fixed-wing aircraft **Systems:** Sonobuoys (e.g., AN/SSQ-62), passive sonobuoys (e.g., AN/SSQ-53) **Ordnance/Munitions:** IEER, SUS, high duty cycle sonobuoys **Targets:** MK 39, MK 30, smoke device, submarine **Duration:** 4–6 flight hours/event	**Location:** Northeast VACAPES Navy Cherry Point JAX GOMEX Other AFTT Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (ASW2; MF5, MF6), underwater explosives (E3, E4), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, sonobuoy fragments	
Detailed Military Expended Materials Information	• 1 MK 39 or MK 30 target (MK 30 is recovered and reused, MK 39 is not) • If target air dropped, 1 parachute/target • 20–60 sonobuoys/event (1 parachute/sonobuoy) • Smoke device	
Assumptions Used for Analysis	Torpedo, missile, flare, and chaff use will be captured under anti-submarine warfare torpedo test, anti-surface warfare missile test, flare test, and chaff test, respectively. Analysis of these will not be conducted under this activity. 1 MK 58 per event	

A.2.5 MINE WARFARE

Mine warfare involves the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained, explosive device placed in the water at predetermined depths to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of or contact with an enemy ship, or until removed or otherwise destroyed. Naval mines can be laid by minelayers, other ships, submarines, and aircraft. Naval Air Systems Command mine warfare testing events include airborne mine countermeasures events, mine laying events (similar to mine exercises), and mine neutralization events. Sonar systems and sound sources associated with mine warfare testing events are listed in Table 2.3-2 (see Chapter 2, Description of Proposed Action and Alternatives). The AN/ASQ-235, an airborne projectile-based mine clearance system, and AN/ALQ-220 (Organic and Surface Influence Sweep) are mine neutralization systems capable of destroying mines or otherwise rendering them non-functional. The AN/AQS-20A and airborne laser mine detection system are mine hunting systems used for locating and recording the positions of mines for avoidance or subsequent neutralization.

A.2.5.1 Airborne Mine Neutralization Systems Test – ASQ-235 (Airborne Mine Neutralization System)

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Mine Neutralization Systems (AMNS) Test	Airborne mine neutralization tests of the airborne mine neutralization system evaluate the system's ability to detect and destroy mines off of the MH-60 airborne mine countermeasures capable helicopter. The airborne mine neutralization system uses up to four unmanned underwater vehicles equipped with high-frequency sonar, video cameras, and explosive neutralizers.	
Long Description	Mine neutralization tests evaluate aircraft and aircraft systems intended to neutralize or otherwise destroy mines through the use of explosives or other munitions. For most neutralization tests, mine shapes or non-explosive mines are used to evaluate new or enhanced mine neutralization systems. The airborne mine neutralization system uses up to four unmanned underwater vehicles equipped with high-frequency sonar and video cameras to detect submerged mines. The unmanned underwater vehicles are also equipped with explosives to neutralize the mines after they are located. Data from unmanned underwater vehicles are relayed to the operator in the helicopter through a fiber-optic cable enabling the operator to position the neutralizing charge onto the most vulnerable area of the mine. The explosive charge is then detonated to neutralize the mine. For most tests, recoverable non-explosive neutralizers are used. A mine shape, rather than a high-explosive mine, serves as the target and a range support vessel recovers the non-explosive neutralizer and the mine shape following the test. Testing scenarios include a non-explosive neutralizer against and non-explosive mine shape, or a high-explosive neutralizer against a non-explosive mine shape or a high-explosive neutralizer against an explosive mine.	
Information Typical to the Event	**Platform:** MH-60 helicopter **Systems:** Airborne Mine Neutralization System (e.g., AN/ASQ-235) **Ordnance/Munitions:** Neutralizers (explosive and non-explosive); mines (explosive and non-explosive) **Targets:** Floating/moored/bottom mine or shapes, high-explosive neutralizers **Duration:** 2.5 flight hours/event	**Location*:** VACAPES: W-50, W-72, W-386 SFOMF NSWC PCD

Activity Name	Activity Description
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E4; E11), aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Aircraft strike (birds only); military expended material strike; seafloor device strike (mine shapes) **Entanglement:** Fiber optic cable **Ingestion:** Mine fragments, neutralizer fragments, fiber optic cable fragments
Detailed Military Expended Materials Information	• Fiber-optic cable, plus additional expended material, such as the can that holds and deploys the cable • 1–4 neutralizers deployed per high-explosive event Mine shapes are typically retrieved and reused, if they are not too badly damaged from neutralization attempt.
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). The in-air low energy laser stressor was used in analysis of potential impacts on human resources.

A.2.5.2 Airborne Projectile-Based Mine Clearance System

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Projectile-based Mine Clearance System	An MH-60 helicopter uses a laser-based detection system to search for mines and to fix mine locations for neutralization with an airborne projectile-based mine clearance system. The system neutralizes mines by firing a small- or medium-caliber non-explosive, supercavitating projectile from a hovering helicopter.	
Long Description	During an airborne projectile-based mine clearance system test, a MH-60 helicopter evaluates the search capabilities of an airborne projectile-based mine clearance system (such as the AN/AWS-2 Rapid Airborne Mine Clearance System] to detect mines and fix mine locations using a laser. The airborne projectile-based mine clearance system can work in tandem with the airborne laser mine detection system by providing a mine neutralizing (destroying) capability for airborne laser mine detection system-detected, near-surface mines. The gun (such as the Bushmaster) fires a small- or medium-caliber (such as a 30 mm) non-explosive, supercavitating projectile at the target from a hovering MH-60. The projectile penetrates the target, rendering it non-functional. Mine shapes (as opposed to high-explosive mines) would almost always be used as the targets during a test. In the event a high-explosive mine is used during the final testing phase an underwater explosion may be generated as the mine is neutralized.	
Information Typical to the Event	**Platform**: MH-60 helicopter **Systems**: Rapid Airborne Mine Clearance System or similar system **Ordnance/Munitions:** Small- or medium-caliber supercavitating projectile (non-explosive), mines (non-explosive and explosive) **Targets:** Floating/moored/bottom /mine or mine shape **Duration:** 2.5 flight hours/event	**Location*:** VACAPES: W-50 NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E11); aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Military expended material strike (projectiles), seafloor device strike (mine shapes), aircraft strikes (birds only) **Entanglement:** None **Ingestion:** Projectiles (small- and medium-caliber), target fragments	
Detailed Military Expended Materials Information	Projectiles (small- and medium-caliber); target fragments. Mine shapes are typically retrieved and reused, if they are not too badly damaged from neutralization attempt.	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). All mines under the No Action Alternative are non-explosive. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.2.5.3 Airborne Towed Mine Sweeping Test

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Towed Minesweeping Test	An airborne towed minesweeping test (such as the Organic Airborne and Surface Influence Sweep) would be conducted by a MH-60 helicopter to evaluate the functionality of towed minesweeping devices and the MH-60 at sea. The OASIS is towed from a forward flying helicopter and works by emitting an electromagnetic field and mechanically generated underwater sound to simulate the presence of a ship. The sound and electromagnetic signature cause nearby mines to explode.	
Long Description	An airborne towed minesweeping test (such as the Organic Airborne and Surface Influence Sweep) would be conducted by an airborne mine countermeasures capable MH-60 helicopter to evaluate the functionality of Organic Airborne and Surface Influence Sweep and MH-60 at sea. For most tests, mine sweeping would be simulated using Versatile Exercise Mine System (non-explosive mine shapes that emit a plume of smoke rather than exploding) and high-explosive mines at the culmination of testing, approximately 1 per event. The Organic Airborne and Surface Influence Sweep works by emitting an electromagnetic field and underwater sound generated from a mechanical source to simulate a ship's sound signature. The Organic Airborne and Surface Influence Sweep serves to "sweep" or cause explosive mines to detonate when exposed to the electromagnetic field and simulated ship sound signature. The sound generated from the Organic Airborne and Surface Influence Sweep is not sonar, but rather a mechanically-generated sound to simulate a ship prop.	
Information Typical to the Event	**Platform:** MH-60 **Systems:** Towed minesweeping systems (e.g., Organic Airborne and Surface Influence Sweep) **Ordnance/Munitions:** Mines (explosive), Versatile Exercise Mine System **Targets:** Floating/moored/bottom mines (non-explosive and explosive) **Duration:** 2.5 flight hours/event	**Location*:** VACAPES: W-50, W-72 NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E11); aircraft noise **Energy:** Electromagnetic **Physical Disturbance and Strike:** In-water towed device strike, seafloor device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Mine fragments	
Detailed Military Expended Materials Information	Mine fragments	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). Non-explosive mine shapes will be recovered.	

A.2.5.4 Airborne Towed Mine Hunting Sonar Test

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Towed Minehunting Sonar Test	A mine-hunting system that is towed from an MH-60 helicopter with sonar for detection and classification of bottom and moored mines. An electro-optical sensor allows for identification of bottom mines.	
Long Description	Tests of towed mine-hunting sonar systems (such as the AN/AQS-20A, or "Q20") evaluate the search capabilities of this helicopter-towed, mine hunting, detection, and classification system. The sonar on the Q20 identifies mine-like objects in the deeper parts of the water column, but is not designed to identify near-surface mines.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft (MH-60) **Systems:** Towed mine-hunting sonar systems (AN/AQS-20A) **Ordnance/Munitions:** None **Targets:** Floating/moored/near surface mine or mine shape **Duration:** 2.5 flight hours/event	**Location*:** VACAPES: W-50, W-72 NSWC PCD SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (HF4), aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water towed device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information		
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.5.5 Airborne Laser-Based Mine Detection System Test

Activity Name	Activity Description	
Mine Warfare (MIW)		
Airborne Laser-Based Mine Detection System Test	An airborne mine hunting test of the AN/AES-1 Airborne Laser Mine Detection System, that is operated from the MH-60 helicopter and evaluates the system's ability to detect, classify, and fix the location of floating and near-surface, moored mines. The system uses a laser to locate mines and may operate in conjunction with an airborne projectile-based mine detection system to neutralize mines.	
Long Description	During an Airborne Mine Countermeasures test, a MH-60 helicopter evaluates the search capabilities of the AN/AES-1 Airborne Laser Mine Detection System. Airborne Laser Mine Detection System is a mine hunting system designed to detect, classify, and localize floating and near-surface, moored sea mines using a laser system. The Airborne Laser Mine Detection System will be integrated into the MH-60 helicopter to provide a rapid wide-area reconnaissance and assessment of mine threats in littoral zones, confined straits, choke points, and amphibious objective areas for Carrier and Expeditionary Strike Groups. The Airborne Laser Mine Detection System uses pulsed laser light to image the entire near-surface volume potentially containing mines. Airborne Laser Mine Detection System is capable of day or night operations without stopping to deploy or recover equipment and without towing any equipment in the water. With untethered operations, it can attain high area search rates. This design uses the forward motion of the aircraft to generate image data negating the requirement for complex scanning mechanisms and ensuring high system reliability. Airborne Laser Mine Detection System also provides accurate target geo-location to support follow on neutralization of the detected mines. Airborne Laser Mine Detection System works in conjunction with Airborne Projectile-Based Mine Clearance System.	
Information Typical to the Event	**Platform:** MH-60 helicopter **Systems:** AN/AES-1 Airborne Laser Mine Detection System **Ordnance/Munitions:** None **Targets:** Floating/moored mine shapes **Duration:** 2.5 flight hours/event	**Location*:** VACAPES: W-50, W-72 NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives). The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.2.5.6 Mine Laying Test

Activity Name	Activity Description	
Mine Warfare (MIW)		
Mine Laying Test	Fixed-winged aircraft evaluate the performance of mine laying equipment and software systems to lay mines. A mine test may also train aircrew in laying mines using a new or enhanced mine deployment system.	
Long Description	During a mine laying test, fixed-winged aircraft evaluate the performance of aircraft mine laying equipment or associated software systems to lay mines using non-explosive mine shapes. A mine test may also train aircrew in the technique of laying mines and in using a new or enhanced mine deployment system. Aircrew typically drop a series of about four non-explosive mine shapes (i.e., MK 76, BDU-45, or BDU-48), making multiple passes in the same flight pattern and dropping one or more shapes each time. The mine shapes are scored for accuracy as they enter the water. The non-explosive mine shapes are expendable and are typically not recovered after the test.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Mine shapes (i.e., MK 62, MK 63. or MK 65 quick-strike; non-explosive) **Targets:** None **Duration:** 2 flight hours/event	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only); seafloor device strike (mine shape) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Mine shapes (10/event)	
Assumptions Used for Analysis		

A.2.6 OTHER TESTING ACTIVITIES

A.2.6.1 Test and Evaluation – Catapult Launch

Activity Name	Activity Description	
Other Testing		
Test and Evaluation Catapult Launch	Tests evaluate the function of aircraft carrier catapults at sea following enhancements, modifications, or repairs to catapult launch systems, including aircraft catapult launch tests. No weapons or other expendable materials would be released.	
Long Description	Aircraft catapults are systems used to assist aircraft take-off in aircraft carriers. Catapults consist of a track built into the flight deck, below which is a large piston or shuttle that is attached through the track to the nose gear of the aircraft. Navy aircraft launch systems are powered by steam or driven by an electromagnetic motor. Steam-powered catapults draw steam from the ship's boilers to the catapult steam receivers or accumulator, where it is stored at the desired pressure. From the receivers/accumulator, steam is directed to the launching valves, and provides the energy to launch aircraft. The most significant differences between the various types of steam catapults are the length and capacity. An electromagnetic launch system provides higher launch energy capability, reduced weight, volume, and maintenance, increased controllability, availability, reliability, and efficiency. The present electromagnetic aircraft launch system design centers around a linear synchronous motor and supplied power from pulsed disk alternators through a cycloconverter. Average power, obtained from an independent source on the host platform, is stored kinetically in the rotors of the disk alternators. It is then released in a 2–3 second pulse during a launch. This high-frequency power is fed to the cycloconverter which acts as a rising voltage, rising frequency source to the launch motor. The linear synchronous motor takes the power from the cycloconverter and accelerates the aircraft down the launch stroke, all the while providing "real time" closed loop control. Catapult launch tests would occur on fleet aircraft carriers during deployment. The specific locations of carriers from 2014–2020 is unknown. No weapons or other expendable materials would be released during catapult tests.	
Information Typical to the Event	**Platform:** CVN 68–78, fixed-wing aircraft **Systems:** Catapult; electromagnetic aircraft launch system **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–6 flight hours/event	**Location:** VACAPES Navy Cherry Point JAX AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.2.6.2 Air Platform Shipboard Integration Test

Activity Name	Activity Description	
Other Testing		
Air Platform Shipboard Integration Test	Fixed wing aircraft are tested to determine operability from shipboard platforms, performance of shipboard physical operations, and to verify and evaluate communications and tactical data links.	
Long Description	The air platform shipboard integration test is performed to evaluate the compatibility of an aircraft to operate from designated shipboard platforms, perform shipboard physical operations, and to verify and evaluate communications and tactical data links. This test function also includes an assessment of carrier-shipboard suitability, hazards of electromagnetic radiation to ordnance, hazard of electromagnetic radiation to personnel, and high energy radio frequency.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** Data link and communication systems, hazards of electromagnetic radiation to ordnance, hazard of electromagnetic radiation to personnel, high energy radio frequency **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–6 flight hours/event	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.6.3 Shipboard Electronic Systems Evaluation

Activity Name	Activity Description	
Other Testing		
Shipboard Electronic Systems Evaluation	Tests measure ship antenna radiation patterns and test communication systems with a variety of aircraft.	
Long Description	Shipboard electronic systems evaluation tests measure ship antenna radiation patterns and evaluate communication systems linking ships and aircraft. Aircraft capable of landing on a ship (e.g., aircraft carrier or littoral combat ship) temporarily deploy to a nearshore ship and conduct a variety of tests over a period of days to test newly installed or modified systems onboard the aircraft for compatibility with shipboard electronic systems. Follow-on test and evaluation of unmanned aerial systems would consist of dynamic interface testing, shipboard electromagnetic testing, and envelope expansion tests intended to evaluate capability of the unmanned aerial systems to conduct launch and recovery operations from a ship at sea as well as perform missions in a maritime environment. Altitudes would range from mean seal level to 15,000 feet mean seal level with the majority of flights occurring between mean seal level and 3,000 feet. Unmanned aerial systems would include STUAS/Tier II tactical unmanned aerial systems, BAMS, Fire Scout VTUAV, and UCAS-D testing. Shipboard testing of the Joint Precision Approach and Landing System (test new technology systems to provide precision guidance to aircraft landing on air capable ships. At-sea flight test of the CH-53K would consist of shipboard compatibility (dynamic interface/envelope expansion) and, during Operational Evaluation, amphibious assault scenarios. SESE tests of the V-22 helicopter would involve flight and wind envelope expansion interface testing with LHA, LHD, and LPD class ships.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft, unmanned aerial systems **Systems:** Joint Precision Approach and Landing System **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–20 flight hours/event	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.2.6.4 Maritime Security

Activity Name	Activity Description	
Other Testing		
Maritime Security	Maritime patrol aircraft and helicopters participate in maritime security activities and fleet training events. Aircraft and surface ships identify, track, intercept, board, and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions or conflict rules of engagement.	
Long Description	Crews from Navy helicopters and surface ships identify, track, intercept, board, and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions or conflict rules of engagement. The boarding party will be delivered from a surface ship via rigid-hull inflatable boat or similar small craft if the target vessel is non-hostile or via helicopter if hostile. This training event is non-firing. Naval Air Systems Command maritime patrol aircraft and helicopters may participate in maritime security activities and training events.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Paintballs **Targets:** High performance small boats and unmanned vehicles **Duration:** Under 12 hours	**Location*:** VACAPES: W-386, W-72 Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-2 of Chapter 2 (Description of Proposed Action and Alternatives).	

A.3 NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES

Naval Sea Systems Command testing activities are aligned with its mission of new ship construction, life cycle support, and weapon systems development. Each major category of Naval Sea Systems Command activities is described below.

A.3.1 NEW SHIP CONSTRUCTION

Ship construction activities include pierside testing events, a series of sea trials, and developmental and operational test and evaluation programs. Pierside and at-sea testing of systems aboard a ship may include activation of acoustic sources, acoustic countermeasures, radars, and radio equipment. Pierside events also consist of light-off and operational checks of the vessel's propulsion, weapons, and other combat systems prior to at-sea operations. However, for purposes of this EIS/OEIS, pierside testing at Navy contractor shipyards will consist only of tactical sonar systems. At sea, each new ship is operated at full power and subjected to high-speed runs and steering tests. At-sea test firing of shipboard weapons systems, including guns, is also conducted.

A.3.1.1 Surface Combatant Sea Trials – Pierside Sonar Testing

Activity Name	Activity Description	
Ship Construction and Maintenance		
New Ship Construction		
Surface Combatant Sea Trials – Pierside Sonar Testing	Ship's sonar systems are tested pierside to ensure proper operation.	
Long Description	Pierside sonar testing is one part of the total surface combatant sea trial activity. Surface combatant sonars are tested pierside to ensure proper operation prior to conducting the at-sea portion of the sea trial. Surface combatants included in this activity are the ARLEIGH BURKE class (DDG 51) and the ZUMWALT class (DDG 1000) destroyers.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** Mid-frequency sonars **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 weeks total per ship, with each source run independently and not continuously during this time	**Location:** Bath, Maine Norfolk, Virginia Mayport, Florida Pascagoula, Mississippi
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, MF10), underwater communications (e.g., MF9) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.1.2 Surface Combatant Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).	
Long Description	Propulsion testing is one part of the total surface combatant sea trial activity. Propulsion testing includes ship maneuvering, including full power runs (speeds in excess of 30 knots) and endurance runs.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Full-power runs are conducted for a total of 4 hours, and endurance runs are conducted for a total of 2 hours	**Location*:** Northeast: Boston Area Complex Gulf of Mexico:** GOMEX: W-155B VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships may not be traveling in a straight line. Ships will operate across the full spectrum of capable speeds. Ships will not be conducting test constantly for the entire duration.	

A.3.1.3 Surface Combatant Sea Trials – Gun Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Gun Testing	Gun systems are tested using non-explosive rounds.	
Long Description	Large-caliber gun testing is one part of the total surface combatant sea trial activity. Tests currently include firing of the 5 inch .62 caliber gun, and will potentially include a 155 mm gun for future DDG 1000 platforms.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** Large-caliber guns (5 inch, 155 mm); close-in weapon system **Ordnance/Munitions:** Large-caliber projectiles (e.g., 5 inch, 155 mm) (non-explosive); medium-caliber projectiles (non-explosive) **Targets:** None **Duration:** Within the 4-day surface combat sea trial	**Location*:** Northeast: CGULL OPAREA Gulf of Mexico:** GOMEX: W-151C VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, military expended material strike (non-explosive projectiles) **Entanglement:** None **Ingestion:** Medium-caliber projectiles	
Detailed Military Expended Materials Information	26 large-caliber non-explosive practice munitions/event; 700 medium-caliber non-explosive practice munitions/event Projectiles, casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration. 26 large-caliber rounds per event 700 medium-caliber rounds per event	

A.3.1.4 Surface Combatant Sea Trials – Missile Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Missile Testing	Non-explosive or explosive missiles are fired at target drones to test the launching system.	
Long Description	Missile testing is one part of the total surface combatant sea trial activity. During the event, support craft launch target drones, upon which two non-explosive or explosive missiles are fired.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** Missile launch system **Ordnance/Munitions:** Missiles (explosive and non-explosive) **Targets:** Retrievable mobile targets (e.g., drones) **Duration:** Within the 4-day surface combat sea trial	**Location*:** Northeast: CGULL OPAREA Gulf of Mexico:** GOMEX: W-151C VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapons firing noise; in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions; munition fragments), vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Munition fragments	
Detailed Military Expended Materials Information	2 missiles (non-explosive or explosive)/event	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration. Two missiles per event (these could be either explosive or non-explosive). Target drones are recovered by supporting craft.	

A.3.1.5 Surface Combatant Sea Trials – Decoy Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Decoy Testing	Surface combatant ships test the MK 36 decoy launching system.	
Long Description	Testing of the MK 36 Decoy Launching system is one part of the total surface combatant sea trial activity. During the event, chaff cartridges or concrete slugs are launched to ensure proper operation of the system.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** MK 36 Decoy Launching system **Ordnance/Munitions:** None **Targets:** None **Duration:** Within the 4-day surface combat sea trial	**Location*:** Northeast: CGULL OPAREA Gulf of Mexico:** (GOMEX: W-151C) VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; expended material other than munitions (concrete slugs) **Entanglement:** None **Ingestion:** End caps, pistons, chaff	
Detailed Military Expended Materials Information	36 chaff cartridges or concrete slugs/event	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration. 36 chaff cartridges or concrete slugs/event	

A.3.1.6 Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Surface Warfare Testing – Large-Caliber	Ships defend against surface targets with large-caliber guns.	
Long Description	Surface warfare testing is one part of the total surface combatant sea trial activity. During this event, a high-speed maneuverable surface target would run a weaving pattern towards the ship at speeds in excess of 20 knots. The surface combatant would fire non-explosive large-caliber rounds at the incoming target.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** Large-caliber weapons systems **Ordnance/Munitions:** Large-caliber projectiles (e.g., 5 inch, 155 mm) (non-explosive) **Targets:** Surface targets (e.g., high-speed maneuverable surface target) **Duration:** Within the 4-day surface combat sea trial	**Location*:** Northeast: CGULL OPAREA Gulf of Mexico:** (GOMEX: W-151C) VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise; weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, military expended material strike (non-explosive practice munitions) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Large-caliber projectiles	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration. 48 rounds per event	

A.3.1.7 Surface Combatant Sea Trials – Anti-Submarine Warfare Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Anti-Submarine Warfare Testing	Ships demonstrate capability of countermeasure systems and underwater surveillance and communications systems.	
Long Description	Anti-submarine warfare testing is one part of the total surface combatant sea trial activity. During this event, hull-mounted sonar systems are operated to test the capability of the systems. Mid- and high-frequency acoustic sources are used during this activity.	
Information Typical to the Event	**Platform:** Surface combatant (e.g., DDG 51 and DDG 1000) **Systems:** Surface ship sonars, countermeasure systems, and underwater surveillance and communications systems **Ordnance/Munitions:** None **Targets:** Motorized autonomous targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** Within the 4-day surface combat sea trial	**Location*:** Northeast: CGULL OPAREA Gulf of Mexico** (GOMEX: W-151C) VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonars (e.g., MF1, MF1K, MF10), acoustic countermeasures (e.g., ASW3), underwater communications (e.g., MF9), vessel noise **Energy:** None **Physical Disturbance and Strike**: Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	3 passive sonobuoys/event; targets	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration.	

A.3.1.8 Aircraft Carrier Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Aircraft Carrier Sea Trial – Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).	
Long Description	Propulsion testing is one part of the total aircraft carrier sea trial activity. Propulsion testing includes ship maneuvering, including full power runs (speeds in excess of 30 knots) and endurance runs in both straight line and reciprocal paths.	
Information Typical to the Event	**Platform:** Aircraft carrier **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Within the 1–2 day aircraft carrier sea trial	**Location:** VACAPES
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike**: Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Ships may not be traveling in a straight line. Ships will operate across the full spectrum of capable speeds. Ships will not be conducting test constantly for the entire duration.	

A.3.1.9 Aircraft Carrier Sea Trials – Gun Testing – Small-Caliber

Activity Name	Activity Description	
New Ship Construction		
Aircraft Carrier Sea Trial – Gun Testing Small-Caliber	Gun systems are tested using non-explosive rounds.	
Long Description	Small-caliber gun testing is included as part of the total aircraft carrier sea trial activity. Small-caliber gun testing includes .50 caliber guns.	
Information Typical to the Event	**Platform:** Aircraft carrier **Systems:** .50 caliber gun **Ordnance/Munitions:** Small-caliber projectiles (e.g., .50 caliber) (non-explosive) **Targets:** None **Duration:** Within the 1–2 day aircraft carrier sea trial	**Location:** VACAPES Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike**: Military expended material strike (non-explosive projectiles), vessel strike **Entanglement:** None **Ingestion:** Small-caliber projectiles, casings	
Detailed Military Expended Materials Information	Casings, projectiles	
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration. Events can occur in any of the range complexes. 100 rounds per event	

A.3.1.10 Aircraft Carrier Sea Trials – Gun Testing – Medium-Caliber

Activity Name	Activity Description	
New Ship Construction		
Aircraft Carrier Sea Trial – Gun Testing Medium-Caliber	Gun systems are tested using non-explosive and explosive rounds.	
Long Description	Medium-caliber gun testing is included as part of the total aircraft carrier sea trial activity. Medium-caliber gun testing includes 20 mm guns. In addition, fixed-wing aircraft deployed from an aircraft carrier will fire medium-caliber guns.	
Information Typical to the Event	**Platform:** Aircraft carrier, fixed-wing aircraft **Systems:** Medium-caliber gun systems **Ordnance/Munitions:** Medium-caliber projectiles (20 mm) (non-explosive and explosive) **Targets:** None **Duration:** Within the 1–2 day aircraft carrier sea trial	**Location:** VACAPES Navy Cherry Point JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, weapons firing noise, underwater explosives (e.g., E1), vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles, fragments), aircraft strike (birds only), vessel strike **Entanglement:** None **Ingestion:** Projectiles, casings, fragments	
Detailed Military Expended Materials Information	Casings, projectiles, fragments	
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration. Events can occur in any of the range complexes. Approximately one percent of projectiles are high-explosive.	

A.3.1.11 Aircraft Carrier Sea Trials – Missile Testing

Activity Name	Activity Description	
New Ship Construction		
Aircraft Carrier Sea Trial – Missile Testing	Surface-to-air missiles are fired to test the launching system.	
Long Description	Aircraft carrier sea trials include self defense systems such as surface-to-air missiles.	
Information Typical to the Event	**Platform:** Aircraft carrier **Systems:** Missile launching system **Ordnance/Munitions:** Missiles (e.g., Evolved Sea Sparrow Missile or Rolling Airframe Missile) (explosive) **Targets:** Drone **Duration:** Within the 1–2 day aircraft carrier sea trial	**Location:** VACAPES
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** In-air explosives, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (fragments), vessel strike; aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments	
Detailed Military Expended Materials Information	Missile fragments	
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration. Missiles explode in the air. One target per event	

A.3.1.12 Aircraft Carrier Sea Trials – Bomb Testing

Activity Name	Activity Description	
New Ship Construction		
Aircraft Carrier Sea Trial – Bomb Testing	Air-to-surface non-explosive bombs are delivered from carrier-launched fixed-wing aircraft.	
Long Description	Fixed-wing aircraft deployed from an aircraft carrier will deliver non-explosive practice bombs.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, aircraft carrier **Systems:** None **Ordnance/Munitions:** Non-explosive practice bombs **Targets:** Surface target (towed or smoke float) **Duration:** Within the 1–2 day aircraft carrier sea trial	**Location:** JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive bombs), aircraft strike (birds only), vessel strike, in-water device strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Non-explosive bombs	
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration. Two bombs per event Assume one target per event	

A.3.1.13 Submarine Sea Trials – Pierside Sonar Testing

Activity Name	Activity Description	
New Ship Construction		
Submarine Sea Trial – Pierside Sonar Testing	Tests submarine's sonar systems pierside to ensure proper operation.	
Long Description	Pierside sonar testing is one part of the total submarine sea trial activity. Submarine sonar systems are tested pierside to ensure proper operation prior to conducting the at-sea portion of the sea trial.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Submarine sonars, underwater communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Within a 5-day sea trial	**Location:** Groton, Connecticut Newport News, Virginia
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3), high-frequency sonar (e.g., HF1), underwater communication (e.g., M3, MF10) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration.	

A.3.1.14 Submarine Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Submarine Sea Trial – Propulsion Testing	Submarine is run at high speeds in various formations, and at various depths.	
Long Description	Propulsion testing is one part of the total submarine sea trial activity. During this activity, submarines undergo a controlled deep dive to test depth, emergency surfacing, full-power operations, high speed turns, and extreme depth changes.	
Information Typical to the Event	**Platform:** Submarines **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Within a 5-day sea trial	**Location:** Northeast VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Subs will not be conducting test constantly for the entire duration. Subs may not be traveling in a straight line. Subs will operate across the full spectrum of capable speeds.	

A.3.1.15 Submarine Sea Trials – Weapons System Testing

Activity Name	Activity Description	
New Ship Construction		
Submarine Sea Trial – Weapons System Testing	Submarine weapons systems are tested by cycling water through them in lieu of actual weapons firing.	
Long Description	Weapons system testing is one part of the total submarine sea trial activity. During this event, the submarine launches "water slugs" in lieu of actual torpedoes or countermeasures.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Torpedo and countermeasure systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Within a 5-day sea trial	**Location:** Northeast VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Submarines will not be conducting test constantly for the entire duration.	

A.3.1.16 Submarine Sea Trials – Anti-Submarine Warfare Testing

Activity Name	Activity Description	
New Ship Construction		
Submarine Sea Trial – Anti-Submarine Warfare Testing	Submarines demonstrate capability of underwater surveillance and communications systems.	
Long Description	Anti-submarine warfare testing is one part of the total submarine sea trial activity. During this event, hull-mounted sonar systems and underwater communications are operated to test the capability of the systems. Mid- and high-frequency acoustic sources are used during this activity.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Surveillance and communication systems **Ordnance/Munitions:** None **Targets:** Submarines, motorized autonomous targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** Within a 5-day sea trial	**Location:** Northeast VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3), high-frequency sonar (e.g., HF1), underwater communication (e.g., M3, MF10) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Targets	
Assumptions Used for Analysis	Subs will not be conducting test constantly for the entire duration.	

A.3.1.17 Other Class Ship Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Other Class Ship Sea Trial – Propulsion Testing	Ship is run at high speeds in various formations (e.g., straight-line and reciprocal paths).	
Long Description	Propulsion testing is one part of the total sea trial activity. During this event, the ship is tested for maneuverability, including full power and endurance runs.	
Information Typical to the Event	**Platform:** Amphibious warfare ships, surface combatant (e.g., Littoral Combat Ship), support craft/other – specialized high speed , support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** During one day of a 5-day sea trial	**Location*:** AFTT Study Area: VACAPES Gulf of Mexico:** GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration. Ships may not be traveling in a straight line. Ships will operate across the full spectrum of capable speeds.	

A.3.1.18 Other Class Ship Sea Trials – Gun Testing – Small-Caliber

Activity Name	Activity Description	
New Ship Construction		
Other Class Ship Sea Trial – Gun Testing Small-Caliber	Ships defend against surface targets with small-caliber guns.	
Long Description	Small-caliber gun testing is included as part of the total sea trial activity. Small-caliber gun testing includes .50 caliber guns.	
Information Typical to the Event	**Platform:** Amphibious warfare ships, surface combatant (e.g., Littoral Combat Ship), support craft/other – specialized high speed , support craft/other **Systems:** Small-caliber weapon systems **Ordnance/Munitions:** Small-caliber projectiles (non-explosive) **Targets:** None **Duration:** Within the 5-day sea trial	**Location*:** Gulf of Mexico**: GOMEX VACAPES
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles), vessel strike **Entanglement:** None **Ingestion:** Small-caliber projectiles, casings	
Detailed Military Expended Materials Information	Small-caliber projectiles, casings	
Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). **Gulf of Mexico refers to the body of water. Ships will not be conducting test constantly for the entire duration.	

A.3.1.19 Anti-Submarine Warfare Mission Package Testing

Activity Name	Activity Description	
New Ship Construction		
Anti-Submarine Warfare Mission Package Testing	Ships and their supporting platforms (e.g., helicopters, unmanned aerial systems) detect, localize, and prosecute submarines.	
Long Description	Littoral combat ships conduct detect-to-engage operations against modern diesel-electric and nuclear submarines using airborne and surface assets (both manned and unmanned). Active and passive acoustic systems are used to detect and track submarine targets, culminating in the deployment of lightweight torpedoes to engage the threat.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft **Systems:** Surface ship sonars, helicopter-deployed sonars, active sonobuoys, torpedo sonars **Ordnance/Munitions:** Non-explosive torpedoes **Targets:** Motorized autonomous targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** 1–2 weeks, with 4–8 hours of active sonar use with intervals of non-activity in between	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF12), helicopter-deployed sonar (e.g., MF4), active sonobuoys (e.g., MF5), torpedo sonar (e.g., TORP1); Anti-submarine sonar (e.g., ASW1); acoustic countermeasures (e.g., ASW3); vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike; aircraft strike (birds only); military expended material strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	Lightweight torpedo launch accessories; sonobuoys; parachutes	
Assumptions used for Analysis	One target per event All sonobuoys have parachutes unless otherwise noted. 2 sonobuoys expended per event	

A.3.1.20 Surface Warfare Mission Package Testing– Gun Testing Small-Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing Small-Caliber	Ships defend against surface targets with small-caliber guns.	
Long Description	Littoral combat ships conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare mission package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 30 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface combatant **Systems:** Small-caliber weapon systems **Ordnance/Munitions:** Small-caliber projectiles (.50 caliber) (non-explosive) **Targets:** None **Duration:** 1–2 weeks, with intervals of surface warfare mission package use during this time	**Location:** AFTT Study Area (typically in designated Fleet OPAREAs)*
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles); vessel strike **Entanglement:** None **Ingestion:** Small projectiles, casings	
Detailed Military Expended Materials Information	Casings, small projectiles	
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). 500 rounds per event	

A.3.1.21 Surface Warfare Mission Package Testing – Gun Testing Medium-Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing Medium-Caliber	Ships defend against surface targets with medium-caliber guns.	
Long Description	Littoral combat ships conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare mission package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 30 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface combatant **Systems:** Medium-caliber gun systems **Ordnance/Munitions:** Medium-caliber projectiles (explosive and non-explosive) **Targets:** None **Duration:** 1–2 weeks, with intervals of surface warfare mission package use during this time	**Location:** AFTT Study Area (typically in designated fleet OPAREAs)*
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E1); weapons firing noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles); vessel strike **Entanglement:** None **Ingestion:** Projectiles, casings, fragments	
Detailed Military Expended Materials Information	Casings, projectiles, fragments	
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). 700 explosive and 700 non-explosive rounds per event	

A.3.1.22 Surface Warfare Mission Package Testing – Gun Testing Large-Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing Large-Caliber	Ships defend against surface targets with large-caliber guns.	
Long Description	Littoral combat ships conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare mission package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 57 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface combatant **Systems:** Gun systems **Ordnance/Munitions:** Large-caliber projectiles (explosive and non-explosive) **Targets:** None **Duration:** 1–2 weeks, with intervals of surface warfare mission package use during this time	**Location:** AFTT Study Area (typically in designated fleet OPAREAs)*
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** In-air explosive; weapons firing noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles, fragments); vessel strike **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Casings, projectiles; fragments	
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). 980 explosive rounds per event 420 non-explosive rounds per event	

A.3.1.23 Surface Warfare Mission Package Testing – Missile/Rocket Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Missile/Rocket Testing	Ships defend against surface targets with medium range missiles or rockets.	
Long Description	Littoral combat ships conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare mission package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range missiles or rockets, and gun weapon system.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Missiles (e.g., anti-surface) (non-explosive and explosive) **Targets:** None **Duration:** 1–2 weeks, with intervals of surface warfare mission package use during this time	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E6), weapons firing noise, aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; military expended material strike (non-explosive projectiles and explosive fragments), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Missile or rocket fragments	
Assumptions used for Analysis	2 missiles or rockets per event	

A.3.1.24 Mine Countermeasure Mission Package Testing

Activity Name	Activity Description	
New Ship Construction		
Mine Countermeasure Mission Package Testing	Vessels and associated aircraft conduct mine countermeasure operations.	
Long Description	Littoral combat ships conduct mine detection using unmanned submersible and aerial systems, magnetic and acoustic sensor systems deployed by ship or support helicopters, and laser systems. Mines are then neutralized using magnetic, acoustic, and supercavitating systems.	
Information Typical to the Event	**Platform:** Surface combatant, unmanned underwater vehicles, rotary-wing aircraft **Systems:** Towed sonar system **Ordnance/Munitions:** Mine neutralization systems (e.g., Airborne Mine Neutralization System) **Targets:** Floating/moored/bottom non-explosive, mines or passive mine simulation systems **Duration:** 1–2 weeks with intervals of mine countermeasure mission package use during this time	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Towed sonar systems (e.g., HF4), underwater explosives (e.g., E4), aircraft noise, vessel noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Fragments	
Assumptions Used for Analysis	8 charges per event The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.3.1.25 Post-Homeporting Testing

Activity Name	Activity Description	
New Ship Construction		
Post-Homeporting Testing (all classes)	Tests electronic, navigation, and refueling capabilities.	
Long Description	Post-homeporting testing includes Shipboard Electronic Systems Evaluation Facility measurements of antenna radiation patterns, Tactical Air Navigation certification, Identification Friend or Foe Verification, Dynamic Interface test (to validate helicopter operations), and underway replenishments.	
Information Typical to the Event	**Platform:** All classes of surface ships **Systems:** Electronic and navigation systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–5 days, depending upon the test being conducted (e.g., Shipboard Electronic Systems Evaluation Facility testing is 1 day, dynamic interface testing is 5 days)	**Location:** Northeast VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.2 SHIP SHOCK TRIALS

Each new class (or major upgrade) of surface ships constructed for the Navy may undergo an at-sea shock trial. A shock trial consists of a series of underwater detonations that send shock waves through the ship's hull to simulate near misses during combat. A series of up to four underwater detonations would be conducted at various distances from the ship (charges are set closer to the ship as the trial progressives). Anticipated shock trials prior to 2019 include a CVN 21 Class aircraft carrier, DDG 1000 Zumwalt Class Destroyer, Independence Class Littoral Combat Ship, and Freedom Class Littoral Combat Ship.

A.3.2.1 Aircraft Carrier Full Ship Shock Trial

Activity Name	Activity Description	
Ship Shock Trials		
Aircraft Carrier Full Ship Shock Trial	Underwater detonations against an aircraft carrier.	
Long Description	Each new class (or major upgrade) of surface ships constructed for the Navy may undergo an at-sea shock trial. A shock trial is a series of underwater detonations that sends a shock wave through the ship's hull to simulate near misses during combat. A series of up to four underwater detonations would be conducted at various distances from the ship (charges are set closer to the ship as the trial progressives).	
Information Typical to the Event	**Platform:** Aircraft carrier, support craft/other **Systems:** None **Ordnance/Munitions:** High-explosive charges **Targets:** None **Duration:** Typically over 4 weeks, with one detonation per week. However, smaller charges may be detonated on consecutive days.	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E17), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Charge fragments	
Detailed Military Expended Materials Information	Charge fragments	
Assumptions Used for Analysis	Four charges per event Only one event will occur per five year period. Event may occur in either JAX or VACAPES. Will occur in waters deeper than 650 ft. *Modeling scenario:* Four 40,000-lb. charges	

A.3.2.2 DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial

Activity Name	Activity Description	
Shock Trials		
DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial	Underwater detonations against DDG 1000 Zumwalt Class Destroyer.	
Long Description	Each new class (or major upgrade) of surface ships constructed for the Navy may undergo an at-sea shock trial. A shock trial is a series of underwater detonations that sends a shock wave through the ship's hull to simulate near misses during combat. A series of up to four underwater detonations would be conducted at various distances from the ship (charges are set closer to the ship as the trial progressives).	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** None **Ordnance/Munitions:** High-explosive charges **Targets:** None **Duration:** Typically over 4 weeks, with one detonation per week. However, smaller charges may be detonated on consecutive days.	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E16), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Charge fragments	
Detailed Military Expended Materials Information	Charge fragments	
Assumptions Used for Analysis	Four charges per event One event will occur during the five year period. Event may occur in either JAX or VACAPES. Will occur in waters deeper than 650 ft. *Modeling scenario:* Four 10,000-lb. charges	

A.3.2.3 Littoral Combat Ship Full Ship Shock Trial

Activity Name	Activity Description	
Shock Trials		
Littoral Combat Ship Full Ship Shock Trial	Underwater detonations against Littoral Combat Ship.	
Long Description	Each new class (or major upgrade) of surface ships constructed for the Navy may undergo an at-sea shock trial. A shock trial is a series of underwater detonations that sends a shock wave through the ship's hull to simulate near misses during combat. A series of up to four underwater detonations would be conducted at various distances from the ship (charges are set closer to the ship as the trial progressives).	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** None **Ordnance/Munitions:** High-explosive charges **Targets**: None **Duration:** Typically over 4 weeks, with one detonation per week. However, smaller charges may be detonated on consecutive days.	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E16), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Charge fragments	
Detailed Military Expended Materials Information	Charge fragments	
Assumptions Used for Analysis	Four charges per event Two events will occur through five year period. Event may occur in either JAX or VACAPES. Will occur in waters deeper than 650 ft. *Modeling scenario:* Four 10,000-lb. charges	

A.3.3 LIFE CYCLE ACTIVITIES

Testing activities are conducted throughout the life cycle of a Navy ship to verify performance and mission capabilities. Tactical sonar system testing occurs pierside during maintenance, repair and overhaul availabilities, and at sea immediately following most major industrial periods. A Combat System Ship Qualification Trial is conducted for new ships and for ships that have undergone modification or overhaul of their combat systems.

A.3.3.1 Ship Signature Testing

Activity Name	Activity Description	
Life Cycle Activities		
Ship Signature Testing	Tests ship and submarine radar signatures and electromagnetic countermeasures.	
Long Description	Radar cross signature testing of surface ships is accomplished on new vessels and periodically throughout a ship's life cycle to measure how detectable the ship is to radar. For example, Assessment Identification of Mine Susceptibility measurements are specific electromagnetic and passive acoustical tests performed on mine countermeasure ships and on the Littoral Combat Ship mine countermeasure modules to determine their mine susceptibility. Additionally, measurements of deployed electromagnetic countermeasures are conducted during the new construction, post-delivery, and life cycle phases of the acquisition process for submarines. Signature testing of all surface ships and submarines verifies that each vessel's signature is within specifications, and may include the use of helicopter-deployed instrumentation, ship-mounted safety and navigation systems, fathometers, tracking devices, radar systems, and underwater communications equipment. Event duration includes all systems checks, including those that do not have active sonar.	
Information Typical to the Event	**Platform:** All surface ship and submarine classes **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 20 days	**Location:** VACAPES Joint Expeditionary Base Little Creek, Virginia Beach, Virginia Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	**Gulf of Mexico refers to the body of water.	

A.3.3.2 Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)

Activity Name	Activity Description	
Life Cycle Activities		
Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)	Pierside and at-sea testing of ship systems occurs periodically following major maintenance periods and for routine maintenance.	
Long Description	Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as tactical sonars, navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, would be tested.	
Information Typical to the Event	**Platform:** All surface ship classes **Systems:** Surface ship sonars, fathometers, underwater communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 3 weeks, with intermittent use of active sonar	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K), underwater communications (e.g., MF9, MF10), acoustic countermeasures (e.g., ASW3), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Sonar would not be continuously active for the duration of the test.	

A.3.3.3 Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)

Activity Name	Activity Description	
Life cycle Activities		
Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)	Pierside and at-sea testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.	
Long Description	Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, would be tested.	
Information Typical to the Event	**Platform:** Submarine **Systems:** Submarine sonars, fathometers, underwater communications, tracking pingers **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to three weeks, with intermittent use of active sonar	**Location:** Northeast VACAPES
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3), high-frequency sonar (HF1, HF3), underwater communications (e.g., M3), **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Sonar would not be used continuously throughout duration of test.	

A.3.3.4 Combat System Ship Qualification Trial – In-Port Maintenance Period

Activity Name	Activity Description	
Life cycle Activities		
Combat System Ship Qualification Trial (CSSQT) – In-Port Maintenance Period	Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events.	
Long Description	Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events. The ship's test plans and procedures, Maintenance Repair/Requirements Cards, and computerized planned maintenance system are used in establishing testing standards for each system and pieces of equipment. Ship's crew, under supervision of subject matter experts, complete all actions and receive remedial training where required. Trouble observation reports are written on noted discrepancies.	
Information Typical to the Event	**Platform:** Surface combatant, amphibious warfare ship **Systems:** All combat systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 weeks	**Location:** Norfolk, Virginia Mayport, Florida
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Sonar would not be continuously active for the duration of the test.	

A.3.3.5 Combat System Ship Qualification Trial – Air Defense

Activity Name	Activity Description	
Life cycle Activities		
Combat System Ship Qualification Trial (CSSQT) – Air Defense (AD)	Tests the ship's capability to detect, identify, track, and successfully engage live and simulated targets.	
Long Description	Air defense events are conducted in clear and varied electronic attack environments, using a mix of missile firings to verify the ship's capability to detect, identify, track, and successfully engage live and simulated targets. The tests include testing the radar's track load in the presence of debris, long range engagement processing, low-elevation detection and tracking, track load in the presence of electronic attack and chaff, and missile performance.	
Information Typical to the Event	**Platform:** Surface combatant, amphibious warfare ship **Systems:** All combat systems **Ordnance/Munitions**: Missiles (e.g., anti-air) (non-explosive and explosive), medium-caliber projectiles (non-explosive), large-caliber projectiles (explosive and non-explosive) **Targets:** Retrievable mobile targets (e.g., drones) and towed targets **Duration:** 1 week	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** In-air explosives, weapons firing noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions, munition fragments), aircraft strike (birds only), vessel strike **Entanglement:** None **Ingestion:** Chaff, target fragments, medium-caliber projectiles, end caps, pistons, casings, munition fragments	
Detailed Military Expended Materials Information	• 2,000 medium-caliber projectiles/event non-explosive • 20 large-caliber projectiles/event (explosive and non-explosive) • 6 surface-to-air missiles/event (explosive and non-explosive) • Munition fragments • Target fragments • Chaff, end caps, pistons – 24 canisters per event • Targets	
Assumptions Used for Analysis		

A.3.3.6 Combat System Ship Qualification Trial – Surface Warfare

Activity Name	Activity Description	
Life cycle Activities		
Combat System Ship Qualification Trial (CSSQT) – Surface Warfare (SUW)	Tests shipboard sensors capabilities to detect and track surface targets, relay the data to the gun weapon system, and engage targets.	
Long Description	Surface warfare events are gun weapons system tests conducted in a clear environment to demonstrate shipboard and remote (e.g., helicopter) sensors capabilities to detect and track surface targets, relay the data to the gun weapon system, and engage targets. The event qualified the ship's surface warfare gun capability to receive track data from the sensors, filter it, calculate ballistics, recommend aimpoint corrections (spots), generate gun orders, select ammunition properly for targets at differing ranges, and deliver surface direct fire on the surface targets.	
Information Typical to the Event	**Platform:** Surface combatant, amphibious warfare ship **Systems:** Gun weapons system, missile systems **Ordnance/Munitions:** Large-caliber projectiles (e.g., 155 mm, 5 inch) (non-explosive and explosive), medium-caliber projectiles (non-explosive), missiles (non-explosive) **Targets:** Mobile surface targets (e.g., High-Speed Maneuvering Surface Target), towed surface targets (e.g., Low Cost Modular Target) **Duration:** 1 week	**Location:** VACAPES JAX Key West
Potential Impact Concerns *(Information regarding de-construct categories and stressors)*	**Acoustic:** In-air explosives, weapons firing noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions, projectile fragments), vessel strike, in-water device strike **Entanglement:** None **Ingestion:** Medium-caliber projectiles, fragments	
Detailed Military Expended Materials Information	• Up to 300 large-caliber gun rounds/event • 1 surface-to-surface missile/event • 2,000 medium-caliber rounds • Munition fragments	
Assumptions used for Analysis	Explosive large-caliber rounds are air-burst.	

A.3.3.7 Combat System Ship Qualification Trial – Undersea Warfare

Activity Name	Activity Description	
Life cycle Activities		
Combat System Ship Qualification Trial (CSSQT) – Undersea Warfare (USW)	Tests ships ability to track and engage undersea targets.	
Long Description	Undersea warfare events are comprised of a series of tracking and firing exercises. The events ensure the operability of the undersea warfare suite and its interface with the Light Airborne Multi-Purpose System helicopter. Approximately 1 week of in-port training precedes exercises on an instrumented underwater range, where ship's force becomes familiar with operation and maintenance of the Undersea Warfare system. Personnel then demonstrate the capability to establish the datalink between the helicopter and ship's undersea warfare system.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft **Systems:** Surface ship sonars, underwater communication systems, sonobuoys **Ordnance/Munitions:** Non-explosive torpedoes **Targets:** Motorized autonomous targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** 1 week	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2), high-frequency sonar (e.g., HF4), helicopter-deployed dipping sonar (e.g., MF4), active sonobuoys (e.g., MF5), torpedo sonar (e.g., TORP1), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Materials Information	• Lightweight torpedo launch accessories (nose cap, suspension bands, air stabilizer, sway brace pad, arming wire, fahnstock clip, parachute) • Sonobuoys – 83 per event • Expendable targets	
Assumptions Used for Analysis	Five targets per event All sonobuoys have parachutes unless otherwise noted. Lightweight torpedoes only; no guidance wires Sonobuoys: 8 DICASS + 75 DIFAR/event	

A.3.4 NAVAL SEA SYSTEM COMMAND RANGE ACTIVITIES NAVAL SURFACE WARFARE CENTER, PANAMA CITY DIVISION TESTING RANGE

A.3.4.1 Air Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Air Operations	Various aircraft operations in support of other test activities.	
Long Description	Helicopters support the majority of testing activities at Naval Surface Warfare Center, Panama City Division Testing Range. Aircraft ensure that test areas are clear of other air and surface vessels prior to testing and perform post-test surveys following the completion of a test event. Air operations also involve the towing, delivery, and recovery of real and mock operational systems such as mines, rockets, and mine countermeasure systems. Any active acoustic stressors will be analyzed under separate activities. Aircraft are also involved in high-explosive firing exercise, gun firing is included under a separate activity, projectile firing. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1,116 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.4.2 Surface Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Surface Operations	Surface vessel operations for deployment and recovery of mine warfare systems and testing of communication and propulsion systems.	
Long Description	Surface vessels are often used to tow mine warfare systems for testing. Surface crafts are also used to deploy and recover mock mine warfare systems to assess the effectiveness of surface and airborne mine countermeasures systems and other test systems. Developmental and operational testing of communications and propulsion systems on surface vessels are also conducted within the Study Area. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 7,443 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.4.3 Subsurface Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Subsurface Operations	Subsurface operations include testing of underwater vehicles, items placed on the ocean floor, and diving activities.	
Long Description	Subsurface operations include a variety of underwater vehicles, robotic or autonomous systems, and items placed on the sea floor. Diving activities and special operations activities also occur. Other subsurface operations involve manned and unmanned underwater vehicles. All subsurface vehicles are retrieved after use, while most objects (e.g., non-explosive mines) remain for a period of time to be used as testing fixtures. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations and items expended per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** Submarine, unmanned underwater vehicles, support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1,620 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, seafloor device strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Items (e.g., non-explosive mines) placed on seafloor will be retrieved after a certain amount of time. 966 items per year	
Assumptions Used for Analysis		

A.3.4.4 Sonar Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Sonar Operations	Sonar systems testing determines their capability to detect, localize, and characterize mine-like objects.	
Long Description	Sonar operations involve the testing of various sonar systems in the ocean and laboratory environment to analyze the systems' capability to detect, locate, and characterize mine-like objects under various environmental conditions. Testing activities include sonar operations in the mid- and high-frequency ranges. Low-frequency sonar is not proposed to be used during activities. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** Mid-frequency sonar, high-frequency sonar **Ordnance/Munitions:** None **Targets:** None **Duration:** 1,080 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1K, MF2K), high-frequency sonar (e.g., HF4, HF5, SAS2), acoustic modem (M3); very high-frequency sonar (e.g., SAS3), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.4.5 Electromagnetic Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Electromagnetic Operations	Electromagnetic operations test an array of magnetic sensors used in mine countermeasure operations.	
Long Description	Electromagnetic operations tests an array of magnetic sensors used in mine countermeasures operations. Aircraft and surface vessels deploy sensors in the territorial and non-territorial waters of the Study Area. Multiple sweeps are then conducted over specified test areas containing tethered and buried mock mines in an effort to demonstrate the systems' effectiveness to influence or trigger magnetic targets. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other, aircraft **Systems:** Electromagnetic system (e.g., Organic Airborne and Surface Influence Sweeps) **Ordnance/Munitions**: None **Targets**: None **Duration:** 735 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** Electromagnetic device **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.4.6 Laser Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Laser Operations	Laser systems are tested to determine effectiveness as a tool to identify mine like objects.	
Long Description	Laser systems emit a narrow, high-frequency beam, and are often utilized to map underwater habitat and bottom contours. Testing is used to determine this technology's effectiveness as a tool to identify mine-like objects. Systems employed by the Navy include light imaging detection and ranging, laser line scan, and directional systems. These operations occur both below and above the water surface. Naval Surface Warfare Center, Panama City Division Testing Range activities are identified as hours of operations per year rather than duration of each individual event.	
Information Typical to the Event	**Platform:** None **Systems:** Lasers (including light imaging detection and ranging, laser line scan, and directional systems) **Ordnance/Munitions**: None **Targets:** None **Duration:** 1,053 hours/year	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** In-air low energy laser **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.3.4.7 Ordnance Operations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Ordnance Operations	Airborne, surface, organic (readily available units in place), and shallow water mine countermeasure systems testing using explosive ordnance.	
Long Description	High-explosive testing is necessary to analyze the effectiveness of naval airborne, surface, organic (readily available units in place), and shallow water mine countermeasure systems. Testing involving detonation of explosives is only conducted after a system has successfully completed non-explosive testing and an adequate amount of data has been collected to support the decision for high-explosive testing. Depending on the test scenario, high-explosive testing may occur from the surf zone to the outer perimeter of the Study Area. Some testing activities may also require the use of line charges or projectile firing.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft, support craft/other **Systems:** None **Ordnance/Munitions:** 51 detonations of 1–10 lb. net explosive weight Three detonations of 11–75 lb. net explosive weight 16 detonations of 76–600 lb. net explosive weight Three line charges **Targets:** None **Duration:** 1 day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E5, E14), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, military expended materials strike (fragments), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Fragments	
Assumptions Used for Analysis	73 items/year	

A.3.4.8 Projectile Firing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Projectile Firing	Airborne and surface crews defend against surface targets with small-, medium-, and large-caliber guns.	
Long Description	Projectile firing includes small-, medium-, and large-caliber projectiles. Projectiles associated with these rounds are mainly armor-piercing projectiles. All projectile firing occurs over non-territorial waters.	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** None **Ordnance/Munitions:** 6,000 small-caliber, 4,572 medium-caliber, and 300 large-caliber rounds (non-explosive) **Targets:** Non-explosive mines **Duration:** 1 day	**Location:** NSWC PCD (past 12 nm)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, military expended material strike (projectiles) **Entanglement:** None **Ingestion:** Small-caliber projectiles, medium-caliber projectiles, casing	
Detailed Military Expended Materials Information	Small-, medium-, and large-caliber projectiles, casings	
Assumptions Used for Analysis	10,872 items/year All projectile firing takes place outside of territorial waters. Some mine shapes could be deployed for a specific event, and then retrieved afterwards. However, some mine shapes are left in place so that multiple events could use the same shapes without needing to redeploy.	

A.3.4.9 Unmanned Underwater Vehicle Demonstrations

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Unmanned Underwater Vehicle (UUV) Demonstration	Testing and demonstrations of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems.	
Long Description	Includes tests and demonstrations of unmanned underwater vehicles in detecting and classifying mine-like or other buried objects. Vehicles would employ both passive and active acoustic systems. Many vehicles are employed over a 3-week event.	
Information Typical to the Event	**Platform:** Unmanned underwater vehicles, support craft/other **Systems:** Sonar systems (low, mid-, and high-frequency) **Ordnance/Munitions:** None **Targets:** Non-explosive mines and mine-like objects **Duration:** 3 weeks	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF5), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., HF5, HF6, HF7, FLS2, SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, seafloor device strike (bottom crawling unmanned underwater vehicles) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Active acoustic use would not be continuous throughout the duration of the activity. Multiple vehicles operate simultaneously in one or multiple areas.	

A.3.4.10 Mine Detection and Classification Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Mine Detection and Classification Testing	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.	
Long Description	Mine detection and classification systems require testing to evaluate the capability of generating underwater magnetic and acoustic signature fields as well as sonar systems that can detect and classify a wide range of threat mines at tactically significant water depths, ranging from the surf zone to deep water. In order to develop better and safer methods of minesweeping, the Navy is currently testing new systems to detect, locate, and identify mines including a laser airborne mine detection system that uses laser illumination coupled with sensitive electro-optic receivers to find mines in the upper part of the water column. This type of equipment is currently designed for operation from a manned helicopter; however, the next generation of such equipment is expected to operate from unmanned aerial systems.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, unmanned aerial system, support craft/other, unmanned underwater vehicles, submarines **Systems:** Mine detection and classification systems **Ordnance/Munitions:** None **Targets:** Floating, moored, or bottom mounted non-explosive mines or mine simulation systems. **Duration:** Up to 10 days, with up to 12 hours of acoustic activity each day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1K), high-frequency sonar (e.g., HF1, HF4, SAS2), vessel noise, aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Some mine shapes could be deployed for a specific event, and then retrieved afterwards. However, some mine shapes are left in place so that multiple events could use the same shapes without needing to redeploy. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.	

A.3.4.11 Mine Countermeasure/Neutralization Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Mine Countermeasure / Neutralization Testing	Air, surface, and subsurface vessels neutralize threat mines and mine-like objects.	
Long Description	Mine countermeasure/neutralization testing is required to ensure systems can effectively neutralize threat mines that would otherwise restrict passage through an area. Countermeasure systems are deployed from surface ships and helicopters to neutralize mines a number of ways: cutting mooring cables of buoyant mines, producing acoustic energy that fires acoustic-influence mines, producing electrical energy to replicate the magnetic signatures of surface ships in order to detonate threat mines, detonation of mines using remotely-operated vehicles such as the Archerfish Common Neutralizer, and using explosive charges or supercavitating projectiles to destroy threat mines.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, surface combatants, remotely operated vehicles **Systems:** Mid- and high-frequency sources, electrical energy generation, explosive neutralizers **Ordnance/Munitions:** Explosive charges or supercavitating projectiles (small and medium projectiles-non-explosive) **Targets:** Non-explosive mines **Duration:** 1–10 days, with intermittent use of countermeasure/neutralization systems during this period	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E4), vessel noise, aircraft noise **Energy:** Electromagnetic systems **Physical Disturbance and Strike:** Aircraft strike (birds only), vessel strike, in-water device strike, military expended material strike **Entanglement:** None **Ingestion:** Fragments; small-caliber projectiles; medium-caliber projectiles	
Detailed Military Expended Materials Information	Target fragments, charge fragments; small- and medium-caliber projectiles	
Assumptions Used for Analysis		

A.3.4.12 Stationary Source Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Stationary Source Testing	Stationary equipment (including swimmer defense systems) is tested to determine functionality.	
Long Description	Stationary source testing is performed from: a fixed site, suspended over the side of a boat, moored to the bottom, suspended in the water column, or on the surface. Examples of semi-stationary equipment include moored hydrophones (i.e., devices to listen to underwater sound), line arrays (i.e., multiple hydrophones) deployed on the ocean bottom, acoustic countermeasures, a moored oceanographic sensor that moves vertically through the water column, and sonobuoys (i.e., expendable sonar systems). Some units produce sound in the water (e.g., acoustic countermeasures), while others only listen (e.g., passive sonobuoys, which are vector sensors that measure particle motion). Some tests could require deployment in an area that provides opportunistic data collection (e.g., placing a hydrophone near a shipping lane to collect shipping noise data), or with specific geographic or oceanographic requirements. In addition, swimmer defense testing includes testing of systems to determine if they can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments. Swimmer and diver threats are detected with high-frequency sonars. The threats are then warned to exit the water through the use of underwater voice communications. If the threat does not comply, non-lethal diver deterrent air guns are used against the threat. Surface loudhailers are also used during the test.	
Information Typical to the Event	**Platform:** Support craft/other **Systems:** Acoustic countermeasures, high-frequency sonar, airguns, surface loudhailers **Ordnance/Munitions:** None **Targets:** None **Duration:** From 20 minutes to multiple days for stationary source testing 14 days, with intermittent periods of use for each system during this time, for swimmer defense	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF8), high-frequency sonar (e.g., SD1), very high-frequency sonar (e.g., SD2), airgun (e.g., AG), vessel noise **Energy:** None **Physical Disturbance and Strike:** Seafloor device strike (swimmer defense tripod), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Acoustics will not be used continuously throughout the event.	

A.3.4.13 Special Warfare Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Special Warfare Testing	Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances.	
Long Description	Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances. Testing could include the use of special operations forces deployed from submerged submarines while at sea.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Acoustic communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 5 days, with intermittent periods of active acoustics	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic communications (e.g., MF9) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.4.14 Unmanned Underwater Vehicle Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Unmanned Underwater Vehicle (UUV) Testing	Unmanned Underwater Vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.	
Long Description	Unmanned underwater vehicle testing ranges from simple, single-vehicle tests to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments. Most unmanned underwater vehicle operations include a launch, run, and recovery sequence of events. Unmanned underwater vehicles include modular, multi-mission platforms and anti-submarine warfare targets. Unmanned underwater vehicles may be launched from aircraft, surface craft, submarines, or land. Once launched, the vehicles are either towed or self-propelled to the test area. Unmanned underwater vehicles may also deploy and recover remote sensors and acoustically communicate with them.	
Information Typical to the Event	**Platform:** Unmanned underwater vehicle, support craft/other **Systems:** High-frequency sonar, very high-frequency sonar **Ordnance/Munitions:** None **Targets:** Bottom and moored non-explosive mines **Duration:** For unmanned underwater vehicles with traditional propulsion, typically up to 40 hours. Some propulsion systems (e.g., gliders) could operate continuously for multiple months.	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF5), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., HF5, HF6, HF7, FLS2, SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, seafloor device strike (bottom-crawling unmanned underwater vehicles) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Some mine shapes could be deployed for a specific event, and then retrieved afterwards. However, some mine shapes are left in place so that multiple events could use the same shapes without needing to redeploy.	

A.3.4.15 Ordnance Testing – Line Charge Testing

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Ordnance Testing – Line Charge Testing	Surface vessels deploy line charges to test the capability to safely clear an area for expeditionary forces.	
Long Description	Line charges are tested to verify the capability to safely clear surf zone areas for sea-based expeditionary operations. Naval Surface Warfare Center, Panama City Division Testing Range performs testing on various surf zone clearing systems that use either line charges or explosive arrays to neutralize mine threats. This is a systems development test and only assesses the in-water components of testing. Line charges consist of a 107 m (350 ft.) detonation cord with explosives lined from one end to the other end in a series of 2 kg (5 lb.) increments.	
Information Typical to the Event	**Platform:** Support craft/other **Systems:** None **Ordnance/Munitions:** Line charges **Targets:** None **Duration:** 1 day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E14), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Charge fragments	
Detailed Military Expended Materials Information	Charge fragments	
Assumptions Used for Analysis		

A.3.4.16 Ordnance Testing – Gun Testing – Small-Caliber

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Ordnance Testing – Gun Testing –Small-Caliber	Airborne and surface crews defend against surface targets with small-caliber guns	
Long Description	Small-caliber guns are fired from airborne and surface crews.	
Information Typical to the Event	**Platform:** Surface combatants, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Small-caliber projectiles (non-explosive) **Targets:** None **Duration:** 1 day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended materials strike (non-explosive projectiles), vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Small-caliber projectiles, casings	
Detailed Military Expended Materials Information	• Small-caliber projectiles, casings • 1,000 rounds per event	
Assumptions Used for Analysis	1,000 rounds per event	

A.3.4.17 Ordnance Testing – Gun Testing – Medium-Caliber

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Ordnance Testing – Gun Testing – Medium-Caliber	Airborne and surface crews defend against surface targets with medium-caliber guns	
Long Description	Medium-caliber guns are fired from airborne and surface crews.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Medium-caliber projectiles (non-explosive) **Targets:** None **Duration:** 1 day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), military expended material strike (non-explosive projectiles) **Entanglement:** None **Ingestion:** Medium-caliber projectiles, casings	
Detailed Military Expended Materials Information	• Medium-caliber projectiles, casings • 50 rounds per event	
Assumptions Used for Analysis	50 rounds per event	

A.3.4.18 Ordnance Testing – Gun Testing – Large-Caliber

Activity Name	Activity Description	
Naval Surface Warfare Center, Panama City Division Testing Range (NSWC PCD)		
Ordnance Testing – Gun Testing – Large-Caliber	Airborne and surface crews defend against surface targets with large-caliber guns	
Long Description	Large-caliber guns are fired from airborne and surface crews.	
Information Typical to the Event	**Platform:** Surface combatant, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Large-caliber projectiles (explosive and non-explosive) **Targets:** None **Duration:** 1 day	**Location:** NSWC PCD
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, underwater explosives (e.g., E5), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles), vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Large-caliber projectiles, casings, fragments	
Assumptions Used for Analysis	10 rounds per event.	

A.3.5 NAVAL UNDERSEA WARFARE CENTER DIVISION, NEWPORT TESTING RANGE

A.3.5.1 Launcher Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Launcher Testing	Launcher systems are tested to evaluate performance.	
Long Description	Testing is conducted to evaluate the performance of current or future launchers, which are used to deploy objects (e.g., torpedoes, decoys, countermeasures, sensors, and unmanned underwater vehicles). These tests may be performed from a fixed location or a mobile platform. The objects deployed may be operational equipment or mock equipment that is instrumented to evaluate the performance of the launcher system. Various methods may be employed to launch test items. The test items are recovered after the test and are usually equipped with an acoustic locator to aid in their recovery.	
Information Typical to the Event	**Platform:** Support craft/other, support craft/other-specialized high speed **Systems:** Launcher systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 12 hours, with multiple launches conducted during this time	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike **Entanglement:** None **Ingestion:** Military expended materials other than ordnance	
Detailed Military Expended Materials Information	Small metal or plastic items	
Assumptions Used for Analysis	Instrumented operational equipment or mock equipment used will be recovered.	

A.3.5.2 Torpedo Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Torpedo Testing	Non-explosive torpedoes are launched to record operational data. All torpedoes are recovered.	
Long Description	Testing of torpedoes consists of a pre-test, launch, run, and recovery sequence of events in Narragansett Bay and surrounding waters. Test launches may be from a permanent launch platform, or from surface or underwater vehicles. After launch, the torpedo typically follows a pre-programmed scenario to reach points of specific depth and location, and data are recorded for post-run performance evaluation. Test torpedoes are outfitted with special transponders that can locate the units at the end of their runs. Occasionally, there may be a test that involves acoustics. Recovery operations are typically conducted from ships that are specifically crewed and outfitted for torpedo recovery.	
Information Typical to the Event	**Platform:** Surface combatant, support craft/other **Systems:** None **Ordnance/Munitions:** Torpedoes (non-explosive) **Targets:** None **Duration:** 1–12 hours	**Location:** Narragansett Bay and surrounding waters Narragansett Bay and Rhode Island Sound Restricted Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Torpedo sonar (e.g., TORP1, TORP2), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike (torpedo) **Entanglement:** Guidance wire **Ingestion:** None	
Detailed Military Expended Materials Information	Heavyweight torpedo accessories (guidance wire, flex hose)	
Assumptions Used for Analysis	All torpedoes will be recovered. One torpedo per event	

A.3.5.3 Towed Equipment Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Towed Equipment Testing	Surface vessel or unmanned surface vehicles deploys equipment to determine functionality of towed systems.	
Long Description	Testing is conducted on equipment to evaluate hydrodynamic characteristics and control of a tow body, to test fully functional items, or to test a particular aspect of a system utilizing a mock-up of a functional item. A typical test operation for towed equipment testing involves a deployment, use, and recover scenario that requires range or commercial craft support. This equipment may be deployed from and towed by range craft, or unmanned surface vehicles. Equipment may be acoustically active or produce radio-frequency transmissions.	
Information Typical to the Event	**Platform:** Support craft/other, unmanned surface vehicle **Systems:** Towed device, low-, mid-, and high-frequency sonars **Ordnance/Munitions:** None **Targets:** None **Duration:** Typically 2–8 hours	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., SAS1), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike (towed devices), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.5.4 Unmanned Underwater Vehicle Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Unmanned Underwater Vehicle (UUV) Testing	Unmanned underwater vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.	
Long Description	Unmanned underwater vehicle testing ranges from simple, single-vehicle tests to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments. Most unmanned underwater vehicle operations include a launch, run, and recovery sequence of events. Unmanned underwater vehicles include modular, multi-mission platforms and anti-submarine warfare targets. Unmanned underwater vehicles may be launched from aircraft, surface craft, submarines, or land. Once launched, the vehicles are either towed or self-propelled to the test area. Unmanned underwater vehicles may also deploy and recover remote sensors and acoustically communicate with them.	
Information Typical to the Event	**Platform:** Unmanned underwater vehicle, support craft/other **Systems:** Low-, mid-, and high- frequency sonars **Ordnance/Munitions:** None **Targets:** None **Duration:** For unmanned underwater vehicles with traditional propulsion, typically up to 40 hours. Some propulsion systems (e.g., gliders) could operate continuously for multiple months.	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF5), high-frequency sonar (e.g., HF6, HF7, SAS2). mid-frequency sonar (MF10), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.5.5 Unmanned Surface Vehicle Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Unmanned Surface Vehicle (USV) Testing	Unmanned surface vehicles are deployed to verify the functionality of basic capabilities and complex tests that involve multiple participants and missions.	
Long Description	Unmanned surface vehicle testing includes simple tests to verify the functionality of basic capabilities and complex tests that involve multiple participants and missions. Unmanned surface vehicles are generally remote-controlled, semi-autonomous, modular, multi-mission platforms. Unmanned surface vehicles include rigid hull inflatable boats, cooperative autonomous research platform (e.g., an autonomous kayak), and remote-controlled jet skis.	
Information Typical to the Event	**Platform:** Unmanned surface vehicle, support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–12 hours	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.5.6 Unmanned Aerial System Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Unmanned Aerial System (UAS) Testing	Unmanned aerial systems are launched to test the capability to extend the communications range of unmanned underwater vehicles, unmanned surface vehicles, and submarines.	
Long Description	Unmanned aerial system testing is a possibility for future testing operations. Unmanned aerial systems are reusable, uncrewed vehicles capable of controlled, sustained, level flight. Anticipated scenarios of unmanned aerial system testing include both unmanned aerial system launcher testing and using unmanned aerial systems to extend the communications range of unmanned underwater vehicles, unmanned surface vehicles, and submarines. To test unmanned aerial system launcher systems, a subsurface capsule release may be conducted within the Narragansett Bay restricted area. In the event of an extended communications test, an aerostat (helium filled balloon) may be tethered to either a stationary buoy or an unmanned surface vehicle to test the extended range of communications.	
Information Typical to the Event	**Platform:** Unmanned aerial system, support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–12 hours	**Location:** NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), vessel strike, in-water device strike (unmanned aerial system launch) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.5.7 Semi-Stationary Equipment Testing

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Semi-Stationary Equipment Testing	Semi-stationary equipment (e.g., hydrophones) is deployed to determine functionality.	
Long Description	Semi-stationary equipment testing is performed from: a fixed site, suspended over the side of a boat, moored to the bottom, suspended in the water column, or on the surface. Examples of semi-stationary equipment include moored hydrophones (i.e., devices to listen to underwater sound), line arrays (i.e., multiple hydrophones) deployed on the ocean bottom, acoustic countermeasures, a moored oceanographic sensor that moves vertically through the water column, and sonobuoys (i.e., expendable sonar systems). Some units produce sound in the water (e.g., acoustic countermeasures), while others only listen (e.g., passive sonobuoys, which are vector sensors that measure particle motion). Some tests could require deployment in an area that provides opportunistic data collection (e.g., placing a hydrophone near a shipping lane to collect shipping noise data), or with specific geographic or oceanographic requirements.	
Information Typical to the Event	**Platform:** Support craft/other **Systems:** Acoustic countermeasures **Ordnance/Munitions:** None **Targets:** None **Duration:** From 20 minutes to multiple days	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4, LF5), mid-frequency sonar (e.g., MF9, MF10), high-frequency sonar (e.g., HF5, HF6), countermeasures (ASW3, ASW4), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.5.8 Unmanned Underwater Vehicle Demonstrations

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Unmanned Underwater Vehicle (UUV) Demonstrations	Testing and demonstrations of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems.	
Long Description	Includes tests and demonstrations of autonomous vehicles in detecting and classifying mine-like or other buried objects. Vehicles would employ both passive and active acoustic systems. Many vehicles are employed over a two-week event.	
Information Typical to the Event	**Platform:** Unmanned underwater vehicles, support craft/other **Systems:** Unmanned underwater vehicle sonar systems **Ordnance/Munitions:** None **Targets:** Non-explosive mines and mine-like objects **Duration:** 2 weeks	**Location:** Narragansett Bay and surrounding waters NUWCDIVNPT
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF5), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., HF5, HF6, HF7, FLS2, SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, vessel strike, seafloor device strike (bottom crawling unmanned underwater vehicles) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Active acoustic use would not be continuous throughout the duration of the activity. Multiple vehicles operate simultaneously in one or multiple areas. Mine shapes used as targets are in place from previous activities and are not deployed as part of this activity.	

A.3.5.9 Pierside Integrated Swimmer Defense

Activity Name	Activity Description	
Naval Undersea Warfare Center Division, Newport Testing Range (NUWCDIVNPT)		
Pierside Integrated Swimmer Defense Testing	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and defend against swimmer/diver threats in harbor environments.	
Long Description	Swimmer defense testing includes testing of systems to determine if they can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments. Swimmer and diver threats are detected with high-frequency sonars. The threats are then warned to exit the water through the use of underwater voice communications. If the threat does not comply, non-lethal diver deterrent air guns are used against the threat. Surface loudhailers are also used during the test.	
Information Typical to the Event	**Platform:** Support craft/other **Systems:** High-frequency sonar, airguns, surface loudhailers **Ordnance/Munitions:** None **Targets:** None **Duration:** 14 days	**Location:** NUWCDIVNPT Pierside: Newport, Rhode Island
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF8), swimmer defense sonar (e.g., SD1), airgun (e.g., AG), vessel noise, airborne noise **Energy:** None **Physical Disturbance and Strike:** Seafloor device strike (swimmer defense tripod) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.6 SOUTH FLORIDA OCEAN MEASUREMENT FACILITY TESTING RANGE

A.3.6.1 Signature Analysis Operations

Signature Analysis operations include electromagnetic, acoustic, optical, and radar signature measurements, recording, and post-run analyses of data of Navy surface and subsurface vessels. These activities include electromagnetic signature detection of submarines, acoustic and magnetic signature detection of unmanned underwater vehicles and surface ships, radar, and optical detection of surface ships.

Activity Name	Activity Description	
South Florida Ocean Measurement Facility Testing Range (SFOMF)		
Signature Analysis (SA) Activities	Surface ship and submarine testing of electromagnetic, acoustic, optical, and radar signature measurements.	
Long Description	Signature analysis activities include electromagnetic, acoustic, optical, and radar signature measurements, recording, and post-run analyses of data of Navy surface and subsurface vessels. These activities include electromagnetic signature detection of submarines, acoustic and magnetic signature detection of unmanned underwater vehicles and surface ships, radar, and optical detection of surface ships.	
Information Typical to the Event	**Platform:** Surface combatant, amphibious warfare ship, submarines, unmanned underwater vehicles **Systems:** Ship and submarine sonars, underwater communications, **Ordnance/Munitions:** None **Targets:** None **Duration:** Periodically over multiple days	**Location:** SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., HF1, HF6), acoustic modem (M3); sonobuoys (ASW2); vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.6.2 Mine Research, Development, Test, and Evaluation Activities

Activity Name	Activity Description	
South Florida Ocean Measurement Facility Testing Range (SFOMF)		
Mine Testing	Air, surface, and sub-surface systems detect, counter, and neutralize ocean-deployed mines and mine-like objects.	
Long Description	Mine testing activities require the placement of underwater temporary minefields (non-explosive). Mine testing encompasses subsurface sensor installation and retrieval; bottom mounted sub-surface targets (mine-like objects and target shapes) and sensor deployment and recovery; and air, surface, and subsurface sensor (acoustic and magnetic) array calibration. Mine testing activities include air, surface, and sub-surface systems which are used to detect, counter, and neutralize ocean-deployed mine-like objects. Sensor and target deployment and recovery may be performed utilizing small, large, and autonomous surface vessels; sub-surface autonomous undersea vehicles, unmanned undersea vehicles, and submarines (self-propelled, towed, and autonomous); and aircraft.	
Information Typical to the Event	**Platform:** Unmanned surface vehicles, unmanned undersea vehicles, submarines, fixed-wing aircraft, surface combatants, support craft/other **Systems:** Mine countermeasure systems **Ordnance/Munitions:** None **Targets:** Floating/moored/bottom non-explosive mines or passive mine simulation systems **Duration:** 5 days	**Location:** SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mine countermeasure systems (e.g., HF4), aircraft noise, vessel noise **Energy:** Electromagnetic **Physical Disturbance and Strike:** In-water device strike, aircraft strike (birds only), seafloor device strike (non-explosive mine shape), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Placement of temporary minefields (these will be removed after the test is finished)	

A.3.6.3 Surface Testing Activities

Activity Name	Activity Description	
South Florida Ocean Measurement Facility Testing Range (SFOMF)		
Surface Testing Activities	Various surface vessels, moored equipment, and materials are tested to evaluate performance in the marine environment.	
Long Description	Various surface activities utilizing the marine environment for testing and evaluation. Sample projects include buoy deployments, vessel entanglement systems, materials testing, and renewable energy devices. Other surface operations involve manned and unmanned surface vehicles. Miscellaneous types of equipment are deployed, including temperature, humidity, magnetic, acoustic, optical and air quality instrumentation to measure, record and analyze system effectiveness, dependability, operational parameters and durability. Surface operations utilize a variety of vessels for deployment of test equipment and for the monitoring of the air, surface, subsurface.	
Information Typical to the Event	**Platform:** Unmanned surface vehicles, support craft/other **Systems:** Unmanned vehicle sonar systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 1 day to multiple months	**Location:** SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, low-frequency sonar (e.g., LF5), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., FLS2, HF5, HF6, HF7, SAS2), **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.6.4 Subsurface Testing Activities

Activity Name	Activity Description	
South Florida Ocean Measurement Facility Testing Range (SFOMF)		
Subsurface Testing Activities	Various underwater, bottom crawling, robotic, vehicles utilized in underwater search, recovery, installation, and scanning activities.	
Long Description	Subsurface activities include a variety of underwater vehicles, robotic or autonomous systems, and items placed on the sea floor. Diving activities and special operations training also occur. Other subsurface activities involve manned and unmanned underwater vehicles. All subsurface vehicles are retrieved after use, while most objects (e.g., non-explosive mines) remain for a period of time to be used as testing fixtures.	
Information Typical to the Event	**Platform:** Manned and unmanned underwater vehicles, support craft/other **Systems:** None **Ordnance/Munitions:** None **Targets:** Mine shapes (non-explosive) **Duration:** 1 day	**Location:** SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, seafloor device strike (non-explosive mine shapes) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Mines and other objects may be placed on the bottom where they may remain for a period of time. They will eventually be retrieved.	

A.3.6.5 Unmanned Underwater Vehicle Demonstrations

Activity Name	Activity Description	
South Florida Ocean Measurement Facility Testing Range (SFOMF)		
Unmanned Underwater Vehicle (UUV) Demonstrations	Testing and demonstrations of multiple unmanned underwater vehicles and associated acoustic, optical, and magnetic systems.	
Long Description	Includes tests and demonstrations of unmanned vehicles in detecting and classifying mine-like or other buried objects. Vehicles would employ both passive and active acoustic systems. Many vehicles are employed over a two-week event.	
Information Typical to the Event	**Platform:** Unmanned underwater vehicles, support craft/other **Systems:** Unmanned underwater vehicle sonar systems **Ordnance/Munitions:** None **Targets:** Non-explosive mines and mine-like objects **Duration:** 2 weeks	**Location:** SFOMF
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF5), mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., HF5, HF6, HF7, FLS2, SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, vessel strike, seafloor device strike (non-explosive mine shapes, bottom crawling unmanned underwater vehicles) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Use of active acoustics would not be continuous throughout the duration of the activity. Multiple vehicles operate simultaneously in one or multiple areas.	

A.3.7 ADDITIONAL ACTIVITIES AT LOCATIONS OUTSIDE OF NAVAL SEA SYSTEMS COMMAND RANGES – ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING

A.3.7.1 Missile Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Missile Testing	Missile testing includes various missiles fired from submarines and surface combatants.	
Long Description	Missile testing includes various missiles (e.g., standard missiles, Water Piercing Missile Launch) fired from submarines and surface combatants.	
Information Typical to the Event	**Platform:** Surface combatant, submarines **Systems:** None **Ordnance/Munitions:** Missiles (e.g., anti-surface, strike) – (non-explosive) **Targets:** Unmanned surface vehicles, drones **Duration:** 1–2 hours	**Location:** VACAPES AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions), vessel strike, in-water device strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	One surface-to-surface missile/event	
Assumptions Used for Analysis	All targets will be recovered.	

A.3.7.2 Kinetic Energy Weapon Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Kinetic Energy Weapon Testing	A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile.	
Long Description	A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile to more than seven times the speed of sound to a range of up to 200 miles.	
Information Typical to the Event	**Platform:** Surface Combatant **Systems:** Kinetic energy weapon **Ordnance/Munitions:** Large-caliber projectile (non-explosive) **Targets:** Recoverable or expendable floating target **Duration:** 1 day	**Location:** VACAPES AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectile), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	• 40 large-caliber projectile per event • One event with 5,000 large-caliber projectiles • Expendable target – 1 target per event	
Assumptions Used for Analysis	Assume one target per event One event with 5,000 projectiles would occur only once before 2019.	

A.3.7.3 Electronic Warfare Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Electronic Warfare Testing	Testing will include radiation of military and commercial radar and communication systems (or simulators).	
Long Description	Testing will include radiation of military and commercial radar and communication systems (or simulators). No subsurface transmission would occur during this testing.	
Information Typical to the Event	**Platform:** Submarines **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 hours per day over a 7-day period	**Location:** Norfolk, Virginia Groton, Connecticut Northeast
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.7.4 Torpedo (Non-Explosive) Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Torpedo (Non-explosive) Testing	Air, surface, or submarine crews employ non-explosive torpedoes against submarines or surface vessels.	
Long Description	Aerial, surface, and subsurface assets fire exercise torpedoes against surface or subsurface targets. Torpedo testing evaluates the performance and the effectiveness of hardware and software upgrades of heavyweight or lightweight torpedoes. Event duration is dependent on number of torpedoes fired. Events can last up to 2 weeks and use 40 torpedoes. Typically, no more than eight torpedoes are fired per day during daylight hours.	
Information Typical to the Event	**Platform:** Submarines, surface combatant, fixed-wing aircraft, rotary-wing aircraft, support craft/other **Systems:** Surface ship and submarine sonars, sonobuoys, dipping sonars **Ordnance/Munitions:** Lightweight torpedoes, heavyweight torpedoes **Targets:** Submarines, surface ships, motorized autonomous targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target), stationary artificial targets (e.g., Fleet Training Target) **Duration:** Up to 2 weeks	**Location:** Northeast VACAPES JAX Gulf of Mexico** Boston Area Complex: Cape Cod TORPEX boxes
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF1), mid-frequency sonar (e.g., MF1, MF3), acoustic modem (M3); helicopter-deployed sonar (e.g., MF4), active sonobuoy (e.g., MF5), torpedo sonar (e.g., TORP1, TORP2), acoustic countermeasure (e.g., ASW3, ASW4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only), military expended material strike **Entanglement:** Parachutes (sonobuoy and torpedo), guidance wire **Ingestion:** Parachutes (sonobuoy and torpedo), torpedo launch accessories	

Detailed Military Expended Materials Information	• Sonobuoys – 384 sonobuoys per year
	• Expendable targets – one target per event
	• Acoustic countermeasures – 356 countermeasures per year
	• Torpedo launch accessories
	  ◦ Lightweight torpedo launch accessories – 136 torpedoes per year (Alternative 2)
	  ○ Nose cap, suspension bands, air stabilizer, sway brace pad, arming wire, fahnstock clip, wing kit, rocket booster, parachute, lead weights
	  ○ Expended material is dependent upon torpedo fired and firing platform.
	  ◦ Heavyweight torpedo launch accessories – 492 torpedoes per year (Alternative 2)
	  ○ Guidance wire, flex hose	

Assumptions Used for Analysis	**Gulf of Mexico refers to the body of water. All torpedoes are recovered. Assume all lightweight torpedo launch accessories have all listed material. All sonobuoys have a parachute unless otherwise noted.	

A.3.7.5 Torpedo (Explosive) Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Torpedo (Explosive) Testing	Air, surface, or submarine crews employ explosive torpedoes against artificial targets.	
Long Description	Non-explosive and explosive torpedoes (carrying a warhead) would be launched at a suspended target by a submarine and fixed- or rotary-winged aircraft or surface combatants. Torpedoes would detonate on an artificial target located at a depth between 200 and 700 ft. below the water's surface. Event duration is 1 to 2 days during daylight hours. Only one heavyweight torpedo test could occur in one day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day.	
Information Typical to the Event	**Platform:** Submarine, surface combatant, fixed-wing aircraft, rotary-wing aircraft, support craft/other **Systems:** None **Ordnance/Munitions:** Torpedoes (heavyweight and lightweight) (explosive and non-explosive) **Targets:** Stationary artificial targets (e.g., MK 28) **Duration:** 1–2 days during daylight hours	**Location*:** Other AFTT Areas: Sinking Exercise Box AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E8, E11), torpedo sonar (TORP1, TORP2), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only), military expended material strike **Entanglement:** Parachutes (sonobuoy and torpedo), guidance wire **Ingestion:** Target and torpedo fragments, parachutes (sonobuoy and torpedo	

Detailed Military Expended Materials Information	• Eight high-explosive torpedoes per year
	• Torpedo launch accessories
	  • Lightweight torpedo launch accessories – 12 torpedoes per year (Alternatives 1 and 2)
	  ○ Nose cap, suspension bands, air stabilizer, sway brace pad, arming wire, fahnstock clip, wing kit, rocket booster, parachute, lead weights
	  ○ Expended material is dependent upon torpedo fired and firing platform.
	  • Heavyweight torpedo launch accessories – 16 torpedoes per year (Alternatives 1 and 2)
	  ○ Guidance wire, flex hose	

Assumptions Used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). All sonobuoys have parachutes unless otherwise noted. 210 passive sonobuoys per event	

A.3.7.6 Countermeasure Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Countermeasure Testing	Towed sonar arrays and anti-torpedo torpedo defense systems are employed to detect and neutralize incoming weapons.	
Long Description	Countermeasure testing involves the testing of systems that would detect, localize, and track incoming weapons. At-sea testing of the Surface Ship Torpedo Defense systems includes towed acoustic systems (e.g., NIXIE), torpedo warning systems, and countermeasure anti-torpedo subsystems. Some countermeasure scenarios would employ non-explosive torpedoes against targets released by secondary platforms (e.g., helicopter or submarine). While surface vessels are in transit, countermeasure systems will be used to identify false alert rates. Event duration is up to 10 days with a maximum of 40 torpedoes fired (up to 10 shots occurring per day).	
Information Typical to the Event	**Platform:** Surface combatant, aircraft carrier, submarine, fixed-wing aircraft **Systems:** Countermeasure systems **Ordnance/Munitions:** Lightweight torpedoes (non-explosive) **Targets:** Torpedo test vehicle **Duration:** From 4 hours to 10 days, depending on the countermeasure being tested. For example, NIXIE pierside testing occurs in 4 hours, whereas countermeasure anti-torpedo subsystems durations are 10 days with a maximum of 40 anti-torpedo torpedoes fired (up to 10 shots per day).	**Location:** AFTT Study Area Northeast: Boston Area Complex – Cape Cod TORPEX boxes VACAPES GOMEX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1), high-frequency sonar (e.g., HF5), acoustic countermeasure (e.g., ASW3), torpedo sonar (e.g., TORP1, TORP2), vessel noise; aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike; aircraft strike (birds only) **Entanglement:** Parachute (torpedo) **Ingestion:** Parachute (torpedo)	
Detailed Military Expended Materials Information	Lightweight torpedo launch accessories (nose covers, parachutes, ram plates)	
Assumptions Used for Analysis		

A.3.7.7 Pierside Sonar Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
Pierside Sonar Testing	Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities.	
Long Description	Ships and submarines would activate mid- and high-frequency tactical sonars, underwater communications systems, and navigational devices to ensure they are fully functional prior to at-sea test events. Event duration is 2 weeks with active sonar used intermittently over 2 days during the total event duration.	
Information Typical to the Event	**Platform:** Submarine, surface combatant **Systems:** Mid- and high-frequency sonars, underwater communications systems, countermeasure systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 weeks	**Location:** Portsmouth, New Hampshire Groton, Connecticut Norfolk, Virginia Kings Bay, Georgia Mayport, Florida Port Canaveral, Florida
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF3), high-frequency sonar (e.g., HF1, HF3), acoustic countermeasure (e.g., ASW3) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Event duration is 2 weeks with active sonar used intermittently over 2 days during the total event duration.	

A.3.7.8 At-Sea Sonar Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW) / Anti-Submarine Warfare (ASW) Testing		
At-sea Sonar Testing	At-sea testing to ensure systems are fully functional in an open ocean environment.	
Long Description	At-sea sonar testing is required to calibrate sonar systems while the ship or submarine is in an open ocean environment. Tests consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes.	
Information Typical to the Event	**Platform:** Surface combatant, submarine **Systems:** Tactical sonar **Ordnance/Munitions:** None **Targets:** None **Duration:** From 4 hours to 11 days	**Location:** AFTT Study Area VACAPES Northeast JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3), high-frequency sonar (e.g., HF1), acoustic countermeasure (e.g., ASW4), acoustic modem (e.g., M3); vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, military expended material strike (acoustic countermeasures) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	Acoustic countermeasures – 10 per event	
Assumptions Used for Analysis	Active sonar use is intermittent throughout the duration of the event.	

A.3.8 MINE WARFARE TESTING

A.3.8.1 Mine Detection and Classification Testing

Activity Name	Activity Description	
Mine Warfare (MIW) Testing		
Mine Detection and Classification	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.	
Long Description	Mine detection and classification systems require testing to evaluate the capability of generating underwater magnetic and acoustic signature fields capable of sweeping a wide range of threat mines at tactically significant water depths, ranging from the surf zone to deep water. In order to develop better and safer methods of minesweeping, the Navy is currently testing new systems to detect, locate, and identify mines including a laser airborne mine detection system that uses laser illumination coupled with sensitive electro-optic receivers to find mines in the upper part of the water column. This type of equipment is currently designed for operation from a manned helicopter; however, the next generation of such equipment is expected to operate from unmanned aerial systems.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, unmanned aerial systems, surface combatant, amphibious warfare ship, remotely operated vehicles **Systems:** Mine detection and classification systems **Ordnance/Munitions:** None **Targets:** Floating/moored/bottom non-explosive mines or passive mine simulation systems **Duration:** Up to 10 days	**Location:** VACAPES JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Laser systems also used during testing.	

A.3.8.2 Mine Countermeasure/Neutralization Testing

Activity Name	Activity Description	
Mine Warfare (MIW) Testing		
Mine Countermeasure / Neutralization Testing	Air, surface, and subsurface vessels neutralize threat mines that would otherwise restrict passage through an area.	
Long Description	Mine countermeasure/neutralization testing is required to ensure systems can effectively neutralize threat mines that would otherwise restrict passage through an area. Countermeasure systems are deployed from surface ships and helicopters to neutralize mines a number of ways: cutting mooring cables of buoyant mines, producing medium- to high-frequency acoustic energy that fires acoustic-influence mines, producing electrical energy to replicate the magnetic signatures of surface ships in order to detonate threat mines, detonation of mines using remotely-operated vehicles such as the Archerfish Common Neutralizer, and using explosive charges or supercavitating projectiles to destroy threat mines.	
Information Typical to the Event	**Platform:** Surface combatant, amphibious warfare ship, rotary-wing aircraft, remotely operated vehicles **Systems:** Mine neutralization systems **Ordnance/Munitions:** Explosive mines **Targets:** Floating/moored/bottom non-explosive and explosive mines and mine simulation systems, high-explosive mines **Duration:** 1–10 days	**Location:** VACAPES Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF4), acoustic modem (M3); underwater explosives (e.g., E4, E8), vessel noise, aircraft noise **Energy:** Electromagnetic minesweeping systems **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** Fiber-optic cable **Ingestion:** Target fragments	
Detailed Military Expended Materials Information	Target fragments, fiber-optic cable	
Assumptions Used for Analysis	**Gulf of Mexico refers to the body of water. **Other Sensors:** Mine countermeasure systems (e.g., AN/AWS-2 Rapid Airborne Mine Clearance System, AN/ALQ-220 Organic Airborne and Surface Influence Sweep)	

A.3.9 SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING

A.3.9.1 Pierside Integrated Swimmer Defense

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Pierside Integrated Swimmer Defense	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments.	
Long Description	Swimmer defense testing includes testing of systems to determine if they can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments. Swimmer and diver threats are detected with high-frequency sonars. The threats are then warned to exit the water through the use of underwater voice communications. If the threat does not comply, non-lethal diver deterrent air guns are used against the threat. Surface loudhailers are also used during the test.	
Information Typical to the Event	**Platform:** Support craft/other **Systems:** High-frequency sonar, airguns, surface loudhailers **Ordnance/Munitions:** None **Targets:** None **Duration:** 14 days	**Location:** Joint Expeditionary Base Little Creek, Virginia Beach, Virginia
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF8), swimmer defense sonar (e.g., SD1), airgun (e.g., AG), vessel noise **Energy:** None **Physical Disturbance and Strike:** Seafloor device strike (swimmer defense tripod), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.9.2 Shipboard Protection Systems Testing

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Shipboard Protection Systems Testing	Various systems are used to protect surface combatants from various threats.	
Long Description	Surface ships engage small boat threats through the use of spotlights and loudhailers (pierside) but can also include the use of .50 caliber guns (at sea).	
Information Typical to the Event	**Platform:** Surface combatant **Systems:** None **Ordnance/Munitions:** Small-caliber projectiles (e.g., .50 caliber) (non-explosive) **Targets:** Floating target, rigid-hull inflatable boat **Duration:** 10 days	**Location:** VACAPES Norfolk, Virginia
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles), vessel strike **Entanglement:** None **Ingestion:** Small-caliber projectiles, casings	
Detailed Military Expended Materials Information	• Casings, projectiles • Target fragments	
Assumptions Used for Analysis		

A.3.9.3 Chemical/Biological Simulant Testing

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Chemical/Biological Simulant Testing	Chemical/biological agent simulants are deployed against surface ships.	
Long Description	Chemical or biological agent simulants are deployed against surface ships to verify the integrity of the ship's defense system including installed detection, protection, and decontamination systems. Methods of simulant delivery include aerial dispersal and hand-held spray.	
Information Typical to the Event	**Platform:** Surface combatant, fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 days	**Location:** VACAPES Northeast JAX Cherry Point
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Examples of chemical simulants: glacial acetic acid, triethyl phosphate Examples of biological simulants: spore-forming bacteria, ovalbumin	

A.3.10 UNMANNED VEHICLE TESTING

A.3.10.1 Underwater Deployed Unmanned Aerial System Testing

Activity Name	Activity Description	
Unmanned Vehicle Testing		
Underwater Deployed Unmanned Aerial System Testing	Submarines launch unmanned aerial systems while submerged.	
Long Description	During testing, a negatively buoyant capsule is deployed underwater and descends to a programmed depth. The capsule then drops a weight, inflates a flotation collar, rises to the surface, and launches an unmanned aerial system. Personnel use radio frequency communications to control and communicate with the unmanned aerial system during its flight.	
Information Typical to the Event	**Platform:** Submarine **Systems:** Unmanned aerial systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 8 hours (4 hours per day over 2 days)	**Location:** VACAPES Northeast
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike (unmanned aerial system launch), aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	• Expandable capsule (with flotation collar) • Ballast weights	
Assumptions Used for Analysis		

A.3.10.2 Unmanned Vehicle Development and Payload Testing

Activity Name	Activity Description	
Unmanned Vehicle Testing		
Unmanned Vehicle Development and Payload Testing	Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes.	
Long Description	Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes. Platforms can include unmanned underwater vehicles, unmanned surface vehicles, and unmanned aerial systems. Payload testing assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions. Tests range from basic remote control and autonomous navigation tests to deployment and activation of onboard systems which may include hydrodynamic instruments, launchers, and recovery capabilities. These vehicles are capable of expanding the communication and surveillance capabilities of submarines, surface vessels, and terrestrial commands Event duration for unmanned vehicles with traditional propulsion typically lasts up to 40 hours. Some propulsion systems (e.g., gliders) could operate continuously for multiple months.	
Information Typical to the Event	**Platform:** Unmanned vehicles (underwater, surface, and aerial), support craft/other **Systems:** Unmanned vehicle sonars **Ordnance/Munitions:** None **Targets:** None **Duration:** Typically up to 40 hours, although some could continue for multiple months	**Location:** Northeast VACAPES Navy Cherry Point JAX Gulf of Mexico**
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF9), high-frequency sonar (e.g., SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, seafloor device (bottom crawling vehicles), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	** Gulf of Mexico refers to the body of water.	

A.3.11 OTHER TESTING

A.3.11.1 Special Warfare

Activity Name	Activity Description	
Other Testing		
Special Warfare	Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances.	
Long Description	Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances. Testing could include the use of special operations forces deployed from submerged submarines while at sea.	
Information Typical to the Event	**Platform:** Surface craft/other, submarines **Systems:** Submarine sonars, Doppler sonar, underwater communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 30 days	**Location:** Key West
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF1), underwater communications (e.g., MF9), acoustic modem (M3); vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis	Test will not occur constantly throughout duration	

A.3.11.2 Radio Frequency Communications Testing

Activity Name	Activity Description	
Other Testing		
Radio Frequency Communications Testing	Testing of towed or floating buoys for communications through radio-frequencies.	
Long Description	Testing associated with radio frequency communications could occur from towed antennas from surface vessels, from single-transmit buoys released from submarines, or tethered buoys from submarines for two-way communication. Communication would occur from sea to shore or shore to sea.	
Information Typical to the Event	**Platform:** Surface combatant, submarines, support craft/other **Systems:** Towed antennas, single-transmit buoy **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 days (4 hours per day for 3 days)	**Location:** Northeast
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.11.3 Hydrodynamic Testing

Activity Name	Activity Description	
Other Testing		
Hydrodynamic Testing	Submarines maneuver in the submerged operating environment.	
Long Description	Hydrodynamic testing is required to validate the control and maneuverability of a submarine in the submerged operating environment.	
Information Typical to the Event	**Platform:** Submarine **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 10 days	**Location:** AFTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Materials Information	None	
Assumptions Used for Analysis		

A.3.11.4 At-Sea Explosives Testing

Activity Name	Activity Description	
Other Testing		
At-Sea Explosives Testing	Explosives are detonated at sea.	
Long Description	Explosives of various weights could be tested to determine the feasibility of use for different events. Up to 10 charges per event (up to 100 lb. net explosive weight) could be detonated to determine the shock/pressure generated, which could be used for various scenarios at sea.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** Subscale charges **Targets:** None **Duration:** 3 days, with multiple detonations per event	**Location:** Gulf of Mexico** JAX
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (e.g., E5) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Materials Information	Charge fragments	
Assumptions Used for Analysis	**Gulf of Mexico refers to the body of water.	

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APPENDIX B

FEDERAL REGISTER NOTICES

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APPENDIX B FEDERAL REGISTER NOTICES

Appendix B contains the following:

1. Notice of Intent to Prepare an Environmental Impact Statement/Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing (75 Federal Register [FR] 135)

2. Notice of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing Atlantic Fleet Training and Testing Activities, To Support and Conduct Current, Emerging, and Future Training and Testing Activities along the Eastern Coast of the U.S. and Gulf of Mexico (77 FR 92)

3. Notice of Public Meetings for the Draft Environmental Impact Statement/Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing (77 FR 92)

4. Amended Notice of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing Atlantic Fleet Training and Testing Activities, To Support and Conduct Current, Emerging, and Future Training and Testing Activities along the Eastern Coast of the U.S. and Gulf of Mexico (77 FR 97) [*Reflects corrected close to the comment period*]

5. Proposed Rule for Takes of Marine Mammals Incidental to Specified Activities: U.S. Navy Training and Testing Activities in the Atlantic Fleet Training and Testing Study Area (78 FR 21)

Federal Register / Vol. 75, No. 135 / Thursday, July 15, 2010 / Notices 41163

92132, or Meghan Byrne, Naval Facilities Engineering Command, Pacific. Attention: HSTT EIS/OEIS, 258 Makalapa Dr, Ste 100, Building 258, Floor 3, Room 258C210, Pearl Harbor, HI 96860–3134.

SUPPLEMENTARY INFORMATION: The DON's proposed action is to conduct training and testing activities that include the use of active sonar and explosives within the at-sea portions of existing DON training range complexes around the Hawaiian Islands and off the coast of Southern California (known as the HSTT study area). While the majority of these training and testing activities take place in operating and warning areas and/or on training and testing ranges, some training activities, such as sonar maintenance and gunnery exercises, are conducted concurrent with normal transits and may occur outside of DON operating and warning areas.

The HSTT study area combines the at-sea portions of the following range complexes: Hawaii Range Complex, Southern California Range Complex, and Silver Strand Training Complex. The existing western boundary of the Hawaii Range Complex is being expanded 60 miles to the west to the International Dateline. The HSTT study area also includes the transit route between Hawaii and Southern California as well as DON and commercial piers at Pearl Harbor, HI and San Diego, CA where sonar may be tested.

The proposed action is to conduct military training and testing activities in the HSTT study area. The purpose of the proposed action is to achieve and maintain Fleet Readiness to meet the requirements of Title 10 of the U.S. Code, which requires DON to "maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas." The proposed action would also allow DON to attain compliance with applicable environmental authorizations, consultations, and other associated environmental requirements, including those associated with new platforms and weapons systems, for example, the Low Frequency Anti-Submarine Warfare capability associated with the Littoral Combat Ship.

The alternatives that will be analyzed in the HSTT EIS and OEIS meet the purpose and need of the proposed action by providing the level of training that meets the requirements of Title 10, thereby ensuring that Sailors and Marines are properly prepared for operational success. Similarly, the level of RDT&E proposed for the HSTT study area is necessary to ensure that Sailors and Marines deployed overseas have the latest proven military equipment. Accordingly, the alternatives to be addressed in the HSTT EIS and OEIS are:

1. No Action—The No Action Alternative continues baseline training and testing activities and force structure requirements as defined by existing DON environmental planning documents. This documentation includes the Records of Decision for the Hawaii and Southern California range complexes and the Preferred Alternative for the Silver Strand Training Complex Draft EIS and OEIS.

2. Alternative 1—This alternative consists of the No Action alternative, plus expansion of the overall study area boundaries, and updates and/or adjustments to locations and tempo of training and testing activities. This alternative also includes changes to training and testing requirements necessary to accommodate force structure changes, and the development and introduction of new vessels, aircraft, and weapons systems.

3. Alternative 2—Alternative 2 consists of Alternative 1 with an increased tempo of training and testing activities. This alternative also allows for additional range enhancements and infrastructure requirements.

Resource areas that will be addressed because of the potential effects from the proposed action include, but are not limited to: Ocean and biological resources (including marine mammals and threatened and endangered species); air quality; airborne soundscape; cultural resources; transportation; regional economy; recreation; and public health and safety.

The scoping process will be used to identify community concerns and local issues to be addressed in the EIS and OEIS. Federal agencies, state agencies, local agencies, Native American Indian Tribes and Nations, the public, and interested persons are encouraged to provide comments to the DON to identify specific issues or topics of environmental concern that the commenter believes the DON should consider. All comments provided orally or in writing at the scoping meetings, will receive the same consideration during EIS and OEIS preparation. Written comments must be postmarked no later than September 14, 2010, and should be mailed to: Naval Facilities Engineering Command, Southwest, 2730 McKean Street, Building 291, San Diego, CA 92136–5198, Attention: Mr. Kent Randall—HSTT EIS/OEIS.

Dated: July 9, 2010.

D.J. Werner

Lieutenant Commander, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2010–17234 Filed 7–14–10; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement and Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102 of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality Regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508), and Executive Order 12114, the Department of the Navy (DON) announces its intent to prepare an Environmental Impact Statement (EIS) and Overseas EIS (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (RDT&E) activities (hereinafter referred to as "training and testing" activities) conducted within the Atlantic Fleet Training and Testing (AFTT) study area. The AFTT study area includes the western North Atlantic Ocean along the east coast of North America (including the area where the Undersea Warfare Training Range will be used), the Chesapeake Bay, and the Gulf of Mexico. Also included are select Navy pierside locations and channels. The AFTT study area does not include the Arctic. This EIS and OEIS is being prepared to renew and combine current regulatory permits and authorizations; address current training and testing not covered under existing permits and authorizations; and to obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements.

The DON will invite the National Marine Fisheries Service to be a cooperating agency in preparation of this EIS and OEIS.

DATES AND ADDRESSES: Five public scoping meetings will be held between 4 p.m. and 8 p.m. on the following dates and at the following locations:

1. Monday, August 23, 2010, Hynes Convention Center, 900 Boylston Street, Boston, MA.

2. Wednesday, August 25, 2010, Virginia Beach Convention Center, 1000 19th Street, Virginia Beach, VA.

3. Thursday, August 26, 2010, Crystal Coast Civic Center, 3505 Arendell Street, Morehead City, NC.

4. Tuesday, August 31, 2010, Prime F. Osborn III Convention Center, 1000 Water Street, Jacksonville, FL.

5. Wednesday, September 1, 2010, Gulf Coast Community College, 5230 West Highway 98, Panama City, FL.

Each of the five scoping meetings will consist of an informal, open house session with informational stations staffed by DON representatives. Meeting details will be announced in local newspapers. Additional information concerning meeting times is available on the EIS and OEIS Web page located at: *http://www.AFTTEIS.com.*

FOR FURTHER INFORMATION CONTACT: Naval Facilities Engineering Command, Code EV22LL (AFTT EIS/OEIS Project Manager), 6506 Hampton Boulevard, Norfolk, VA 23508–1278, telephone number 757–322–4645.

SUPPLEMENTARY INFORMATION: The DON's proposed action is to conduct training and testing activities that include the use of active sonar and explosives within the at-sea portions of existing range complexes and on RDT&E ranges within the AFTT study area (including the area where the Undersea Warfare Training Range will be used). The boundary of the AFTT study area begins seaward from the mean high water line and moves east to the 45 degree west longitude line, generally following the 2nd Fleet area of responsibility (except for the Arctic). The AFTT study area covers approximately 2.6 million square nautical miles of ocean area, which includes Navy operating areas (sea space) and warning areas (airspace). While the majority of Navy training and many testing activities take place within operating and warning areas and/or on RDT&E ranges, some activities, such as sonar maintenance and gunnery exercises, are conducted concurrent with normal transits and occur outside of operating and warning areas.

The following DON training range complexes fall within the AFTT study area: Northeast Range Complex, Virginia Capes (VACAPES) Range Complex, Navy Cherry Point Range Complex, Jacksonville Range Complex, Key West Range Complex, and Gulf of Mexico (GOMEX) Range Complex. The DON RDT&E ranges in the AFTT study area include: Naval Undersea Warfare Center Newport, Newport, RI; Naval Surface Warfare Center (NSWC) Panama City Division, FL; and NSWC Carderock Division South Florida Test Facility, FL. The piers and channels in the AFTT study area are located at the following Navy ports, Naval Shipyards, and Navy contractor shipyards: Bath Iron Works, ME; Portsmouth Naval Shipyard, ME; Electric Boat and Naval Base Groton, CT; Northrop Grumman Shipbuilding—Newport News, VA; Norfolk Naval Base, VA; Norfolk Naval Shipyard, VA; Naval Amphibious Base Little Creek, VA; Naval Base Kings Bay, GA; Naval Base Mayport, FL; Port Canaveral, FL; Northrop Grumman Shipbuilding—Avondale, LA; Northrop Grumman Shipbuilding—Ingalls, MS; and, Halter Moss Point Shipyard, MS.

The proposed action is to conduct military training and testing activities in the AFTT study area. The purpose of the proposed action is to achieve and maintain Fleet Readiness to meet the requirements of Title 10 of the U.S. Code, which requires the DON to "maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas." The proposed action would also allow the DON to attain compliance with applicable environmental authorizations, consultations, and other associated environmental requirements, including those associated with new platforms and weapons systems, for example, the Low Frequency Anti-Submarine Warfare capability associated with the Littoral Combat Ship.

The alternatives that will be analyzed in the AFTT EIS and OEIS meet the purpose and need of the proposed action by providing the level of training that meets the requirements of Title 10, thereby ensuring that Sailors and Marines are properly prepared for operational success. Similarly, the level of RDT&E proposed for the AFTT study area is necessary to ensure that Sailors and Marines deployed overseas have the latest proven military equipment. Accordingly, the alternatives to be addressed in the AFTT EIS and OEIS are:

1. No Action—The No Action Alternative continues baseline training and testing activities and force structure requirements as defined by existing DON environmental planning documents. This documentation includes the Records of Decision for Atlantic Fleet Active Sonar Training (AFAST), VACAPES, Navy Cherry Point, Jacksonville, and NSWC Panama City Division, and the Preferred Alternative for the GOMEX Draft EIS and OEIS.

2. Alternative 1—This alternative consists of the No Action alternative, plus expansion of the overall study area boundaries, and updates and/or adjustments to locations and tempo of training and testing activities. This alternative also includes changes to training and testing requirements necessary to accommodate force structure changes, and the development and introduction of new vessels, aircraft, and weapons systems.

3. Alternative 2—Alternative 2 consists of Alternative 1 with an increased tempo of training and testing activities. This alternative also allows for additional range enhancements and infrastructure requirements.

Resource areas that will be addressed due to the potential effects from the proposed action include, but are not limited to: Ocean and biological resources (including marine mammals and threatened and endangered species); air quality; airborne soundscape; cultural resources; transportation; regional economy; recreation; and public health and safety.

The scoping process will be used to identify community concerns and local issues to be addressed in the EIS and OEIS. Federal agencies, state agencies, local agencies, Native American Indian Tribes and Nations, the public, and interested persons are encouraged to provide comments to the DON to identify specific issues or topics of environmental concern that the commenter believes the DON should consider. All comments provided orally or in writing at the scoping meetings will receive the same consideration during EIS and OEIS preparation. Written comments must be postmarked no later than September 14, 2010, and should be mailed to: Naval Facilities Engineering Command, Atlantic, Code: EV22LL (AFTT EIS/OEIS Project Manager), 6506 Hampton Boulevard, Norfolk, VA, 23508–1278.

Dated: July 9, 2010.

D.J. Werner,

Lieutenant Commander, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2010–17237 Filed 7–14–10; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Submission for OMB Review; Comment Request

AGENCY: Department of Education.

SUMMARY: The Director, Information Collection Clearance Division,

waters, states are required to establish TMDLs according to a priority ranking.

EPA's Water Quality Planning and Management regulations include requirements related to the implementation of Section 303(d) of the CWA (40 CFR 130.7). The regulations require states to identify water-quality-limited waters still requiring TMDLs every two years. The lists of waters still needing TMDLs must also include priority rankings, identify the pollutants causing the impairment, and must identify the waters targeted for TMDL development during the next two years (40 CFR 130.7).

Consistent with EPA's regulations, Utah submitted to EPA its listing decisions under Section 303(d)(2) in correspondence dated March 31, 2011 and April 21, 2011. On February 10, 2012, EPA partially approved with further review pending for Kanab Creek and tributaries, Utah's 2008 and 2010 listings of waters and associated priority rankings. On April 11, 2012, EPA disapproved Utah's decision to not include Kanab Creek and tributaries, from state line to irrigation diversion at confluence with Reservoir Canyon on the 2008 and 2010 lists. EPA solicits public comment on the addition of these waters to the State's list, as required by 40 CFR 130.7(d)(2).

Authority: Clean Water Act, 33 U.S.C. 1251 *et seq.*

Dated: April 26, 2012.

Martin Hestmark,

Acting Assistant Regional Administrator, Office of Ecosystems Protection and Remediation.

[FR Doc. 2012–11428 Filed 5–10–12; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–9002–9]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7146 or *http://www.epa.gov/compliance/nepa/.*

Weekly receipt of Environmental Impact Statements
Filed 04/30/2012 Through 05/04/2012
Pursuant to 40 CFR 1506.9.

Notice

Section 309(a) of the Clean Air Act requires that EPA make public its comments on EISs issued by other Federal agencies. EPA's comment letters on EISs are available at: *http://www.epa.gov/compliance/nepa/eisdata.html.*

Supplementary Information: EPA is seeking agencies to participate in its e-NEPA electronic EIS submission pilot. Participating agencies can fulfill all requirements for EIS filing, eliminating the need to submit paper copies to EPA Headquarters, by filing documents online and providing feedback on the process. To participate in the pilot, register at: *https://cdx.epa.gov.*

EIS No. 20120136, Final Supplement, APHIS, NY, Bird Hazard Reduction Program, John F. Kennedy International Airport, Updated Information on the Efficacy and Impacts of the Gull Hazard Reduction Program and All Other Bird Hazard Management Activities, Queens County, NY, Review Period Ends: 06/13/2012, Contact: Martin S. Lowney 518–477–4837.

EIS No. 20120137, Draft EIS, USFS, 00, Mountain Pine Beetle Response Project, Implementing Multiple Resource Management Activities, Black Hills National Forest, Custer, Fall River, Lawrence, Meade, and Pennington Counties, SD and Crook and Weston Counties, WY, Comment Period Ends: 06/25/2012, Contact: Katie Van Alstyne 605–343–1567.

EIS No. 20120138, Draft EIS, USACE, FL, Tarmac King Road Limestone Mine, Construction, Issuance of Permit, Levy County, FL, Comment Period Ends: 07/11/2012, Contact: Edward Sarfert 850–439–9533.

EIS No. 20120139, Draft EIS, NPS, GA, Fort Pulaski National Monument General Management Plan and Wilderness Study, Implementation, Chatham County, GA, Comment Period Ends: 07/09/2012, Contact: David Libman 404–507–5701.

EIS No. 20120140, Final EIS, USAF, OH, Wright-Patterson Air Force Base (WPAFB) Project, Reconfigure and Relocate Facilities and Base Perimeter Fence Relocation in Area A, Fairborn, OH, Review Period Ends: 06/11/2012, Contact: Estella Holmes 937–522–3522.

EIS No. 20120141, Final EIS, USFS, CO, Beaver Creek Mountain Improvements Project, Special Use Permit, White River National Forest, Eagle County, CO, Review Period Ends: 06/11/2012, Contact: Don Dressler 970–827–5157.

EIS No. 20120142, Draft EIS, USN, 00, Atlantic Fleet Training and Testing Activities, To Support and Conduct Current, Emerging, and Future Training and Testing Activities along the Eastern Coast of the U.S. and Gulf of Mexico, Comment Period Ends: 06/25/2012, Contact: Jene Nissen 757–836–5221.

EIS No. 20120143, Draft EIS, USN, 00, Hawaii-Southern California Training and Testing Activities, To Support and Conduct Current, Emerging, and Future Training and Testing Activities off Southern California and around the Hawaiian Islands, CA, HI, Comment Period Ends: 06/25/2012, Contact: Alex Stone 619–545–8128.

EIS No. 20120144, Draft EIS, USAF, CA, F–15 Aircraft Conversion, 144th Fighter Wing, California National Guard, To Convert the Unit from the F–16 Fighting Falcon Aircraft and Operations to the F–15 Eagle Aircraft and Operations at Fresno-Yosemite International Airport, Fresno County, CA, Comment Period Ends: 06/25/2012, Contact: Robert Dogan 240–612–8859.

EIS No. 20120145, Draft EIS, BR, CA, Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority, 2014–2038, To Execute Agreements for Water Transfers/or Exchanges, San Joaquin Valley, Fresno, Madera, Merced, and Stanislaus Counties, CA, Comment Period Ends: 07/03/2012, Contact: Bradley Hubbard 916–978–5204.

Dated: May 8, 2012.

Cliff Rader,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 2012–11467 Filed 5–10–12; 8:45 am]

BILLING CODE 6560–50–P

FEDERAL COMMUNICATIONS COMMISSION

Information Collection Being Reviewed by the Federal Communications Commission

AGENCY: Federal Communications Commission.

ACTION: Notice and request for comments.

SUMMARY: As part of its continuing effort to reduce paperwork burden and as required by the Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501–3520), the Federal Communications Commission invites the general public and other Federal agencies to take this opportunity to comment on the following information collection(s). Comments are requested concerning: (a) Whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimate; (c) ways to enhance the quality, utility, and clarity of the information collected; (d) ways to

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transferred to the National Defense University. All associated records are covered under SORN DNDU 01 (September 21, 2010, 75 FR 57458). Therefore, the system of records notice can be deleted.

A0351c IRMC

IRMC Course Evaluation System (December 18, 2001, 66 FR 65180).

REASON:

The IRMC Course Evaluation System has now transferred to the National Defense University. All associated records are covered under SORN DNDU 01 (September 21, 2010, 75 FR 57458). Therefore, the system of records notice can be deleted.

[FR Doc. 2012–11420 Filed 5–10–12; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Meetings for the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality (40 Code of Federal Regulations parts 1500–1508), and Presidential Executive Order (EO) 12114, the Department of the Navy (DoN) has prepared and filed with the U.S. Environmental Protection Agency a Draft Environmental Impact Statement (EIS)/Overseas EIS (OEIS). The Draft EIS/OEIS evaluates the potential environmental effects associated with military readiness training and research, development, test and evaluation activities (training and testing) conducted within the Atlantic Fleet Training and Testing (AFTT) Study Area. The National Marine Fisheries Service (NMFS) is a cooperating agency for the EIS/OEIS.

The Study Area is in the western Atlantic Ocean and encompasses the waters off the east coast of North America and the Gulf of Mexico. The Study Area covers approximately 2.6 million square nautical miles of ocean area, and includes designated DoN operating areas and special use airspace. The following DoN testing ranges and range complexes fall within the Study Area: Northeast Range Complexes; Naval Undersea Warfare Center Division, Newport Testing Range; Virginia Capes Range Complex; Navy Cherry Point Range Complex; Jacksonville Range Complex; South Florida Ocean Measurement Facility Testing Range; Undersea Warfare Training Range; Key West Range Complex; Naval Surface Warfare Center, Panama City Division Testing Range; and Gulf of Mexico Range Complex. The Study Area only includes the at-sea components of these range complexes and testing ranges, with the exception of the Narragansett Bay, lower Chesapeake Bay, St. Andrew Bay. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area as indicated on the map. The remaining inland waters and land-based portions of the range complexes are not a part of the Study Area and will be or already have been addressed under separate environmental planning documentation.

With the filing of the Draft EIS/OEIS, the DoN is initiating a 60-day public comment period beginning on May 11, 2012 and ending on July 10, 2012. During this period, the DoN will conduct five public meetings to receive oral and written comments on the Draft EIS/OEIS. This notice announces the dates and locations of the public meetings and provides supplementary information about the environmental planning effort.

DATES AND ADDRESSES: Public information and comment meetings will be held at each of the locations listed below between 4:00 p.m. and 8:00 p.m. The meetings will provide individuals with information on the Draft EIS/OEIS in an open house format. DoN and NMFS representatives at informational poster stations will be available during the public meetings to clarify information related to the Draft EIS/OEIS.

The public meetings will be held between 4 p.m. and 8 p.m. on the following dates and at the following locations:

1. May 30, 2012 (Wednesday) at Hotel Providence, 139 Mathewson Street, Providence, RI;

2. June 5, 2012 (Tuesday) at Prime F. Osborn III Convention Center, 1000 Water Street, Jacksonville, FL;

3. June 6, 2012 (Wednesday) Hilton Garden Inn Panama City, 1101 North Highway 231, Panama City, FL;

4. June 11, 2012 (Monday) at Virginia Beach Convention Center, 1000 19th Street, Virginia Beach, VA;

5. June 12, 2012 (Tuesday) at Hampton Inn and Suites Swansboro, 215 Old Hammock Road, Swansboro, NC.

Federal, State and local agencies and officials, and interested groups and individuals are encouraged to provide comments in person at any of the public meetings or in writing anytime during the public comment period. At the public meetings, attendees will be able to submit comments orally using a voice recorder or in writing. Equal weight will be given to oral and written statements. Comments may also be submitted via the U.S. Postal Service to Naval Facilities Engineering Command Atlantic, Attn Code EV22 (AFTT EIS Project Managers), 6506 Hampton Boulevard, Norfolk, VA 23508–1278 or electronically via the project Web site (*http://www.AFTTEIS.com*). All statements, oral or written, submitted during the public review period will become part of the public record on the Draft EIS/OEIS and will be responded to in the Final EIS/OEIS. All written comments must be post marked or received by July 10, 2012, to ensure they become part of the official record.

FOR FURTHER INFORMATION CONTACT: Naval Facilities Engineering Command Atlantic, Attn Code EV22 (AFTT EIS Project Managers), 6506 Hampton Boulevard, Norfolk, VA 23508–1278.

SUPPLEMENTARY INFORMATION: A Notice of Intent (NOI) to prepare this DEIS/OEIS was published in the **Federal Register** on July 15, 2010, (75 FR 41163).

The DoN's Proposed Action is to conduct training and testing activities—which may include the use of active sonar and explosives—primarily within existing range complexes and testing ranges along the east coast of the United States, the Gulf of Mexico, Navy pierside locations, port transit channels, and the lower Chesapeake Bay. The purpose of the Proposed Action is to conduct training and testing activities to ensure that the DoN meets its mission to maintain, train, and equip combat-ready U.S. naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. This Draft EIS/OEIS will also support the renewal of federal regulatory permits and authorizations for current training and testing activities and to propose future training and testing activities requiring environmental analysis.

The Draft EIS/OEIS evaluates the potential environmental impacts of three alternatives, including the No Action Alternative and two action alternatives. The No Action Alternative continues baseline training and testing activities, as defined by existing DoN environmental planning documents.

Alternatives 1 and 2 analyze adjustments to Study Area boundaries and the location, type, and level of training and testing activities necessary to support current and planned DoN training and testing requirements through 2019. The analysis addresses force structure changes, including those resulting from the development, testing, and ultimate introduction of new vessels, aircraft and weapons systems into the fleet.

No significant adverse impacts are identified for any resource area in any geographic location within the Study Area that cannot be mitigated. Additionally, due to the exposure of marine mammals to underwater sound, NMFS has received an application from DoN for a Marine Mammal Protection Act Letter of Authorization and governing regulations to authorize incidental take of marine mammals that may result from the implementation of the activities analyzed in the Draft EIS/OEIS. In accordance with Section 7 of the Endangered Species Act, the DoN is consulting with NMFS and U.S. Fish and Wildlife Service, as appropriate, for potential impacts to federally listed species. In accordance with the Magnuson-Stevens Fishery Conservation and Management Act, the DoN is consulting with NMFS on federally managed species and their essential fish habitat. The DoN will initiate consultation under the National Historic Preservation Act regarding impacts to historic properties, and will comply with other applicable laws and regulations.

The Draft EIS/OEIS was distributed to Federal, State, and local agencies, elected officials, and other interested individuals and organizations. Copies of the Draft EIS/OEIS are available for public review at the following libraries:

1. Anne Arundel County Public Library, Annapolis Area Branch, 1410 West Street, Annapolis, MD 21401.
2. Bay County Public Library, 898 West 11th Street, Panama City, FL 32401.
3. Ben May Main Library, 701 Government Street, Mobile, AL 36602.
4. Boston Public Library, Central Library, 700 Boylston Street, Boston, MA 02116.
5. Camden County Public Library, 1410 Highway 40 E, Kingsland, GA 31548.
6. Carteret County Public Library, 1702 Live Oak Street, Suite 100, Beaufort, NC 28516.
7. Charleston County Public Library, Main Library, 68 Calhoun Street, Charleston, SC 29401.
8. Corpus Christi Public Library, La Retama Library, 805 Comanche, Corpus Christi, TX 78401.
9. East Bank Regional Library, 4747 West Napoleon Avenue, Metairie, LA 70001.
10. Hatteras Library, 57709 Highway 12, Hatteras, NC 27943.
11. Havelock-Craven County Public Library, 301 Cunningham Boulevard, Havelock, NC 28532.
12. Houston Public Library, 500 McKinney Street, Houston, TX 77002.
13. Jacksonville Public Library, Main Library, 303 North Laura Street, Jacksonville, FL 32202.
14. Kill Devil Hills Branch Library, Main Library, 400 Mustian Street, Kill Devil Hills, NC 27948.
15. Meridian-Lauderdale County Public Library, 2517 7th Street, Meridian, MS 39301.
16. New Hanover County Public Library, 201 Chestnut Street, Wilmington, NC 28401.
17. New Orleans Public Library, Main Library, 219 Loyola Avenue, New Orleans, LA 70112.
18. Mary D. Pretlow Anchor Branch Library, 111 West Ocean View Avenue, Norfolk, VA 23503.
19. Onslow County Public Library, 58 Doris Avenue East, Jacksonville, NC 28540.
20. Portland Public Library, 5 Monument Square, Portland, ME 04101.
21. Providence Public Library, 150 Empire Street, Providence, RI 02903.
22. Public Library of New London, 63 Huntington Street, New London, CT 06320.
23. Southmost Branch Library, 4320 Southmost Boulevard, Brownsville, TX 78521.
24. Walton County Coastal Branch Library, 437 Greenway Trail, Santa Rosa Beach, FL 32459.
25. Webb Memorial Library and Civic Center, 812 Evans Street, Morehead City, NC 28557.
26. West Florida Public Library, Main Library, 200 West Gregory Street, Pensacola, FL 32502.
27. West Florida Public Library, Southwest Branch, 12248 Gulf Beach Highway, Pensacola, FL 32507.
28. West Palm Beach Public Library, 411 Clematis Street, West Palm Beach, FL 33401.

Copies of the AFTT Draft EIS/OEIS are available for electronic viewing or download at *http://www.AFTTEIS.com*. A paper copy of the Executive Summary or a single compact disc of the Draft EIS/OEIS will be made available upon written request by contacting: Naval Facilities Engineering Command Atlantic, Attn Code EV22 (AFTT EIS Project Managers), 6506 Hampton Boulevard, Norfolk, VA 23508–1278.

Dated: May 4, 2012.

J.M. Beal,

Lieutenant Commander, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2012–11410 Filed 5–10–12; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Meetings for the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for Navy Hawaii-Southern California Training and Testing

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969, and regulations implemented by the Council on Environmental Quality regulations (40 Code of Federal Regulations parts 1500–1508), and Presidential Executive Order 12114, the Department of the Navy (DoN) has prepared and filed with the U.S. Environmental Protection Agency a Draft Environmental Impact Statement (EIS)/Overseas EIS (OEIS). The Draft EIS/OEIS evaluates the potential environmental effects associated with military readiness training and research, development, test and evaluation activities (training and testing) conducted within the Hawaii-Southern California Training and Testing (HSTT) Study Area. The National Marine Fisheries Service (NMFS) is a Cooperating Agency for the EIS/OEIS.

The HSTT Study Area is comprised of established operating and warning areas across the north-central Pacific Ocean, from Southern California west to Hawaii and the International Date Line. The Study Area combines the at-sea portions of the Hawaii Range Complex; the Southern California Range Complex; the Silver Strand Training Complex; transit corridors on the high seas that are not part of the range complexes where training and sonar testing may occur during vessel transit between the Hawaii Range Complex and the Southern California Range Complex; and Navy pierside locations where sonar maintenance and testing activities occurs. The HSTT Study Area includes only the at-sea components of the range complexes and testing ranges. The land-based portions of the range complexes are not a part of the Study Area and will be or already have been addressed under separate DoN environmental planning documentation.

sections of TSCA that EPA may provide Student Services contractors access to these CBI materials on a need-to-know basis only. All access to TSCA CBI under this contract will take place at EPA Headquarters in accordance with EPA's *TSCA CBI Protection Manual.*

Access to TSCA data, including CBI, will continue until August 30, 2014. If the contracts are extended, this access will also continue for the duration of the extended contracts without further notice.

The Student Services contractors personnel will be required to sign nondisclosure agreements and will be briefed on appropriate security procedures before they are permitted access to TSCA CBI.

List of Subjects

Environmental protection, Confidential business information.

Dated: May 5, 2012.

Mario Caraballo,

Acting Director, Information Management Division, Office of Pollution Prevention and Toxics.

[FR Doc. 2012–11973 Filed 5–17–12; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–9003–1]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7146 or *http://www.epa.gov/compliance/nepa/.*

Weekly receipt of Environmental Impact Statements filed 05/07/2012 through 05/11/2012.

Pursuant to 40 CFR 1506.9.

Notice

Section 309(a) of the Clean Air Act requires that EPA make public its comments on EISs issued by other Federal agencies. EPA's comment letters on EISs are available at: *http://www.epa.gov/compliance/nepa/eisdata.html.*

SUPPLEMENTARY INFORMATION: EPA is seeking agencies to participate in its e-NEPA electronic EIS submission pilot. Participating agencies can fulfill all requirements for EIS filing, eliminating the need to submit paper copies to EPA Headquarters, by filing documents online and providing feedback on the process. To participate in the pilot, register at: *https://cdx.epa.gov.*

EIS No. 20120146, Final EIS, USFS, OR, Jackson Vegetation Management Project, Implementation, Paulina Ranger District, Ochoco National Forest, Crook and Wheeler Counties, OR, Review Period Ends: 06/18/2012, Contact: Jeff Marszal 541–416–6500.

EIS No. 20120147, Final Supplement, USFS, OR, Cobbler II Timber Sale and Fuels Reduction Project, Updated Information to Revise and Clarify Aspects of the Analyses Presented in the FEIS of October 2010, Proposing Vegetation and Fuels Management to Improve Health and Vigor Upland Forest Stands and Reduce Hazardous and Ladder Fuels, Walla Walla Ranger District, Umatilla National Forest, Wallowa and Union Counties, OR, Review Period Ends: 06/18/2012, Contact: Kimpton Cooper 509–522–6290.

EIS No. 20120148, Draft EIS, USFS, NM, La Jara Mesa Mine Project, Development, Operation and Mine Reclamation up to 20 Years, Approval, Mt. Taylor Ranger District, Cibola National Forest, Cibola County, NM, Comment Period Ends: 07/16/2012, Contact: Keith Baker 505–346–3820.

EIS No. 20120149, Draft Supplement, FTA, CA, Capitol Expressway Corridor Project, To Construct an Extension of the Capitol Light Rail System from Alum Rock Station to the Eastridge Transit Center, Santa Clara Valley Transportation Authority, City of San Jose, Santa Clara County, CA, Comment Period Ends: 07/03/2012, Contact: Eric Eidlin 415–744–2502.

EIS No. 20120150, Draft EIS, FHWA, CA, Interchange 5/State Route 56 Interchange Project, Connection between southbound I–5 to eastbound SR–56 and northbound SR 56 to northbound I–5, San Diego County, CA, Comment Period Ends: 07/02/2012, Contact: Manuel E. Sanchez 619–699–7336.

EIS No. 20120151, Final EIS, USFS, MT, Sparring Bulls Project, Proposes Timber Harvest, Non-commercial Fuels Reduction, Prescribed Burning, and Watershed Improvement Activities, Three Rivers Ranger District, Kootenai National Forest, Lincoln County, MT, Review Period Ends: 06/18/2012, Contact: Leslie McDougall 406–295–4693.

EIS No. 20120152, Draft EIS, FHWA, CA, San Diego Freeway (I–405) Improvement Project, between State Route 73 and Interstate 605, USACE Section 404 Permit, Orange and Los Angeles Counties, CA, Comment Period Ends: 07/02/2012, Contact: Tay Dam 213–605–2013.

EIS No. 20120153, Draft EIS, NOAA, 00, Southeastern U.S. Shrimp Fisheries, To Reduce Incidental Bycatch and Mortality of Sea Turtles, Tidally Influenced Waters and Substrates of the Gulf of Mexico and South Atlantic and its Estuaries of LA, MS, AL, and NC and extending out to the limit of the U.S. Exclusive Economic Zone, Comment Period Ends: 07/02/2012, Contact: Michael Barnette 727–824–5312.

EIS No. 20120154, Final EIS, USFWS, MT, Charles M. Russell National Wildlife Refuge and UL Bend National Wildlife Refuge prehensive Conservation Plan, To Provide Alternatives and Identify Consequences, Fergus, Petroleum, Garfield, McCone, Valley, and Phillips Counties, MT, Review Period Ends: 06/18/2012, Contact: Laurie Shannon 303–236–4317.

EIS No. 20120155, Final EIS, USFS, NC, Uwharrie National Forest, Proposed Land and Resource Management Resource Plan, Implementation, Montgomery, Randolph and Davidson Counties, NC, Review Period Ends: 06/18/2012, Contact: Ruth Berner 828–257–4862.

EIS No. 20120156, Draft Supplement EIS, USFS, AK, Bell Island Geothermal Leases, To Update Analysis in the Programmatic EIS to Address Roadless Concerns, Consideration for Lease Approval, Ketchikan-Misty Fiords Ranger District, Tongass National Forest, Ketchikan Gateway Borough, AK, Comment Period Ends: 07/02/2012, Contact: Sarah Samuelson 907–789–6274.

Amended Notices

EIS No. 20120073, Draft EIS, USACE, CA, Isabella Lake Dam Safety Modification Project, To Remediate Seismic, Seepage, and Hydrologic Deficiencies in the Main Dam, Spillway and Auxiliary Dam, Kern County, CA, Comment Period Ends: 05/22/2012, Contact: Tyler M. Stalker 916–557–5107.

Revision to FR Notice Published 03/23/2012; Extending Comment Period from 05/07/12 to 05/22/2012.

EIS No. 20120130, Final EIS, USFS, CA, Algoma Vegetation Management Project, Proposing to Protect and Promote Conditions of Late-Successional Forest Ecosystem on 4,666 Acres, Shasta-Trinity National Forest, Siskiyou County, CA, Review Period Ends: 06/11/2012, Contact: Emelia Barnum 530–926–9600.

Revision to FR Notice Published 05/04/2012; Correction to Title.

EIS No. 20120142, Draft EIS, USN, 00, Atlantic Fleet Training and Testing Activities, To Support and Conduct

Current, Emerging, and Future Training and Testing Activities along the Eastern Coast of the U.S. and Gulf of Mexico, Comment Period Ends: 07/10/2012, Contact: Jene Nissen 757–836–5221.

Revision to FR Notice Published 05/11/2012; Extending Comment Period from 06/25/12 to 07/10/2012.

EIS No. 20120143, Draft EIS, USN, 00, Hawaii-Southern California Training and Testing Activities, To Support and Conduct Current, Emerging and Future Training and Testing Activities off Southern California and around the Hawaiian Islands, CA, HI, Comment Period Ends: 07/10/2012, Contact: Alex Stone 619–545–8128.

Revision to FR Notice Published 05/11/2012; Extending Comment Period from 06/25/12 to 07/10/2012.

Dated: May 15, 2012.

Cliff Rader,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 2012–12112 Filed 5–17–12; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OPP–2012–0003; FRL–9348–6]

SFIREG Full Committee; Notice of Public Meeting

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Association of American Pesticide Control Officials (AAPCO)/State FIFRA Issues Research and Evaluation Group (SFIREG), Full Committee will hold a 2-day meeting, beginning on June 18, 2012 and ending June 19, 2012. This notice announces the location and times for the meeting and sets forth the tentative agenda topics.

DATES: The meeting will be held on Monday, June 18, 2012 from 8:30 a.m. to 5:00 p.m. and 8:30 a.m. to 12 noon on Tuesday June 19, 2012.

To request accommodation of a disability, please contact the person listed under **FOR FURTHER INFORMATON CONTACT**, preferably at least 10 days prior to the meeting, to give EPA as much time as possible to process your request.

ADDRESSES: The meeting will be held at EPA. One Potomac Yard (South Bldg.), 2777 S. Crystal Dr., Arlington, VA, 22202, 1st Floor South Conference Room.

FOR FURTHER INFORMATION CONTACT: Ron Kendall, Field External Affairs Division, Office of Pesticide Programs, Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460–0001; telephone number: (703) 305–5561; fax number: (703) 305–1850; email address: *kendall.ron@epa.gov.* or Grier Stayton, SFIREG Executive Secretary, P.O. Box 466, Milford, DE 19963; telephone number (302) 422–8152; fax (302) 422–2435; email address: *stayton.grier@aapco-sfireg@comcast.net.*

SUPPLEMENTARY INFORMATION:

I. General Information

A. Does this action apply to me?

You may be potentially affected by this action if you are interested in pesticide regulation issues affecting States and any discussion between EPA and SFIREG on FIFRA field implementation issues related to human health, environmental exposure to pesticides, and insight into EPA's decision-making process. You are invited and encouraged to attend the meetings and participate as appropriate. Potentially affected entities may include, but are not limited to:

Those persons who are or may be required to conduct testing of chemical substances under the Federal Food, Drug and Cosmetics Act (FFDCA), or the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and those who sell, distribute or use pesticides, as well as any Non Government Organization.

This listing is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. Other types of entities not listed in this unit could also be affected. The North American Industrial Classification System (NAICS) codes have been provided to assist you and others in determining whether this action might apply to certain entities. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed under **FOR FURTHER INFORMATION CONTACT.**

B. How can I get copies of this document and other related information?

EPA has established a docket for this action under docket ID number EPA–HQ–OPP–2012–0003. Publicly available docket materials are available either in the electronic docket at *http://www.regulations.gov,* or, if only available in hard copy, at the Office of Pesticide Programs (OPP) Regulatory Public Docket in Rm. S–4400, One Potomac Yard (South Bldg.), 2777 S. Crystal Dr., Arlington, VA. The hours of operation of this Docket Facility are from 8:30 a.m. to 4 p.m., Monday through Friday, excluding legal holidays. The Docket Facility telephone number is (703) 305–5805.

II. Tentative Agenda Topics

1. Office of Pesticide Programs update
2. Office of Compliance and Enforcement update
3. Responses to SFIREG Bed Bug and Endangered Species Act Consultation letters
4. Pollinator Protection issues
5. Methomyl fly bait restricted use classification
6. Pyrethroid Label Changes
7. Regional issues/responses to pre-SFIREG questionnaire
8. Report on "State Regulator in Residence" program—issues and opportunities
9. Tribal certification policy implementation—Issues and information exchange
10. Performance Measures Development
11. Imprelis update/discussion on "down stream" effects of pesticides outside control of applicator (e.g. hot compost, treated irrigation water)
12. Interactions of EPA Regions and State Lead Agencies on:
   a. Support for/involvement with
   b. Enforcement/compliance efforts
   c. Certification/training efforts
   d. Environmental programs
   e. Registration issues
13. Grant Negotiation Procedures
14. Distributor Label Enforcement coordination
15. Update on progress of referred cases

III. How can I request to participate in this meeting?

This meeting is open for the public to attend. You may attend the meeting without further notification.

List of Subjects Environmental protection.

Dated: May 5, 2012.

R. McNally,

Director, Field External Affairs Division, Office of Pesticide Programs.

[FR Doc. 2012–11971 Filed 5–17–12; 8:45 am]

BILLING CODE 6560–50–P

FEDERAL COMMUNICATIONS COMMISSION

[MB Docket No. 12–122; File No. CSR–8529–P; DA 12–739]

Game Show Network, LLC v. Cablevision Systems Corp.

AGENCY: Federal Communications Commission.

FEDERAL REGISTER

Vol. 78 Thursday,
No. 21 January 31, 2013

Part IV

Department of Commerce

National Oceanic and Atmospheric Administration

50 CFR Part 218

Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Training and Testing Activities in the Atlantic Fleet Training and Testing Study Area; Proposed Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 130109022–3022–01]

RIN 0648–BC53

Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Training and Testing Activities in the Atlantic Fleet Training and Testing Study Area

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of proposed rulemaking; request for comments and information.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to the training and testing activities conducted in the Atlantic Fleet Training and Testing (AFTT) study area from January 2014 through January 2019. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue regulations and subsequent Letters of Authorization (LOAs) to the Navy to incidentally harass marine mammals.

DATES: Comments and information must be received no later than March 11, 2013.

ADDRESSES: You may submit comments, identified by 0648–BC53, by either of the following methods:

- Electronic submissions: submit all electronic public comments via the Federal eRulemaking Portal *http://www.regulations.gov*
- Hand delivery of mailing of paper, disk, or CD–ROM comments should be addressed to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.regulations.gov* without change. All Personal Identifying Information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information.

NMFS will accept anonymous comments (enter N/A in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Work, Excel, WordPerfect, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Brian D. Hopper, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application may be obtained by visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*. The Navy's Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS) for AFTT was made available to the public on May 11, 2012 (77 FR 27742). Documents cited in this notice may also be viewed, by appointment, during regular business hours, at the aforementioned address.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "* * * an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

The National Defense Authorization Act of 2004 (NDAA) (Pub. L. 108–136) removed the "small numbers" and "specified geographic region" limitations indicated above and amended the definition of "harassment" as applied to "military readiness activity" to read as follows (Section 3(18)(B) of the MMPA: "(i) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment]."

Summary of Request

On April 13, 2012, NMFS received an application from the Navy requesting regulations and two LOAs for the take of 42 species of marine mammals incidental to Navy training and testing activities to be conducted in the AFTT Study Area over 5 years. The Navy submitted addendums on September 24, 2012 and December 21, 2012, and the application was considered complete. This proposed rule is based on the information contained in the revised LOA applications. The Navy is requesting regulations that would establish a process for authorizing take, via two separate 5-year LOAs, of marine mammals for training activities and for testing activities, each proposed to be conducted from 2014 through 2019. The Study Area includes several existing study areas, range complexes, and testing ranges (Atlantic Fleet Active Sonar Training (AFAST), Northeast, Virginia Capes (VACAPES), Cherry Point (CHPT), Jacksonville (JAX), Gulf of Mexico (GOMEX), Naval Surface Warfare Center, Panama City, Naval Undersea Warfare Center Newport, South Florida Ocean Measurement Facility (SFOMF), and Key West) plus pierside locations and areas on the high seas where maintenance, training, or testing may occur. The proposed activities are classified as military readiness activities. Marine mammals present in the Study Area may be exposed to sound from active sonar, underwater detonations, and/or pile driving and removal. In addition, incidental takes of marine mammals may occur from ship strikes. The Navy requests authorization to take individuals of 42 marine mammal species by Level B harassment and individuals of 32 marine mammal species by Level A harassment. In addition, the Navy requests authorization for take by serious injury or mortality individuals of 16 marine mammal species due to the use of explosives, and 11 total marine mammals (any species except North Atlantic right whale) over the course of the 5-year rule due to vessel strike.

The Navy's application and the AFTT DEIS/OEIS contain proposed acoustic criteria and thresholds that would, in some instances, represent changes from what NMFS has used to evaluate the

Navy's proposed activities for past incidental take authorizations. The revised thresholds are based on evaluations of recent scientific studies; a detailed explanation of how they were derived is provided in the AFTT DEIS/OEIS Criteria and Thresholds Technical Report. NMFS is currently updating and revising all of its acoustic criteria and thresholds. Until that process is complete, NMFS will continue its long-standing practice of considering specific modifications to the acoustic criteria and thresholds currently employed for incidental take authorizations only after providing the public with an opportunity for review and comment. NMFS is requesting comments on all aspects of the proposed rule, and specifically requests comment on the proposed acoustic criteria and thresholds.

Background of Request

The Navy's mission is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. Section 5062 of Title 10 of the United States Code directs the Chief of Naval Operations to train all military forces for combat. The Chief of Naval Operations meets that directive, in part, by conducting at-sea training exercises and ensuring naval forces have access to ranges, operating areas (OPAREAs) and airspace where they can develop and maintain skills for wartime missions and conduct research, development, testing, and evaluation (RDT&E) of naval systems.

The Navy proposes to continue conducting training and testing activities within the AFTT Study Area, which have been ongoing since the 1940s. Recently, most of these activities were analyzed in six separate EISs completed between 2009 and 2011; the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS (U.S. Department of the Navy, 2009a), the Virginia Capes Range Complex (VACAPES) EIS/OEIS (U.S. Department of the Navy, 2009b), the Navy Cherry Point Range Complex (CHPT) EIS/OEIS (U.S. Department of the Navy, 2009c), the Jacksonville Range Complex (JAX) EIS/OEIS (U.S. Department of the Navy, 2009d), the Panama City (PCD) EIS/OEIS (U.S. Department of the Navy, 2009e), and the Gulf of Mexico (GOMEX) EIS/OEIS (U.S. Department of the Navy, 2011). These documents, among others, and their associated MMPA regulations and authorizations, describe the baseline of training and testing activities currently conducted in the Study Area. The tempo and types of training and testing activities have fluctuated due to changing requirements; new technologies; the dynamic nature of international events; advances in warfighting doctrine and procedures; and changes in basing locations for ships, aircraft, and personnel. Such developments influence the frequency, duration, intensity, and location of required training and testing. The Navy's request covers training and testing activities that would occur for a 5-year period following the expiration of the current MMPA authorizations for AFAST, VACAPES, CHPT, JAX, and GOMEX. The Navy has also prepared a DEIS/OEIS analyzing the effects on the human environment of implementing their preferred alternative (among others).

The quantified results of the marine mammal acoustic effects analysis presented in the Navy's LOA application differ from the quantified results presented in the AFTT DEIS/OEIS. The differences are due to three main factors: (1) Changes to tempo or location of certain training and testing activities; (2) refinement to the modeling inputs for training and testing; and (3) additional post-model analysis of acoustic effects to include animal avoidance of repeated sound sources, avoidance of areas of activity before use of a sound source or explosive by sensitive species, and implementation of mitigation. The additional post-model analysis of acoustic effects was performed to clarify potential misunderstandings of the numbers presented as modeling results in the AFTT DEIS/OEIS. Some comments indicated that the readers believed the acoustic effects to marine mammals presented in the DEIS/OEIS were representative of the actual expected effects, although the AFTT DEIS/OEIS did not account for animal avoidance of an area prior to commencing sound-producing activities, animal avoidance of repeated explosive noise exposures, and the protections due to standard Navy mitigations. The net result of these changes is an overall decrease in takes in the Mortality and Level A takes within the LOA application compared with the DEIS, a net reduction in Level B takes for training, and a net increase in Level B takes for testing. The Navy has advised NMFS that all comments received on the proposed rule that address: (1) Changes to the tempo or location of certain proposed activities; (2) refinement to the modeling inputs for training and testing; and (3) additional post-model analysis of acoustic effects and implementation of mitigation, will be reviewed and addressed by the Navy in its FEIS/OEIS for AFTT.

Description of the Specified Activity

The Navy requests authorization to take marine mammals incidental to conducting training and testing activities. The Navy has determined that non-impulsive sources (e.g. sonar), underwater detonations, pile driving and removal, and vessel strikes are the stressors most likely to result in impacts on marine mammals that could rise to the level of harassment. Detailed descriptions of these activities are provided in the Navy's Draft Environmental Impact Statement (DEIS) and LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm*) and summarized here.

Overview of Training Activities

The Navy routinely trains in the AFTT Study Area in preparation for national defense missions. Training activities are categorized into eight functional warfare areas (anti-air warfare; amphibious warfare; strike warfare; anti-surface warfare; anti-submarine warfare; electronic warfare; mine warfare; and naval special warfare). The Navy determined that stressors used in the following warfare areas are most likely to result in impacts on marine mammals:

- Amphibious warfare (underwater detonations, pile driving and removal)
- Anti-surface warfare (underwater detonations)
- Anti-submarine warfare (active sonar, underwater detonations)
- Mine warfare (active sonar, underwater detonations)
- Naval special warfare (underwater detonations)

The Navy's activities in anti-air warfare, strike warfare, and electronic warfare do not produce stressors that could result in harassment of marine mammals. Therefore, these activities are not discussed further.

Amphibious Warfare

The mission of amphibious warfare is to project military power from the sea to the shore through the use of naval firepower and Marine Corps landing forces. The Navy uses amphibious warfare to attack a threat located on land by a military force embarked on ships. Amphibious warfare training ranges from individual, crew, and small unit events to large task force exercises. Individual and crew training include amphibious vehicles and naval gunfire support training for shore assaults, boat raids, airfield or port seizures, and reconnaissance. Large-scale amphibious exercises involve ship-to-shore

maneuver, naval fire support, such as shore bombardment, and air strike and close air support training. However, the Navy only analyzed those portions of amphibious warfare training that occur at sea, in particular, underwater detonations associated with naval gunfire support training. The Navy conducts other amphibious warfare support activities that could potentially impact marine mammals (such as pile driving and removal) in the near shore region from the beach to about 914 m from shore.

Anti-Surface Warfare

The mission of anti-surface warfare is to defend against enemy ships or boats. When conducting anti-surface warfare, aircraft use cannons, air-launched cruise missiles, or other precision munitions (guided and unguided); ships use naval guns, and surface-to-surface missiles; and submarines use torpedoes or submarine-launched, anti-ship cruise missiles. Anti-surface warfare training includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or exercise torpedo launch events.

Anti-Submarine Warfare

The mission of anti-submarine warfare is to locate, neutralize, and defeat hostile submarine threats to surface forces. Anti-submarine warfare is based on the principle of a layered defense of surveillance and attack aircraft, ships, and submarines all searching for hostile submarines. These forces operate together or independently to gain early warning and detection, and to localize, track, target, and attack hostile submarine threats. Anti-submarine warfare training addresses basic skills such as detection and classification of submarines, distinguishing between sounds made by enemy submarines and those of friendly submarines, ships, and marine life. More advanced, integrated anti-submarine warfare training exercises are conducted in coordinated, at-sea training events involving submarines, ships, and aircraft. This training integrates the full spectrum of anti-submarine warfare from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons.

Mine Warfare

The mission of mine warfare is to detect, and avoid or neutralize mines to protect Navy ships and submarines and to maintain free access to ports and shipping lanes. Mine warfare also includes offensive mine laying to gain control or deny the enemy access to sea space. Naval mines can be laid by ships, submarines, or aircraft. Mine warfare training includes exercises in which ships, aircraft, submarines, underwater vehicles, or marine mammal detection systems search for mines. Certain personnel train to destroy or disable mines by attaching and detonating underwater explosives to simulated mines. Other neutralization techniques involve impacting the mine with a bullet-like projectile or intentionally triggering the mine to detonate.

Naval Special Warfare

The mission of naval special warfare is to conduct unconventional warfare, direct action, combat terrorism, special reconnaissance, information warfare, security assistance, counter-drug operations, and recovery of personnel from hostile situations. Naval special warfare operations are highly specialized and require continual and intense training. Naval special warfare units are required to utilize a combination of specialized training, equipment, and tactics, including insertion and extraction operations using parachutes, submerged vehicles, rubber boats, and helicopters; boat-to-shore and boat-to-boat gunnery; underwater demolition training; reconnaissance; and small arms training.

Overview of Testing Activities

The Navy researches, develops, tests, and evaluates new platforms, systems, and technologies. Testing activities may occur independently of or in conjunction with training activities. Many testing activities are conducted similarly to Navy training activities and are also categorized under one of the primary mission areas. Other testing activities are unique and are described within their specific testing categories. The Navy determined that stressors used during the following testing activities are most likely to result in impacts on marine mammals:

- Naval Air Systems Command (NAVAIR) Testing
- Anti-surface warfare testing (underwater detonations)
- Anti-submarine warfare testing (active sonar, underwater detonations)
- Mine warfare testing (active sonar, underwater detonations)
- Naval Sea Systems Command (NAVSEA) Testing
- New ship construction (active sonar, underwater detonations)
- Shock trials (underwater detonations)
- Life cycle activities (active sonar, underwater detonations)
- Range Activities (active sonar, underwater detonations)
- Anti-surface warfare/anti-submarine warfare testing (active sonar, underwater detonations)
- Mine warfare testing (active sonar, underwater detonations)
- Ship protection systems and swimmer defense testing (active sonar, airguns)
- Unmanned vehicle testing (active sonar)
- Other testing (active sonar)
- Office of Naval Research (ONR) and Naval Research Laboratory (NRL) Testing
- ONR/NRL Research, Development, Test & Evaluation (active sonar)

Other Navy testing activities that do not involve underwater non-impulse sources or impulse sources that could result in marine mammal harassment are not discussed further.

Naval Air Systems Command Testing (NAVAIR)

NAVAIR events include testing of new aircraft platforms, weapons, and systems before delivery to the fleet for training activities. NAVAIR also conducts lot acceptance testing of weapons and systems, such as sonobuoys. In general, NAVAIR conducts its testing activities the same way the fleet conducts its training activities. However, NAVAIR testing activities may occur in different locations than equivalent fleet training activities and testing of a particular system may differ slightly from the way the fleet trains with the same system.

Anti-Surface Warfare Testing

Anti-surface warfare testing includes air-to-surface gunnery, missile, and rocket exercises. Testing is required to ensure the equipment is fully functional for defense from surface threats. Testing may be conducted on new guns or gun rounds, missiles, rockets, and aircraft, and also in support of scientific research to assess new and emerging technologies. Testing events are often integrated into training activities and in most cases the systems are used in the same manner in which they are used for fleet training activities.

Anti-Submarine Warfare Testing

Anti-submarine warfare testing addresses basic skills such as detection and classification of submarines, distinguishing between sounds made by enemy submarines and those of friendly submarines, ships, and marine life. More advanced, integrated anti-submarine warfare testing is conducted in coordinated, at-sea training events involving submarines, ships, and

aircraft. This testing integrates the full spectrum of anti-submarine warfare from detecting and tracking a submarine to attacking a target using various torpedoes and weapons.

Mine Warfare Testing

Mine warfare testing includes activities in which aircraft detection systems are used to search for and record the location of mines for subsequent neutralization. Mine neutralization tests evaluate a system's effectiveness at intentionally detonating or otherwise disabling the mine. Different mine neutralization systems are designed to neutralize mines either at the sea surface or deployed deeper within the water column. All components of these systems are tested in the at-sea environment to ensure they meet mission requirements.

Naval Sea Systems Command Testing (NAVSEA)

NAVSEA testing activities are aligned with its mission of new ship construction, shock trials, life cycle activities, range activities, and other weapon systems development and testing.

New Ship Construction Activities

Ship construction activities include pierside testing of ship systems, tests to determine how the ship performs at-sea (sea trials), and developmental and operational test and evaluation programs for new technologies and systems. Pierside and at-sea testing of systems aboard a ship may include sonar, acoustic countermeasures, radars, and radio equipment. During sea trials, each new ship propulsion engine is operated at full power and subjected to high-speed runs and steering tests. At-sea test firing of shipboard weapon systems, including guns, torpedoes, and missiles, are also conducted.

Shock Trials

One ship of each new class (or major upgrade) of combat surface ships constructed for the Navy may undergo an at-sea shock trial. A shock trial is a series of underwater detonations that send a shock wave through the ship's hull to simulate near misses during combat. A shock trial allows the Navy to validate the shock hardness of the ship and assess the survivability of the hull and ship's systems in a combat environment as well as the capability of the ship to protect the crew.

Life Cycle Activities

Testing activities are conducted throughout the life of a Navy ship to verify performance and mission capabilities. Sonar system testing occurs pierside during maintenance, repair, and overhaul availabilities, and at sea immediately following most major overhaul periods. A Combat System Ship Qualification Trial is conducted for new ships and for ships that have undergone modification or overhaul of their combat systems.

Radar cross signature testing of surface ships is conducted on new vessels and periodically throughout a ship's life to measure how detectable the ship is by radar. Electromagnetic measurements of off-board electromagnetic signatures are also conducted for submarines, ships, and surface craft periodically.

Range Activities

NAVSEA's testing ranges are used to conduct principal testing, analysis, and assessment activities for ship and submarine platforms, including ordnance, mines, and machinery technology for surface combat systems. Naval Surface Warfare Center, Panama City Division Testing Range focuses on surface warfare tests that often involve mine countermeasures. Naval Undersea Warfare Center Division, Newport Testing Range focuses on the undersea aspects of warfare and is, therefore, structured to test systems such as torpedoes and unmanned underwater vehicles. The South Florida Ocean Measurement Facility Testing Range retains a unique capability that focuses on signature analysis operations and mine warfare testing events.

Other Weapon Systems Development and Testing

Numerous test activities and technical evaluations, in support of NAVSEA's systems development mission, often occur with fleet activities within the Study Area. Tests within this category include, but are not limited to, anti-surface, anti-submarine, and mine warfare, using torpedoes, sonobuoys, and mine detection and neutralization systems.

Office of Naval Research (ONR) and Naval Research Laboratory (NLR) Testing

As the Navy's Science and Technology provider, ONR and NRL provide technology solutions for Navy and Marine Corps needs. ONR's mission, defined by law, is to plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security. Further, ONR manages the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test and evaluation. The Ocean Battlespace Sensing Department explores science and technology in the areas of oceanographic and meteorological observations, modeling, and prediction in the battlespace environment; submarine detection and classification (anti-submarine warfare); and mine warfare applications for detecting and neutralizing mines in both the ocean and littoral environments. ONR events include: Research, development, test and evaluation activities; surface processes acoustic communications experiments; shallow water acoustic propagation experiments; and long range acoustic propagation experiments.

Sonar, Ordnance, Targets, and Other Systems

The Navy uses a variety of sensors, platforms, weapons, and other devices to meet its mission. Training and testing with these systems may introduce acoustic (sound) energy into the environment. This section describes and organizes sonar systems, ordnance, munitions, targets, and other systems to facilitate understanding of the activities in which these systems are used. Underwater sound is described as one of two types for the purposes of the Navy's application: Impulsive and non-impulsive. Underwater detonations of explosives and other percussive events are impulsive sounds. Sonar and similar sound producing systems are categorized as non-impulsive sound sources.

Sonar and Other Non-Impulsive Sources

Modern sonar technology includes a variety of sonar sensor and processing systems. The simplest active sonar emits sound waves, or "pings," sent out in multiple directions and the sound waves then reflect off of the target object in multiple directions. The sonar source calculates the time it takes for the reflected sound waves to return; this calculation determines the distance to the target object. More sophisticated active sonar systems emit a ping and then rapidly scan or listen to the sound waves in a specific area. This provides both distance to the target and directional information. Even more advanced sonar systems use multiple receivers to listen to echoes from several directions simultaneously and provide efficient detection of both direction and distance. The Navy rarely uses active sonar continuously throughout activities. When sonar is in use, the pings occur at intervals, referred to as a duty cycle, and the signals themselves

are very short in duration. For example, sonar that emits a 1-second ping every 10 seconds has a 10 percent duty cycle. The Navy utilizes sonar systems and other acoustic sensors in support of a variety of mission requirements. Primary uses include the detection of, and defense against, submarines (anti-submarine warfare) and mines (mine warfare); safe navigation and effective communications; use of unmanned undersea vehicles; and oceanographic surveys.

Ordnance and Munitions

Most ordnance and munitions used during training and testing events fall into three basic categories: projectiles (such as gun rounds), missiles (including rockets), and bombs. Ordnance can be further defined by their net explosive weight, which considers the type and quantity of the explosive substance without the packaging, casings, bullets, etc. Net explosive weight (NEW) is the trinitrotoluene (TNT) equivalent of energetic material, which is the standard measure of strength of bombs and other explosives. For example, a 5-inch shell fired from a Navy gun is analyzed at about 9.5 pounds (lb) (4.3 kg) of NEW. The Navy also uses non-explosive ordnance in place of high explosive ordnance in many training and testing events. Non-explosive ordnance munitions look and perform similarly to high explosive ordnance, but lack the main explosive charge.

Defense Countermeasures

Naval forces depend on effective defensive countermeasures to protect themselves against missile and torpedo attack. Defensive countermeasures are devices designed to confuse, distract, and confound precision guided munitions. Defensive countermeasures analyzed in this LOA application include acoustic countermeasures, which are used by surface ships and submarines to defend against torpedo attack. Acoustic countermeasures are either released from ships and submarines, or towed at a distance behind the ship.

Mine Warfare Systems

The Navy divides mine warfare systems into two categories: Mine detection and mine neutralization. Mine detection systems are used to locate, classify, and map suspected mines, on the surface, in the water column, or on the sea floor. The Navy analyzed the following mine detection systems for potential impacts on marine mammals:

- Towed or hull-mounted mine detection systems. These detection systems use acoustic and laser or video sensors to locate and classify suspect mines. Fixed and rotary wing platforms, ships, and unmanned vehicles are used for towed systems, which can rapidly assess large areas.
- Unmanned/remotely operated vehicles. These vehicles use acoustic and video or lasers to locate and classify mines and provide unique capabilities in nearshore littoral areas, surf zones, ports, and channels.

Mine Neutralization Systems

Mine neutralization systems disrupt, disable, or detonate mines to clear ports and shipping lanes, as well as littoral, surf, and beach areas in support of naval amphibious operations. The Navy analyzed the following mine neutralization systems for potential impacts to marine mammals:

- Towed influence mine sweep systems. These systems use towed equipment that mimic a particular ship's magnetic and acoustic signature triggering the mine and causing it to explode.
- Unmanned/remotely operated mine neutralization systems. Surface ships and helicopters operate these systems, which place explosive charges near or directly against mines to destroy the mine.
- Airborne projectile-based mine clearance systems. These systems neutralize mines by firing a small or medium-caliber non-explosive, supercavitating projectile from a hovering helicopter.
- Diver emplaced explosive charges. Operating from small craft, divers put explosive charges near or on mines to destroy the mine or disrupt its ability to function.

Classification of Non-Impulsive and Impulsive Sources Analyzed

In order to better organize and facilitate the analysis of about 300 sources of underwater non-impulsive sound or impulsive energy, the Navy developed a series of source classifications, or source bins. This method of analysis provides the following benefits:

- Allows for new sources to be covered under existing authorizations, as long as those sources fall within the parameters of a "bin;"
- Simplifies the data collection and reporting requirements anticipated under the MMPA;
- Ensures a conservative approach to all impact analysis because all sources in a single bin are modeled as the most powerful source (e.g., lowest frequency, highest source level, longest duty cycle, or largest net explosive weight within that bin);
- Allows analysis to be conducted more efficiently, without compromising the results;
- Provides a framework to support the reallocation of source usage (hours/explosives) between different source bins, as long as the total number of marine mammal takes remain within the overall analyzed and authorized limits. This flexibility is required to support evolving Navy training and testing requirements, which are linked to real world events.

A description of each source classification is provided in Tables 1–3. Non-impulsive sources are grouped into bins based on the frequency, source level when warranted, and how the source would be used. Impulsive bins are based on the net explosive weight of the munitions or explosive devices. The following factors further describe how non-impulsive sources are divided:

- Frequency of the non-impulsive source:
  - Low-frequency sources operate below 1 kilohertz (kHz)
  - Mid-frequency sources operate at and above 1 kHz, up to and including 10 kHz
  - High-frequency sources operate above 10 kHz, up to and including 100 kHz
  - Very high-frequency sources operate above 100 kHz, but below 200 kHz
- Source level of the non-impulsive source:
  - Greater than 160 decibels (dB), but less than 180 dB
  - Equal to 180 dB and up to 200 dB
  - Greater than 200 dB

How a sensor is used determines how the sensor's acoustic emissions are analyzed. Factors to consider include pulse length (time source is "on"); beam pattern (whether sound is emitted as a narrow, focused beam, or, as with most explosives, in all directions); and duty cycle (how often a transmission occurs in a given time period during an event).

There are also non-impulsive sources with characteristics that are not anticipated to result in takes of marine mammals. These sources have low source levels, narrow beam widths, downward directed transmission, short pulse lengths, frequencies beyond known hearing ranges of marine mammals, or some combination of these factors. These sources were not modeled by the Navy, but are qualitatively analyzed in Table 1–5 of the LOA application and Table 2.3.3 of the AFTT Draft EIS/OEIS.

TABLE 1—EXPLOSIVE (IMPULSIVE) TRAINING AND TESTING SOURCE CLASSES ANALYZED

Source class	Representative munitions	Net Explosive weight (lbs)
E1	Medium-caliber projectiles	0.1–0.25
E2	Medium-caliber projectiles	0.26–0.5
E3	Large-caliber projectiles	>0.5–2.5
E4	Improved Extended Echo Ranging Sonobuoy	>2.5–5.0
E5	5 in. projectiles	>5–10
E6	15 lb. shaped charge	>10–20
E7	40 lb. demo block/shaped charge	>20–60
E8	250 lb. bomb	>60–100
E9	500 lb. bomb	>100–250
E10	1,000 lb. bomb	>250–500
E11	650 lb. mine	>500–650
E12	2,000 lb. bomb	>650–1,000
E13	1,200 lb. HBX charge	>1,000–1,740
E14	2,500 lb HBX charge	>1,740–3,625
E15	5,000 lb HBX charge	>3,625–7,250

TABLE 2—ACTIVE ACOUSTIC (NON-IMPULSIVE) SOURCE CLASSES ANALYZED

Source class category	Source class	Description
Low-Frequency (LF): Sources that produce low-frequency (less than 1 kHz) signals.	LF3	Low-frequency sources greater than 200 dB.
	LF4	Low-frequency sources equal to 180 dB and up to 200 dB.
	LF5	Low-frequency sources greater than 160 dB, but less than 180 dB.
Mid-Frequency (MF): Tactical and non-tactical sources that produce mid-frequency (1 to 10 kHz) signals.	MF1	Hull-mounted surface ship sonar (e.g., AN/SQS-53C and AN/SQS–60).
	MF1K	Kingfisher mode associated with MF1 sonar.
	MF2	Hull-mounted surface ship sonar (e.g., AN/SQS–56).
	MF2K	Kingfisher mode associated with MF2 sonar.
	MF3	Hull-mounted submarine sonar (e.g., AN/BQQ–10).
	MF4	Helicopter-deployed dipping sonar (e.g., AN/AQS–22 and AN/AQS–13).
	MF5	Active acoustic sonobuoys (e.g., DICASS).
	MF6	Active sound underwater signal devices (e.g., MK–84).
	MF8	Active sources (greater than 200 dB) not otherwise binned.
	MF9	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned.
	MF10	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned.
	MF11	Hull-mounted surface ship sonar with an active duty cycle greater than 80%.
	MF12	Towed array surface ship sonar with an active duty cycle greater than 80%
High-Frequency (HF): Tactical and non-tactical sources that produce high-frequency (greater than 10 kHz but less than 180 kHz) signals.	HF1	Hull-mounted submarine sonar (e.g., AN/BQQ–10).
	HF2	High-Frequency Marine Mammal Monitoring System.
	HF3	Other hull-mounted submarine sonar (classified).
	HF4	Mine detection and classification sonar (e.g., Airborne Towed Minehunting Sonar System).
	HF5	Active sources (greater than 200 dB) not otherwise binned.
	HF6	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned.
	HF7	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned.
	HF8	Hull-mounted surface ship sonar (e.g., AN/SQS-61).
Anti-Submarine Warfare (ASW): Tactical sources such as active sonobuoys and acoustic countermeasures systems used during the conduct of anti-submarine warfare training and testing activities.	ASW1	Mid-frequency Deep Water Active Distributed System (DWADS).
	ASW2	Mid-frequency Multistatic Active Coherent sonobuoy (e.g., AN/SSQ–125)—Sources that are analyzed by item.
	ASW2	Mid-frequency Multistatic Active Coherent sonobuoy (e.g., AN/SSQ–125)—Sources that are analyzed by hours.
	ASW3	Mid-frequency towed active acoustic countermeasure systems (e.g., AN/SLQ–25).
	ASW4	Mid-frequency expendable active acoustic device countermeasures (e.g., MK–3).

TABLE 2—ACTIVE ACOUSTIC (NON-IMPULSIVE) SOURCE CLASSES ANALYZED—Continued

Source class category	Source class	Description
Torpedoes (TORP): Source classes associated with the active acoustic signals produced by torpedoes.	TORP1	Lightweight torpedo (e.g., MK–46, MK–54, or Anti-Torpedo Torpedo).
	TORP2	Heavyweight torpedo (e.g., MK–48).
Doppler Sonars (DS): Sonars that use the Doppler effect to aid in navigation or collect oceanographic information.	DS1	Low-frequency Doppler sonar (e.g., Webb Tomography Source).
Forward Looking Sonar (FLS): Forward or upward looking object avoidance sonars.	FLS2–FLS3	High-frequency sources with short pulse lengths, narrow beam widths, and focused beam patterns used for navigation and safety of ships.
Acoustic Modems (M): Systems used to transmit data acoustically through the water.	M3	Mid-frequency acoustic modems (greater than 190 dB).
Swimmer Detection Sonars (SD): Systems used to detect divers and submerged swimmers.	SD1–SD2	High-frequency sources with short pulse lengths, used for detection of swimmers and other objects for the purposes of port security.
Synthetic Aperture Sonars (SAS): Sonars in which active acoustic signals are post-processed to form high-resolution images of the seafloor.	SAS1	MF SAS systems.
	SAS2	HF SAS systems.
	SAS3	VHF SAS systems.

TABLE 3—EXPLOSIVE SOURCE CLASSES ANALYZED FOR NON-ANNUAL TRAINING AND TESTING ACTIVITIES

Source class	Representative munitions	Net explosive weight [1] (lbs)
E1	Medium-caliber projectiles	0.1–0.25
E2	Medium-caliber projectiles	0.26–0.5
E4	Improved Extended Echo Ranging Sonobuoy	2.6–5
E16	10,000 lb. HBX charge	7,251–14,500
E17	40,000 lb. HBX charge	14,501–58,000

TABLE 4—ACTIVE ACOUSTIC (NON-IMPULSIVE) SOURCES ANALYZED FOR NON-ANNUAL TRAINING AND TESTING

Source class category	Source class	Description
Low-Frequency (LF): Sources that produce low-frequency (less than 1 kHz) signals.	LF5	Low-frequency sources greater than 160 dB, but less than 180 dB.
Mid-Frequency (MF): Tactical and non-tactical sources that produce mid-frequency (1 to 10 kHz) signals.	MF9	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned.
High-Frequency (HF): Tactical and non-tactical sources that produce high-frequency (greater than 10 kHz but less than 180 kHz) signals.	HF4	Mine detection and classification sonar (e.g., AN/AQS–20).
	HF5	Active sources (greater than 200 dB) not otherwise binned.
	HF6	Active sources (equal to 180 dB and up to 200 dB) not otherwise binned.
	HF7	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned.
Forward Looking Sonar (FLS): Forward or upward looking object avoidance sonars.	FLS2–FLS3	High-frequency sources with short pulse lengths, narrow beam widths, and focused beam patterns used for navigation and safety of ships.
Sonars (SAS): Sonars in which active acoustic signals are post-processed to form high-resolution images of the seafloor.	SAS2	HF SAS systems.

Proposed Action

The Navy proposes to continue conducting training and testing activities within the AFTT Study Area. The Navy has been conducting similar military readiness training and testing activities in the AFTT Study Area since the 1940s. Recently, these activities were analyzed in separate EISs completed between 2009 and 2011. These documents, among others, and their associated MMPA regulations and authorizations, describe the baseline of training and testing activities currently conducted in the AFTT Study Area.

To meet all future training and testing requirements, the Navy has prepared the AFTT DEIS/OEIS to analyze changes to these activities due to fluctuations in the tempo and types of training and testing activities due to changing requirements; the introduction of new technologies; the dynamic nature of

international events; advances in warfighting doctrine and procedures; and changes in basing locations for ships, aircraft, and personnel (force structure changes). Such developments have influenced the frequency, duration, intensity, and location of required training and testing. In addition, the Study Area has expanded beyond the areas included in previous NMFS authorizations. The expansion of the Study Area does not represent an increase in areas where the Navy will train and test, but is merely an expansion of the area to be included in the proposed incidental take authorization.

Training

The Navy proposes to conduct training activities in the AFTT Study Area as described in Table 5 of this proposed rule. Detailed information about each proposed activity (stressor, training event, description, sound source, duration, and geographic location) can be found in Appendix A of the AFTT DEIS/OEIS. The Navy's proposed action is an adjustment to existing baseline training activities to accommodate the following:

- Force structure changes including the relocation of ships, aircraft, and personnel to meet Navy needs. As forces are moved within the existing Navy structure, training needs will necessarily change as the location of forces change.
- Development and introduction of new ships, aircraft, and new weapons systems;
- Current training activities that were not addressed in previous documents.

TABLE 5—TRAINING ACTIVITIES WITHIN THE STUDY AREA

Stressor	Training event	Description	Source class	Number of events per year
Anti-Submarine Warfare (ASW)				
Non-Impulsive	Tracking Exercise/Torpedo Exercise—Submarine (TRACKEX/TORPEX—Sub).	Submarine crews search, track, and detect submarines. Exercise torpedoes may be used during this event.	ASW4; MF3; HF1; TORP2.	102
Non-Impulsive	Tracking Exercise/Torpedo Exercise—Surface (TRACKEX/TORPEX—Surface).	Surface ship crews search, track and detect submarines. Exercise torpedoes may be used during this event.	ASW1,3,4; MF1,2,3,4,5,11,12; HF1; TORP1.	764
Non-Impulsive	Tracking Exercise/Torpedo Exercise—Helicopter (TRACKEX/TORPEX—Helo).	Helicopter crews search, detect and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.	ASW4; MF4,5; TORP1.	432
Non-Impulsive	Tracking Exercise/Torpedo Exercise—Maritime Patrol Aircraft (TRACKEX/TORPEX—MPA).	Maritime patrol aircraft crews search, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.	MF5; TORP1	752
Non-Impulsive	Tracking Exercise—Maritime Patrol Aircraft Extended Echo Ranging Sonobuoy (TRACKEX—MPA sonobuoy).	Maritime patrol aircraft crews search, detect, and track submarines with extended echo ranging sonobuoys. Recoverable air launched torpedoes may be employed against submarine targets.	ASW2	160
Non-Impulsive	Anti-Submarine Warfare Tactical Development Exercise.	Multiple ships, aircraft and submarines coordinate their efforts to search, detect and track submarines with the use of all sensors. Anti-Submarine Warfare Tactical Development Exercise is a dedicated ASW event.	ASW3,4; HF1; MF1,2,3,4,5.	4
Non-Impulsive	Integrated Anti-Submarine Warfare Course (IAC).	Multiple ships, aircraft, and submarines coordinate the use of their sensors, including sonobuoys, to search, detect and track threat submarines. IAC is an intermediate level training event and can occur in conjunction with other major exercises.	ASW 3,4; HF1; MF1,2,3,4,5.	5
Non-Impulsive	Group Sail	Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search, detect and track a threat submarine. Group sails are not dedicated ASW events and involve multiple warfare areas.	ASW 2,3; HF1; MF1,2,3,4,5.	20
Non-Impulsive	ASW for Composite Training Unit Exercise (COMPTUEX).	Anti-Submarine Warfare activities conducted during a COMPTUEX.	ASW 2,3,4; HF1; MF1,2,3,4,5,12.	5
Non-Impulsive	ASW for Joint Task Force Exercise (JTFEX)/Sustainment Exercise (SUSTAINEX).	Anti-Submarine Warfare activities conducted during a JTFEX/SUSTAINEX.	ASW2,3,4; HF1; MF1,2,3,4,5,12.	4
Mine Warfare (MIW)				
Non-Impulsive	Mine Countermeasures Exercise (MCM)—Ship Sonar.	Littoral combat ship crews detect and avoid mines while navigating restricted areas or channels using active sonar.	HF4	116
Non-Impulsive	Mine Countermeasures—Mine Detection.	Ship crews and helicopter aircrews detect mines using towed and laser mine detection systems (e.g., AN/AQS–20, ALMDS).	HF4	2,538

TABLE 5—TRAINING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Training event	Description	Source class	Number of events per year
Non-Impulsive	Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises.	Helicopters aircrew members train as a squadron in the use of airborne mine countermeasures, such as towed mine detection and neutralization systems.	HF4	8
Non-Impulsive	Civilian Port Defense	Maritime security operations for military and civilian ports and harbors. Marine mammal systems may be used during the exercise.	HF4	1 event every other year.
Other Training Activities				
Non-Impulsive	Submarine Navigational (SUBNAV).	Submarine crews locate underwater objects and ships while transiting in and out of port.	HF1; MF3	282
Non-Impulsive	Submarine Navigation Under Ice Certification.	Submarine crews train to operate under ice. During training and certification other submarines and ships simulate ice.	HF1	24
Non-Impulsive	Surface Ship Object Detection	Surface ship crews locate underwater objects that may impede transit in and out of port.	MF1K; MF2K	144
Non-Impulsive	Surface Ship Sonar Maintenance.	Pierside and at-sea maintenance of sonar systems.	MF1,2	824
Non-Impulsive	Submarine Sonar Maintenance	Pierside and at-sea maintenance of sonar systems.	MF3	220
Amphibious Warfare (AMW)				
Impulsive	Naval Surface Fire Support Exercise—At Sea (FIREX [At Sea]).	Surface ship crews use large-caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds impact the water and are scored by passive acoustic hydrophones located at or near the target area.	E5	50
Anti-Surface Warfare (ASUW)				
Impulsive	Maritime Security Operations (MSO)—Anti-swimmer Grenades.	Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., Visit, Board, Search, and Seizure; Maritime Interdiction Operations; Force Protection; and Anti-Piracy Operation).	E2	12
Impulsive	Gunnery Exercise (Surface-to-Surface) (Ship)—Medium-Caliber (GUNEX [S–S]—Ship).	Ship crews engage surface targets with ship's medium-caliber guns.	E1; E2	827
Impulsive	Gunnery Exercise (Surface-to-Surface) (Ship)—Large-Caliber (GUNEX [S–S]—Ship).	Ship crews engage surface targets with ship's large-caliber guns.	E3; E5	294
Impulsive	Gunnery Exercise (Surface-to-Surface) (Boat) (GUNEX [S–S]—Boat).	Small boat crews engage surface targets with small and medium-caliber guns.	E1; E2	434
Impulsive	Missile Exercise (Surface-to-Surface) (MISSILEX [S–S]).	Surface ship crews defend against threat missiles and other surface ships with missiles.	E10	20
Impulsive	Gunnery Exercise (Air-to-Surface) (GUNEX [A–S]).	Fixed-wing and helicopter aircrews, including embarked personnel, use small and medium-caliber guns to engage surface targets.	E1; E2	715
Impulsive	Missile Exercise (Air-to-Surface)—Rocket (MISSILEX [A–S]).	Fixed-wing and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets.	E5	210
Impulsive	Missile Exercise (Air-to-Surface) (MISSILEX [A–S]).	Fixed-wing and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets.	E6; E8	248
Impulsive	Bombing Exercise (Air-to-Surface) (BOMBEX [A–S]).	Fixed-wing aircrews deliver bombs against surface targets.	E8; E9; E10; E12	930
Impulsive	Sinking Exercise (SINKEX)	Aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a deactivated ship, which is deliberately sunk using multiple weapon systems.	E3; E5; E8; E9; E10;E11;E12.	1

TABLE 5—TRAINING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Training event	Description	Source class	Number of events per year
Anti-Submarine Warfare (ASW)				
Impulsive	Tracking Exercise—Maritime Patrol Aircraft Extended Echo Ranging Sonobuoy (TRACKEX—MPA sonobuoy).	Maritime patrol aircraft crews search, detect, and track submarines with extended echo ranging sonobuoys. Recoverable air launched torpedoes may be employed against submarine targets..	E4	160
Impulsive	Group Sail	Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search, detect and track a threat submarine. Group sails are not dedicated ASW events and involve multiple warfare areas.	E4	20
Impulsive	ASW for Composite Training Unit Exercise (COMPTUEX).	Anti-Submarine Warfare activities conducted during a COMPTUEX.	E4	4
Impulsive	ASW for Joint Task Force Exercise (JTFEX)/Sustainment Exercise (SUSTAINEX).	Anti-Submarine Warfare activities conducted during a JTFEX/SUSTAINEX.	E4	4
Mine Warfare (MIW)				
Impulsive	Explosive Ordnance Disposal (EOD)/Mine Neutralization.	Personnel disable threat mines. Explosive charges may be used.	E1; E4; E5; E6; E7; E8.	618
Impulsive	Mine Countermeasures—Mine Neutralization—Remotely Operated Vehicles.	Ship crews and helicopter aircrews disable mines using remotely operated underwater vehicles.	E4	508
Impulsive	Civilian Port Defense	Maritime security operations for military and civilian ports and harbors. Marine mammal systems may be used during the exercise.	E2; E4	1 event every other year.
Pile Driving and Pile Removal				
Impulsive	Elevated Causeway System (ELCAS).	A temporary pier is constructed off the beach. Supporting pilings are driven into the sand and then later removed. The Elevated Causeway System is a portion of a larger activity Joint Logistics Over the Shore (JLOTS) which is covered under separate documentation. Construction would involve intermittent impact pile driving of 24-inch, uncapped, steel pipe piles over approximately 2 weeks. Crews work 24 hours a day and can drive approximately 8 piles in that period. Each pile takes about 10 minutes to drive. When training events that use the elevated causeway system are complete, the piles would be removed using vibratory methods over approximately 6 days. Crews can remove about 14 piles per 24-hour period, each taking about 6 minutes to remove.		1

Testing

The Navy's proposed testing activities are described in Tables 6 and 7. Detailed information about each proposed activity (stressor, testing event, description, sound source, duration, and geographic location) can be found in Appendix A of the AFTT DEIS/OEIS. NMFS used the detailed information in Appendix A of the AFTT DEIS/OEIS to analyze the potential impacts on marine mammals; however, the Navy's proposed action is summarized in the Tables based on the type of sound source.

TABLE 6—NAVAL AIR SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA

Stressor	Testing event	Description	Source class	Number of events per year
Anti-Submarine Warfare (ASW)				
Non-Impulsive	Anti-Submarine Warfare Torpedo Test.	This event is similar to the training event Torpedo Exercise. The test evaluates anti-submarine warfare systems onboard rotary wing and fixed wing aircraft and the ability to search for, detect, classify, localize, and track a submarine or similar target.	TORP1	242
Non-Impulsive	Kilo Dip	A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. The sonar system is briefly activated to ensure all systems are functional. A kilo dip is simply a precursor to more comprehensive testing.	MF4	43
Non-Impulsive	Sonobuoy Lot Acceptance Test	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot, or group, of sonobuoys in advance of delivery to the Fleet for operational use.	ASW2; MF5,6	39
Non-Impulsive	ASW Tracking Test—Helicopter	This event is similar to the training event anti-submarine warfare Tracking Exercise—Helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.	MF4,5	428
Non-Impulsive	ASW Tracking Test—Maritime Patrol Aircraft.	This event is similar to the training event anti-submarine warfare Tracking Exercise—Maritime Patrol Aircraft. The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.	ASW2; MF5,6	75
Mine Warfare (MIW)				
Non-Impulsive	Airborne Towed Minehunting Sonar System Test.	Tests of the Airborne Towed Minehunting Sonar System to evaluate the search capabilities of this towed, mine hunting, detection, and classification system. The sonar on the Airborne Towed Minehunting Sonar System identifies mine-like objects in the deeper parts of the water column.	HF4	155
Anti-Surface Warfare (ASUW)				
Impulsive	Air to Surface Missile Test	This event is similar to the training event Missile Exercise Air to Surface. Test may involve both fixed wing and rotary wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test.	E6; E10	239
Impulsive	Air to Surface Gunnery Test	This event is similar to the training event Gunnery Exercise Air to Surface. Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapons system.	E1	165
Impulsive	Rocket Test	Rocket testing evaluates the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-in rockets fired from a hovering or forward flying helicopter or from a fixed wing strike aircraft.	E5	332

TABLE 6—NAVAL AIR SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Testing event	Description	Source class	Number of events per year
Anti-Submarine Warfare (ASW)				
Impulsive	Sonobuoy Lot Acceptance Test	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot, or group, of sonobuoys in advance of delivery to the Fleet for operational use.	E3; E4	39
Impulsive	ASW Tracking Test—Helicopter	This event is similar to the training event anti-submarine warfare Tracking Exercise—Helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.	E3	428
Impulsive	ASW Tracking Test—Maritime Patrol Aircraft.	This event is similar to the training event anti-submarine warfare Tracking Exercise—Maritime Patrol Aircraft. The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.	E3; E4	75
Mine Warfare (MIW)				
Impulsive	Airborne Mine Neutralization System Test.	Airborne mine neutralization tests evaluate the system's ability to detect and destroy mines. The Airborne Mine Neutralization System Test uses up to four unmanned underwater vehicles equipped with HF sonar, video cameras, and explosive neutralizers.	E4; E11	165
Impulsive	Airborne Projectile-based Mine Clearance System.	An MH–60S helicopter uses a laser-based detection system to search for mines and to fix mine locations for neutralization with an airborne projectile-based mine clearance system. The system neutralizes mines by firing a small or medium-caliber inert, supercavitating projectile from a hovering helicopter.	E11	237
Impulsive	Airborne Towed Minesweeping Test.	Tests of the Airborne Towed Minesweeping System would be conducted by a MH–60S helicopter to evaluate the functionality of the system and the MH–60S at sea. The system is towed from a forward flying helicopter and works by emitting an electromagnetic field and mechanically generated underwater sound to simulate the presence of a ship. The sound and electromagnetic signature cause nearby mines to explode.	E11	72

TABLE 7—NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA

Stressor	Testing event	Description	Source class	Number of events per year
New Ship Construction				
Non-Impulsive	Surface Combatant Sea Trials—Pierside Sonar Testing.	Tests ship's sonar systems pierside to ensure proper operation.	MF1,9,10; MF1K	12.
Non-Impulsive	Surface Combatant Sea Trials—Anti-Submarine Warfare Testing.	Ships demonstrate capability of countermeasure systems and underwater surveillance and communications systems.	ASW3; MF 1,9,10; MF1K	10.
Non-Impulsive	Submarine Sea Trials—Pierside Sonar Testing.	Tests ship's sonar systems pierside to ensure proper operation.	M3; HF1; MF3,10	6
Non-Impulsive	Submarine Sea Trials—Anti-Submarine Warfare Testing.	Submarines demonstrate capability of underwater surveillance and communications systems.	M3; HF1; MF3,10	12.

TABLE 7—NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Testing event	Description	Source class	Number of events per year
Non-Impulsive	Anti-submarine Warfare Mission Package Testing.	Ships and their supporting platforms (e.g., helicopters, unmanned aerial vehicles) detect, localize, and prosecute submarines.	ASW1,3; MF4,5,12; TORP1.	24.
Non-Impulsive	Mine Countermeasure Mission Package Testing.	Ships conduct mine countermeasure operations.	HF4	8.
Life Cycle Activities				
Non-Impulsive	Surface Ship Sonar Testing/Maintenance.	Pierside and at-sea testing of ship systems occurs periodically following major maintenance periods and for routine maintenance.	ASW3; MF1, 9,10; MF1K	16.
Non-Impulsive	Submarine Sonar Testing/Maintenance.	Pierside and at-sea testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.	HF1,3; M3; MF3	28.
Non-Impulsive	Combat System Ship Qualification Trial (CSSQT)—In-port Maintenance Period.	All combat systems are tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea CSSQT events.	MF1	12.
Non-Impulsive	Combat System Ship Qualification Trial (CSSQT)—Undersea Warfare (USW).	Tests ships ability to track and defend against undersea targets.	HF4; MF1,2,4,5; TORP1 ..	9.
NAVSEA Range Activities				
Naval Surface Warfare Center, Panama City Division (NSWC PCD)				
Non-Impulsive	Unmanned Underwater Vehicles Demonstration.	Testing and demonstrations of multiple Unmanned Underwater Vehicles and associated acoustic, optical, and magnetic systems.	HF5,6,7; LF5; FLS2; MF9; SAS2.	1 per 5 year period.
Non-Impulsive	Mine Detection and Classification Testing.	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.	HF1,4; MF1K; SAS2	81.
Non-Impulsive	Stationary Source Testing	Stationary equipment (including swimmer defense systems) is deployed to determine functionality.	LF4; MF8; SD1,2	11.
Non-Impulsive	Special Warfare Testing ...	Testing of submersibles capable of inserting and extracting personnel and/or payloads into denied areas from strategic distances.	MF9	110.
Non-Impulsive	Unmanned Underwater Vehicle Testing.	Unmanned Underwater Vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.	FLS2; HF 5,6,7; LF5; MF9; SAS2.	88.
Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT)				
Non-Impulsive	Torpedo Testing	Non-explosive torpedoes are launched to record operational data. All torpedoes are recovered.	TORP1; TORP2	30.
Non-Impulsive	Towed Equipment Testing	Surface vessel or Unmanned Underwater Vehicle deploys equipment to determine functionality of towed systems.	LF4; MF9; SAS1	33.
Non-Impulsive	Unmanned Underwater Vehicle Testing.	Unmanned Underwater Vehicles are deployed to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments.	HF6,7; LF5; MF10; SAS2	123.
Non-Impulsive	Semi-Stationary Equipment Testing.	Semi-stationary equipment (e.g., hydrophones) is deployed to determine functionality.	ASW3,4; HF 5,6; LF 4,5; MF9,10.	154.
Non-Impulsive	Unmanned Underwater Vehicle Demonstrations.	Testing and demonstrations of multiple Unmanned Underwater Vehicles and associated acoustic, optical, and magnetic systems.	FLS2; HF5,6,7; LF5; MF9; SAS2.	1 per 5 year period.

TABLE 7—NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Testing event	Description	Source class	Number of events per year
Non-Impulsive	Pierside Integrated Swimmer Defense Testing.	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and defend against swimmer/diver threats in harbor environments.	LF4; MF8; SD1	6.
South Florida Ocean Measurement Facility (SFOMF)				
Non-Impulsive	Signature Analysis Activities.	Testing of electromagnetic, acoustic, optical, and radar signature measurements of surface ship and submarine.	ASW2; HF1,6; LF4; M3; MF9.	18.
Non-Impulsive	Mine Testing	Air, surface, and sub-surface systems detect, counter, and neutralize ocean-deployed mines.	HF4	33.
Non-Impulsive	Surface Testing	Various surface vessels, moored equipment and materials are testing to evaluate performance in the marine environment.	FLS2; HF5,6,7; LF5; MF9; SAS2.	33.
Non-Impulsive	Unmanned Underwater Vehicles Demonstrations.	Testing and demonstrations of multiple Unmanned Underwater Vehicles and associated acoustic, optical, and magnetic systems.	FLS2; HF5,6,7; LF5; MF9; SAS2.	1 per 5 year period.
Additional Activities at Locations Outside of NAVSEA Ranges				
Anti-Surface Warfare (ASUW)/Anti-Submarine Warfare (ASW) Testing				
Non-Impulsive	Torpedo (Non-explosive) Testing.	Air, surface, or submarine crews employ inert torpedoes against submarines or surface vessels. All torpedoes are recovered.	ASW3,4; HF1; M3; MF1,3,4,5; TORP1,2.	26.
Non-Impulsive	Torpedo (Explosive) Testing.	Air, surface, or submarine crews employ explosive torpedoes against artificial targets or deactivated ships.	TORP1; TORP2	2.
Non-Impulsive	Countermeasure Testing ..	Towed sonar arrays and anti-torpedo torpedo systems are employed to detect and neutralize incoming weapons.	ASW3; HF5; TORP 1,2	3.
Non-Impulsive	Pierside Sonar Testing	Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities.	ASW3; HF1,3; M3; MF1,3	23.
Non-Impulsive	At-sea Sonar Testing	At-sea testing to ensure systems are fully functional in an open ocean environment.	ASW4; HF1; M3; MF3	15.
Mine Warfare (MIW) Testing				
Non-Impulsive	Mine Detection and Classification Testing.	Air, surface, and subsurface vessels detect and classify mines and mine-like objects.	HF4	66.
Non-Impulsive	Mine Countermeasure/ Neutralization Testing.	Air, surface, and subsurface vessels neutralize threat mines that would otherwise restrict passage through an area.	HF4; M3	14.
Shipboard Protection Systems and Swimmer Defense Testing				
Non-Impulsive	Pierside Integrated Swimmer Defense Testing.	Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and defend against swimmer/diver threats in harbor environments.	LF4; MF8; SD1	3.
Unmanned Vehicle Testing				
Non-Impulsive	Unmanned Vehicle Development and Payload Testing.	Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes.	MF9; SAS2	111.

TABLE 7—NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES WITHIN THE STUDY AREA—Continued

Stressor	Testing event	Description	Source class	Number of events per year
Other Testing Activities				
Non-Impulsive	Special Warfare Testing	Special warfare includes testing of submersibles capable of inserting and extracting personnel and/or payloads into denied areas from strategic distances.	HF1; M3; MF9	4.
Ship Construction and Maintenance				
New Ship Construction				
Impulsive	Aircraft Carrier Sea Trials—Gun Testing—Medium-Caliber.	Medium-caliber gun systems are tested using non-explosive and explosive rounds.	E1	410.
Impulsive	Surface Warfare Mission Package—Gun Testing-Medium Caliber.	Ships defense against surface targets with medium-caliber guns.	E1	5.
Impulsive	Surface Warfare Mission Package—Gun Testing-Large Caliber.	Ships defense against surface targets with large-caliber guns.	E3	5.
Impulsive	Surface Warfare Mission Package—Missile/Rocket Testing.	Ships defense against surface targets with medium range missiles or rockets.	E6	15.
Impulsive	Mine Countermeasure Mission Package Testing.	Ships conduct mine countermeasure operations..	E4	8.
Ship Shock Trials				
Impulsive	Aircraft Carrier Full Ship Shock Trial.	Explosives are detonated underwater against surface ships.	E17	1 per 5 year period.
Impulsive	DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial.	Explosives are detonated underwater against surface ships.	E16	1 per 5 year period.
Impulsive	Littoral Combat Ship Full Ship Shock Trial.	Explosives are detonated underwater against surface ships.	E16	2 per 5 year period.
NAVSEA Range Activities				
Naval Surface Warfare Center, Panama City Division (NSWC PCD)				
Impulsive	Mine Countermeasure/Neutralization Testing.	Air, surface, and subsurface vessels neutralize threat mines and mine-like objects.	E4	15.
Impulsive	Ordnance Testing	Airborne and surface crews defend against surface targets with small-, medium-, and large-caliber guns, as well as line charge testing.	E5; E14	37.
Additional Activities at Locations Outside of NAVSEA Ranges				
Anti-Surface Warfare (ASUW)/Anti-Submarine Warfare (ASW) Testing				
Impulsive	Torpedo (Explosive) Testing.	Air, surface, or submarine crews employ explosive torpedoes against artificial targets or deactivated ships.	E8; E11	2.
Mine Warfare (MIW) Testing				
Impulsive	Mine Countermeasure/Neutralization Testing.	Air, surface, and subsurface vessels neutralize threat mines that would otherwise restrict passage through an area.	E4; E8	14.
Other Testing Activities				
Impulsive	At-Sea Explosives Testing	Explosives are detonated at sea	E5	4.

Vessels

Vessels used as part of the proposed action include ships, submarines, Unmanned Undersea Vehicles (UUVs), and boats ranging in size from small, 16 ft (5 m) Rigid Hull Inflatable Boats to 1,092-ft (333 m) long aircraft carriers. Representative Navy vessel types, lengths, and speeds used in both training and testing activities are shown in Table 5 of this proposed rule. While these speeds are representative, some vessels operate outside of these speeds due to unique training, testing, or safety requirements for a given event. Examples include increased speeds needed for flight operations, full speed runs to test engineering equipment, time critical positioning needs, etc. Examples of decreased speeds include speeds less than 5 knots or completely stopped for launching small boats, certain tactical maneuvers, target launch or retrievals, UUVs, etc.

The number of Navy vessels in the Study Area varies based on training and testing schedules. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers, and range areas. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to 2 weeks. Navy vessel traffic would especially be concentrated near Naval Station Norfolk in Norfolk, VA and Naval Station Mayport in Jacksonville, FL. Surface and sub-surface vessel operations in the Study Area may result in marine mammal strikes.

TABLE 8—TYPICAL NAVY BOAT AND VESSEL TYPES WITH LENGTH GREATER THAN 18 METERS USED WITHIN THE AFTT STUDY AREA

Vessel Type (>18 m)	Example(s) (specifications in meters (m) for length, metric tons (mt) for mass, and knots for speed)	Typical operating speed (knots)
Aircraft Carrier	Aircraft Carrier (CVN) length: 333 m beam: 41 m draft: 12 m displacement: 81,284 mt max. speed: 30+ knots.	10 to 15.
Surface Combatants	Cruiser (CG) length: 173 m beam: 17 m draft: 10 m displacement: 9,754 mt max. speed: 30+ knots. Destroyer (DDG). length: 155 m beam: 18 m draft: 9 m displacement: 9,648 mt max. speed: 30+ knots. Frigate (FFG). length: 136 m beam: 14 m draft: 7 m displacement: 4,166 mt max. speed: 30+ knots. Littoral Combat Ship (LCS). length: 115 m beam: 18 m draft: 4 m displacement: 3,000 mt max. speed: 40+ knots.	10 to 15.
Amphibious Warfare Ships	Amphibious Assault Ship (LHA, LHD) length: 253 m beam: 32 m draft: 8 m displacement: 42,442 mt max. speed: 20+knots. Amphibious Transport Dock (LPD). length: 208 m beam: 32 m draft: 7 m displacement: 25,997 mt max. speed: 20+knots. Dock Landing Ship (LSD). length: 186 m beam: 26 m draft: 6 m displacement: 16,976 mt max. speed: 20+knots.	10 to 15.
Mine Warship Ship	Mine Countermeasures Ship (MCM) length: 68 m beam: 12 m draft: 4 m displacement: 1,333 max. speed: 14 knots.	5 to 8.
Submarines	Attack Submarine (SSN) length: 115 m beam: 12 m draft: 9 m displacement: 12,353 mt max. speed: 20+knots. Guided Missile Submarine (SSGN). length: 171 m beam: 13 m draft: 12 m displacement: 19,000 mt max. speed: 20+knots.	8 to 13.
Combat Logistics Force Ships	Fast Combat Support Ship (T–AOE) length: 230 m beam: 33 m draft: 12 m displacement: 49,583 max. speed: 25 knots. Dry Cargo/Ammunition Ship (T–AKE). length: 210 m beam: 32 m draft: 9 m displacement: 41,658 mt max speed: 20 knots. Fleet Replenishment Oilers (T–AO). length: 206 m beam: 30 m draft: 11 m displacement: 42,674 mt max. speed: 20 knots. Fleet Ocean Tugs (T–ATF). length: 69 m beam: 13 m draft: 5 m displacement: 2,297 max. speed: 14 knots.	8 to 12.
Support Craft/Other	Landing Craft, Utility (LCU) length: 41m beam: 9 m draft: 2 m displacement: 381 mt max. speed: 11 knots. Landing Craft, Mechanized (LCM). length: 23 m beam: 6 m draft: 1 m displacement: 107 mt max. speed: 11 knots.	3 to 5.

TABLE 8—TYPICAL NAVY BOAT AND VESSEL TYPES WITH LENGTH GREATER THAN 18 METERS USED WITHIN THE AFTT STUDY AREA—Continued

Vessel Type (>18 m)	Example(s) (specifications in meters (m) for length, metric tons (mt) for mass, and knots for speed)	Typical operating speed (knots)
Support Craft/Other Specialized High Speed.	MK V Special Operations Craft ..... length: 25 m beam: 5 m displacement: 52 mt max. speed: 50 knots	Variable.

Duration and Location

Training and testing activities would be conducted in the AFTT Study Area throughout the year from January 2014 to January 2019. The AFTT Study Area is in the western Atlantic Ocean and encompasses the east coast of North America and the Gulf of Mexico. The Study Area has expanded slightly beyond the areas included in previous Navy authorizations. However, this expansion is not an increase in the Navy's training and testing area, but merely an increase in the area to be analyzed under an incidental take authorization in support of the AFTT EIS/OEIS. The Study Area includes several existing study areas, range complexes, and testing ranges: The Atlantic Fleet Active Sonar Training (AFAST) Study Area; Northeast Range Complexes; Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT) Testing Range; Virginia Capes (VACAPES) Range Complex; Cherry Point (CHPT) Range Complex; Jacksonville (JAX) Range Complex; Naval Surface Warfare Center (NSWC) Carderock Division, South Florida Ocean Measurement Facility (SFOMF) Testing Range; Key West Range Complex; Gulf of Mexico (GOMEX); and Naval Surface Warfare Center, Panama City Division (NSWC PCD) Testing Range. In addition, the Study Area includes Narragansett Bay, the lower Chesapeake Bay and St. Andrew Bay for training and testing activities. Ports included for Civilian Port Defense training events include Earle, New Jersey; Groton, Connecticut; Norfolk, Virginia; Morehead City, North Carolina; Wilmington, North Carolina; Kings Bay, Georgia; Mayport, Florida; Beaumont, Texas; and Corpus Christi, Texas.

The Study Area includes pierside locations where Navy surface ship and submarine sonar maintenance and testing occur. Pierside locations include channels and transit routes in ports and facilities associated with ports and shipyards. These locations in the AFTT Study Area are located at the following Navy ports and naval shipyards:

- Portsmouth Naval Shipyard, Kittery, Maine;
- Naval Submarine Base New London, Groton, Connecticut;
- Naval Station Norfolk, Norfolk, Virginia;
- Joint Expeditionary Base Little Creek—Fort Story, Virginia Beach, Virginia;
- Norfolk Naval Shipyard, Portsmouth, Virginia;
- Naval Submarine Base Kings Bay, Kings Bay, Georgia;
- Naval Station Mayport, Jacksonville, Florida; and
- Port Canaveral, Cape Canaveral, Florida.

Navy-contractor shipyards in the following cities are also in the Study Area:

- Bath, Maine;
- Groton, Connecticut;
- Newport News, Virginia; and
- Pascagoula, Mississippi.

More detailed information is provided in the Navy's LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm*).

Description of Marine Mammals in the Area of the Specified Activities

There are 48 marine mammal species with possible or known occurrence in the AFTT Study Area, 45 of which are managed by NMFS. As indicated in Table 9, there are 39 cetacean species (8 mysticetes and 31 odontocetes) and six pinnipeds. Seven marine mammal species are listed under the Endangered Species Act: Bowhead whale, North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale.

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Order Cetacea							
Suborder Mysticeti (baleen whales)							
Family Balaenidae (right whales)							
North Atlantic right whale.	Eubalaena glacialis.	Endangered, Strategic, Depleted.	Western North Atlantic.	361 (0)/361	Gulf Stream, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Bowhead whale	Balaena mysticetus.	Endangered, Strategic, Depleted.	West Greenland ..	1,230 [5]/490–2,940	Labrador Current	Newfoundland-Labrador Shelf, West Greenland Shelf.	

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Family Balaenopteridae (rorquals)							
Humpback whale	Megaptera novaeangliae.	Endangered, Strategic, Depleted.	Gulf of Maine	847 (0.55)/549	Gulf Stream, North Atlantic Gyre, Labrador Current.	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Minke whale	Balaenoptera acutorostrata.		Canadian east coast.	8,987 (0.32)/6,909	Gulf Stream, North Atlantic Gyre, Labrador Current.	Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Bryde's whale	Balaenoptera brydei/edeni.		Gulf of Mexico Oceanic.	15 (1.98)/5	Gulf Stream, North Atlantic Gyre.	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf.	
Sei whale	Balaenoptera borealis.	Endangered, Strategic, Depleted.	Nova Scotia	386 (0.85)/208	Gulf Stream, North Atlantic Gyre, Labrador Current.	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Fin whale	Balaenoptera physalus.	Endangered, Strategic, Depleted.	Western North Atlantic.	3,985 (0.24)/3,269	Gulf Stream, North Atlantic Gyre, Labrador Current.	Caribbean Sea, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Blue whale	Balaenoptera musculus.	Endangered, Strategic, Depleted.	Western North Atlantic.	NA/440 [6]	Gulf Stream, North Atlantic Gyre, Labrador Current.	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Suborder Odontoceti (toothed whales)							
Family Physeteridae (sperm whale)							
Sperm whale	Physeter macrocephalus.	Endangered, Strategic, Depleted.	North Atlantic	4,804 (0.38)/3,539	Gulf Stream, North Atlantic Gyre, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
		Endangered, Strategic, Depleted.	Gulf of Mexico Oceanic.	1,665 (0.2)/1,409		Gulf of Mexico.	
		Endangered, Strategic, Depleted.	Puerto Rico and U.S. Virgin Islands.	unknown	North Atlantic Gyre.	Caribbean Sea.	

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Family Kogiidae (sperm whales)							
Pygmy sperm whale.	Kogia breviceps ...	Strategic	Western North Atlantic.	395 (0.4)/285 [7]	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico Oceanic.	453(0.35)/340 [7]	.....	Gulf of Mexico, Caribbean Sea.	
Dwarf sperm whale	Kogia sima	.....	Western North Atlantic.	395 (0.4)/285 [7]	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf.	
			Gulf of Mexico Oceanic.	453(0.35)/340 [7]	.....	Gulf of Mexico, Caribbean Sea.	
Family Monodontidae (beluga whale and narwhal)							
Beluga whale	Delphinapterus leucas.	.....	NA8	NA [8]	.....	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Narwhal	Monodon monoceros.	.....	NA9	NA [9]	.....	Newfoundland-Labrador Shelf, West Greenland Shelf.	
Family Ziphiidae (beaked whales)							
Cuvier's beaked whale.	Ziphius cavirostris	.....	Western North Atlantic.	3,513 (0.63)/ 2,154 [10].	Gulf Stream, North Atlantic Gyre, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico Oceanic.	65 (0.67)/39	.....	Gulf of Mexico, Caribbean Sea.	
True's beaked whale.	Mesoplodon mirus	.....	Western North Atlantic.	3,513 (0.63)/ 2,154 [10].	Gulf Stream, North Atlantic Gyre, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Gervais' beaked whale.	Mesoplodon europaeus.	.....	Western North Atlantic.	3,513 (0.63)/ 2,154 [10].	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast United States Continental Shelf.	
			Gulf of Mexico Oceanic.	57 (1.4)/24 [11]	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf.	
Sowerby's beaked whale.	Mesoplodon bidens.	.....	Western North Atlantic.	3,513 (0.63)/ 2,154 [10].	Gulf Stream, North Atlantic Gyre.	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Blainville's beaked whale.	Mesoplodon densirostris.		Western North Atlantic.	3,513 (0.63)/2,154 [10].	Gulf Stream, North Atlantic Gyre, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico Oceanic.	57 (1.4)/24 [11]		Gulf of Mexico, Caribbean Sea.	
Northern bottlenose whale.	Hyperoodon ampullatus.		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current.	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Family Delphinidae (dolphins)							
Rough-toothed dolphin.	Steno bredanensis.		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre.	Caribbean Sea, Southeast U.S. Continental Shelf.	
			Gulf of Mexico (Outer continental shelf and Oceanic).	Unknown		Gulf of Mexico, Caribbean Sea.	
Bottlenose dolphin	Tursiops truncatus	Strategic, Depleted.	Western North Atlantic, offshore [12].	81,588 (0.17)/70,775.	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf.	
		Strategic, Depleted.	Western North Atlantic, coastal, northern migratory.	9,604 (0.36)/7,147		Southeast U.S. Continental Shelf.	Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River.
		Strategic, Depleted.	Western North Atlantic, coastal, southern migratory.	12,482 (0.32)/9,591.		Southeast U.S. Continental Shelf.	Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River.
		Strategic, Depleted.	Western North Atlantic, coastal, South Carolina/Georgia.	7,738 (0.23)/6,399		Southeast U.S. Continental Shelf.	Kings Bay, St. Johns River.
		Strategic, Depleted.	Western North Atlantic, coastal, Northern Florida.	3,064 (0.24)/2,511		Southeast U.S. Continental Shelf.	Kings Bay, St. Johns River.
		Strategic	Western North Atlantic, coastal, Central Florida.	6,318 (0.26)/5,094		Southeast U.S. Continental Shelf.	Port Canaveral.
		Strategic	Northern North Carolina Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	Beaufort Inlet, Cape Fear River.
		Strategic	Southern North Carolina Estuarine System.	2,454 (0.53)/1,614		Southeast U.S. Continental Shelf.	Beaufort Inlet, Cape Fear River.
		Strategic	Charleston Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	
		Strategic	Northern Georgia/Southern South Carolina Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	
		Strategic	Southern Georgia Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	Kings Bay, St. Johns River.
		Strategic	Jacksonville Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	Kings Bay, St. Johns River.

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
		Strategic	Indian River Lagoon Estuarine System.	Unknown		Southeast U.S. Continental Shelf.	Port Canaveral.
		Strategic	Biscayne Bay	Unknown		Southeast U.S. Continental Shelf.	
			Florida Bay	514 (0.17)/447		Gulf of Mexico.	
			Gulf of Mexico Continental Shelf.	Unknown		Gulf of Mexico.	
			Gulf of Mexico, eastern coastal.	7,702 (0.19)/6,551		Gulf of Mexico.	
			Gulf of Mexico, northern coastal.	2,473 (0.25)/2,004		Gulf of Mexico	St. Andrew Bay, Pascagoula River.
		Strategic	Gulf of Mexico, western coastal.	Unknown		Gulf of Mexico	Corpus Christi Bay, Galveston Bay.
			Gulf of Mexico Oceanic.	3,708 (0.42)/2,641		Gulf of Mexico.	
		Strategic	Gulf of Mexico bay, sound, and estuarine.	Unknown		Gulf of Mexico	St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay.
Pantropical spotted dolphin.	Stenella attenuata		Western North Atlantic.	4,439 (0.49)/3,010	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	34,067 (0.18)/29,311.		Gulf of Mexico, Caribbean Sea.	
Atlantic spotted dolphin.	Stenella frontalis		Western North Atlantic.	50,978 (0.42)/36,235.	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico (Continental shelf and Oceanic).	Unknown		Gulf of Mexico, Caribbean Sea.	
Spinner dolphin	Stenella longirostris.		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	1,989 (0.48)/1,356		Gulf of Mexico, Caribbean Sea.	
Clymene dolphin	Stenella clymene		Western North Atlantic.	Unknown	Gulf Stream	Southeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	6,575 (0.36)/4,901		Gulf of Mexico, Caribbean Sea.	
Striped dolphin	Stenella coeruleoalba.		Western North Atlantic.	94,462 (0.4)/68,558.	Gulf Stream.		
			Gulf of Mexico Oceanic.	3,325 (0.48)/2,266		Gulf of Mexico, Caribbean Sea.	
Fraser's dolphin	Lagenodelphis hosei.		Western North Atlantic.	Unknown	North Atlantic Gyre.	Southeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	Unknown		Gulf of Mexico, Caribbean Sea.	
Risso's dolphin	Grampus griseus		Western North Atlantic.	20,479 (0.59)/12,920.	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico Oceanic.	1,589 (0.27)/1,271		Gulf of Mexico, Caribbean Sea.	

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Atlantic white-sided dolphin.	Lagenorhynchus acutus.		Western North Atlantic.	63,368 (0.27)/50,883.	Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
White-beaked dolphin.	Lagenorhynchus albirostris.		Western North Atlantic.	2,003 (0.94)/1,023	Labrador Current	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Long-beaked common dolphin.	Delphinus capensis.		NA [13]	Unknown [13]		Caribbean Sea 13.	
Short-beaked common dolphin.	Delphinus delphis		Western North Atlantic.	120,743 (0.23)/99,975.	Gulf Stream	Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Melon-headed whale.	Peponocephala electra.		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	2,283 (0.76)/1,293		Gulf of Mexico, Caribbean Sea.	
Pygmy killer whale	Feresa attenuata		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre.	Southeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	323 (0.6)/203		Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf.	
False killer whale	Pseudorca crassidens.		Gulf of Mexico Oceanic.	777 (0.56)/501	Gulf Stream, North Atlantic Gyre.	Gulf of Mexico, Caribbean Sea, Southeast U.S. Continental Shelf.	
Killer whale	Orcinus orca		Western North Atlantic.	Unknown	Gulf Stream, North Atlantic Gyre, Labrador Current.	Southeast U.S. Continental Shelf, Northeast U.S. Continental shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
			Gulf of Mexico Oceanic.	49 (0.77)/28		Gulf of Mexico, Caribbean Sea.	
Long-finned pilot whale.	Globicephala melas.		Western North Atlantic.	12,619 (0.37)/9,333.	Gulf Stream	Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Short-finned pilot whale.	Globicephala macrorhynchus.		Western North Atlantic.	24,674 (0.45)/17,190.	Gulf Stream	Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf.	
			Gulf of Mexico Oceanic.	716 (0.34)/542		Gulf of Mexico, Caribbean Sea.	

TABLE 9—MARINE MAMMAL OCCURRENCE WITHIN THE AFTT STUDY AREA—Continued

Common name	Scientific name [1]	ESA/MMPA status [2]	Stock [3]	Stock abundance [3] best (CV)/min	Occurrence in study area [4]		
					Open ocean	Large marine ecosystems	Bays, rivers, and estuaries
Family Phocoenidae (porpoises)							
Harbor porpoise	Phocoena phocoena.		Gulf of Maine/Bay of Fundy.	89,054 (0.47)/ 60,970.		Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebec River.
Order Carnivora							
Suborder Pinnipedia							
Family Phocidae (true seals)							
Ringed seal	Pusa hispida	Proposed [15]	NA [14]	Unknown		Newfoundland-Labrador Shelf, West Greenland Shelf.	
Bearded seal	Erignathus barbatus.		NA [14]	Unknown		Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf.	
Hooded seal	Cystophora cristata.		Western North Atlantic.	592,100/512,000		Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf.	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebec River.
Harp seal	Pagophilus groenlandicus.		Western North Atlantic.	Unknown		Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	
Gray seal	Halichoerus grypus.		Western North Atlantic.	Unknown		Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebeck River.
Harbor seal	Phoca vitulina		Western North Atlantic.	Unknown [16]		Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Scotian Shelf, Newfoundland-Labrador Shelf.	Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Piscataqua River, Thames River, Kennebeck River.

[1] Taxonomy follows Perrin 2009.
[2] ESA listing status. All marine mammals are protected under MMPA. Populations or stocks for which the level of direct human-caused mortality exceeds the potential biological removal level, which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future, or is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA are considered "strategic" under MMPA.
[3] Best CV/Min is a statistic measurement used as an indicator of the accuracy of the estimate. Stock designations for the U.S. Exclusive Economic Zone and abundance estimates from 2010 Stock Assessment Report (Waring *et al.* 2010).
[4] Occurrence in the Study Area includes open ocean areas—Labrador Current, North Atlantic Gyre, and Gulf Stream, and coastal/shelf waters of seven Large Marine Ecosystems—Gulf of Mexico, Southeast U.S. Continental Shelf, Northeast U.S. Continental Shelf, Caribbean Sea, Scotian Shelf, Newfoundland-Labrador Shelf, West Greenland Shelf, and inland waters of—Kennebec River, Piscataqua River, Thames River, Narragansett Bay, Rhode Island Sound, Block Island Sound, Buzzards Bay, Vineyard Sound, Long Island Sound, Sandy Hook Bay, Lower Chesapeake Bay, James River, Elizabeth River, Beaufort Inlet, Cape Fear River, Kings Bay, St. Johns River, Port Canaveral, St. Andrew Bay, Pascagoula River, Sabine Lake, Corpus Christi Bay, and Galveston Bay.
[5] This species occurs in the Atlantic outside of the U.S. Exclusive Economic Zone; and therefore has no associated Stock Assessment Report. See the appropriate subsections below for details of populations that may be found within the Study Area. Abundance and 95 percent confidence interval are provided by the International Whaling Commission.
[6] Photo identification catalogue count of 440 recognizable blue whale individuals from the Gulf of St. Lawrence is considered to be a minimum population estimate for the western North Atlantic stock.
[7] Estimate may include both the pygmy and dwarf sperm whales.
[8] This species occurs in the Atlantic outside of the U.S. Exclusive Economic Zone; and therefore has no associated Stock Assessment Report. See the appropriate subsections below for details of populations that may be found within the Study Area.
[9] Narwhals in the Atlantic are not managed by NMFS and have no associated Stock Assessment Report.
[10] Estimate includes Cuvier's beaked whales and undifferentiated Mesoplodon species.
[11] Estimate includes Gervais' and Blainville's beaked whales.
[12] Estimate may include sightings of the coastal form.
[13] Long-beaked common dolphins are only known in the western Atlantic from a discrete population off the east coast of South America.
[14] This species occurs in the Atlantic outside of the U.S. Exclusive Economic Zone; and therefore has no associated Stock Assessment Report. See the appropriate subsections below for details of populations that may be found within the Study Area.
[15] Arctic sub-species of ringed seal has been proposed as threatened under the ESA (75 **Federal Register** [FR] 77476).
[16] 2010 Stock Assessment Report states that present data are insufficient to calculate a minimum population estimate for this stock, however, the 2009 Stock Assessment Report indicated the "best" population estimate was 99,340 (CV = .097) and minimum population estimate was 91,546.

NMFS has reviewed the information complied by the Navy on the abundance, behavior, status and distribution, and vocalizations of marine mammal species in the waters of the AFTT Study Area, which was derived from peer reviewed literature, the Navy Marine Resource Assessments, NMFS Stock Assessment Reports, and marine mammal surveys using acoustic or visual observations from aircraft or ships. NMFS considers this information to be the best available science with which we can conduct the analyses necessary to propose these regulations and future LOAs. This information may be viewed in the Navy's LOA application and the Navy's EIS for AFTT (*see* Availability). Additional information is available in the NMFS Stock Assessment Reports, which may be viewed at: *http://www.nmfs.noaa.gov/pr/sars/species.htm.*

Bowhead whales, beluga whales, and narwhal are considered rare in the AFTT Study Area. Bowhead whales inhabit only the arctic and subarctic regions, often close to the ice edge. The St. Lawrence estuary is at the southern limit of the beluga whales' distribution (Lesage and Kingsley, 1998). Beluga distribution does not include the Gulf of Mexico or the southeastern Atlantic coast and they are considered extralimital in the Northeast. Narwhals inhabit Arctic waters, but populations from the Hudson Strait and Davis Strait—at the northwest extreme of the Study Area—may extend into the AFTT Study Area, but the possibility of narwhal actually occurring is considered remote. Based on the rare occurrence of these species in the AFTT Study Area, the Navy and NMFS do not anticipate any take of bowhead whales, beluga whales, or narwhals; therefore, these species are not addressed further in this proposed rule.

Important Areas

NMFS identifies biologically important areas when considering an application to authorize the incidental take of marine mammals. The negligible impact finding necessary for the issuance of an MMPA authorization requires NMFS to consider areas where marine mammals are known to selectively breed or calve/pup. In addition, NMFS must prescribe regulations setting forth the permissible methods of taking and other means of effecting the least practicable adverse impact on marine mammals species or stocks by paying particular attention to rookeries, mating grounds, and other areas of similar significance. This section identifies and discusses known important reproductive and feeding areas within the AFTT Study Area.

Little is known about the breeding and calving behaviors of many of the marine mammals that occur within the AFTT Study Area. For rorquals (humpback whale, minke whale, Bryde's whale, sei whale, fin whale, and blue whale) and sperm whales, mating is generally thought to occur in tropical and sub-tropical waters between mid-winter and mid-summer in deep offshore waters. Delphinids (Melon-headed whale, killer whale, pygmy killer whale, false killer whale, pilot whale, common dolphin, Atlantic spotted dolphin, clymene dolphin, pantropical spotted dolphin, spinner dolphin, striped dolphin, rough-toothed dolphin, bottlenose dolphin, Risso's dolphin, Fraser's dolphin, Atlantic white-sided dolphin, white-beaked dolphin) may mate throughout their distribution during any time of year. For pinnipeds, mating and pupping typically occur in coastal waters near northeast rookeries. With one notable exception, no specific areas for breeding or calving/pupping have been identified in the AFTT Study Area for the species that occur there. However, under the Endangered Species Act (ESA), critical habitat has been designated for the North Atlantic right whale. Additional biologically important areas have been identified for humpback whales and sperm whales. Biologically important areas for all three species are discussed below.

North Atlantic Right Whale

Most North Atlantic right whale sightings follow a well-defined seasonal migratory pattern through several consistently utilized habitats (Winn *et al.,* 1986). It should be noted, however, that some individuals may be sighted in these habitats outside of the typical time of year and that migration routes are not well known (there may be a regular offshore component). The population migrates as two separate components, although some whales may remain in the feeding grounds throughout the winter (Winn *et al.,* 1986, Kenney *et al.,* 2001). Pregnant females and some juveniles migrate from the feeding grounds to the calving grounds off the southeastern United States in late fall to winter. The cow-calf pairs return northward in late winter to early spring. The majority of the right whale population leaves the feeding grounds for unknown habitats in the winter but returns to the feeding grounds coinciding with the return of the cow-calf pairs. Some individuals as well as cow-calf pairs can be seen through the fall and winter on the feeding grounds

with feeding being observed (e.g., Sardi *et al.,* 2005).

During the spring through early summer, North Atlantic right whales are found on feeding grounds off the northeastern United States and Canada. Individuals may be found in Cape Cod Bay in February through April (Winn *et al.,* 1986; Hamilton and Mayo, 1990) and in the Great South Channel east of Cape Cod in April through June (Winn *et al.,* 1986; Kenney *et al.,* 1995). Right whales are found throughout the remainder of summer and into fall (June through November) on two feeding grounds in Canadian waters (Gaskin, 1987 and 1991), with peak abundance in August, September, and early October. The majority of summer/fall sightings of mother/calf pairs occur east of Grand Manan Island (Bay of Fundy), although some pairs might move to other unknown locations (Schaeff *et al.,* 1993). Jeffreys Ledge appears to be important habitat for right whales, with extended whale residences; this area appears to be an important fall feeding area for right whales and an important nursery area during summer (Weinrich *et al.,* 2000). The second feeding area is off the southern tip of Nova Scotia in the Roseway Basin between Browns, Baccaro, and Roseway banks (Mitchell *et al.,* 1986; Gaskin, 1987; Stone *et al.,* 1988; Gaskin, 1991). The Cape Cod Bay and Great South Channel feeding grounds have been designated as critical habitat under the ESA (Silber and Clapham, 2001).

During the winter (as early as November and through March), North Atlantic right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida (Winn *et al.,* 1986). The waters off Georgia and northern Florida are the only known calving ground for western North Atlantic right whales and they have been designated as critical habitat under the ESA. Calving occurs from December through March (Silber and Clapham, 2001). On 1 January 2005, the first observed birth on the calving grounds was reported (Zani *et al.,* 2005). The majority of the population is not accounted for on the calving grounds, and not all reproductively active females return to this area each year (Kraus *et al.,* 1986a).

The coastal waters of the Carolinas are suggested to be a migratory corridor for the right whale (Winn *et al.,* 1986). This area, consisting of coastal waters between North Carolina and northern Florida, was mainly a winter and early spring (January–March) right whaling ground during the late 1800s (Reeves and Mitchell, 1986). The whaling ground was centered along the coasts of South Carolina and Georgia (Reeves and Mitchell, 1986). An examination of sighting records from all sources between 1950 and 1992 found that wintering right whales were observed widely along the coast from Cape Hatteras, North Carolina, to Miami, Florida (Kraus *et al.,* 1993). Sightings off the Carolinas were comprised of single individuals that appeared to be transients (Kraus *et al.,* 1993). These observations are consistent with the hypothesis that the coastal waters of the Carolinas are part of a migratory corridor for the North Atlantic right whale (Winn *et al.,* 1986). Knowlton *et al.* (2002) analyzed sightings data collected in the mid-Atlantic from northern Georgia to southern New England and found that the majority of North Atlantic right whale sightings occurred within approximately 30 NM (56 km) from shore. Critical habitat for the north Atlantic population of the North Atlantic right whale exists in portions of the JAX and Northeast OPAREAs (Figure 4–1 of the Navy's Application). The following three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (NMFS, 2005):

- Coastal Florida and Georgia (Sebastian Inlet, Florida, to the Altamaha River, Georgia),
- The Great South Channel, east of Cape Cod, and
- Cape Cod and Massachusetts Bays.

The northern critical habitat areas serve as feeding and nursery grounds, while the southern area from the mid-Georgia coast extending southward along the Florida coast serves as calving grounds. A large portion of this habitat lies within the coastal waters of the JAX OPAREA. The physical features correlated with the distribution of right whales in the southern critical habitat area provide an optimum environment for calving. For example, the bathymetry of the inner and nearshore middle shelf area minimizes the effect of strong winds and offshore waves, limiting the formation of large waves and rough water. The average temperature of critical habitat waters is cooler during the time right whales are present due to a lack of influence by the Gulf Stream and cool freshwater runoff from coastal areas. The water temperatures may provide an optimal balance between offshore waters that are too warm for nursing mothers to tolerate, yet not too cool for calves that may only have minimal fatty insulation. On the calving grounds, the reproductive females and calves are expected to be concentrated near the critical habitat in the JAX OPAREA from December through April.

Two additional biologically important habitat areas are located in Canadian waters—Grand Manan Basin and Roseway Basin. These areas were identified in Canada's final recovery strategy for the North Atlantic right whale. On October 6, 2010, NMFS published a notice announcing 90-day finding and 12-month determination on a petition to revise critical habitat for the North Atlantic right whale (75 FR 61690). NMFS found that the petition, in addition with the information readily available, presents substantial scientific information indicating that the requested revision may be warranted. NMFS determined that we would proceed with the ongoing rulemaking process for revising critical habitat for the North Atlantic right whale.

Humpback Whale

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds that are located from south of New England to northern Norway (NMFS, 1991). The Gulf of Maine is one of the principal summer feeding grounds for humpback whales in the North Atlantic. The largest numbers of humpback whales are present from mid-April to mid-November. Feeding locations off the northeastern United States include Stellwagen Bank, Jeffreys Ledge, the Great South Channel, the edges and shoals of Georges Bank, Cashes Ledge, Grand Manan Banks, the banks on the Scotian Shelf, the Gulf of St. Lawrence, and the Newfoundland Grand Banks (CETAP, 1982; Whitehead, 1982; Kenney and Winn, 1986; Weinrich *et al.,* 1997). Distribution in this region has been largely correlated to prey species and abundance, although behavior and bottom topography are factors in foraging strategy (Payne *et al.,* 1986; Payne *et al.,* 1990b). Humpbacks typically return to the same feeding areas each year.

Feeding most often occurs in relatively shallow waters over the inner continental shelf and sometimes in deeper waters. Large multi-species feeding aggregations (including humpback whales) have been observed over the shelf break on the southern edge of Georges Bank (CETAP, 1982; Kenney and Winn, 1987) and in shelf break waters off the U.S. mid-Atlantic coast (Smith *et al.,* 1996).

Sperm Whale

The region of the Mississippi River Delta (Desoto Canyon) has been recognized for high densities of sperm whales and may potentially represent an important calving and nursery, or feeding area for these animals

(Townsend, 1935; Collum and Fritts, 1985; Mullin *et al.,* 1994a; Würsig *et al.,* 2000; Baumgartner *et al.,* 2001; Davis *et al.,* 2002; Mullin *et al.,* 2004; Jochens *et al.,* 2006). Sperm whales typically exhibit a strong affinity for deep waters beyond the continental shelf, though in the area of the Mississippi Delta they also occur on the outer continental shelf break.

Marine Mammal Density Estimates

A quantitative analysis of impacts on a species requires data on the abundance and distribution of the species population in the potentially impacted area. One metric for performing this type of analysis is density, which is the number of animals present per unit area. The Navy compiled existing, publically available density data for use in the quantitative acoustic impact analysis.

There is no single source of density data for every area of the world, species, and season because of the costs, resources, and effort required to provide adequate survey coverage to sufficiently estimate density. Therefore, to estimate the marine mammal densities for large areas like the AFTT Study Area, the Navy compiled data from several sources. To compile and structure the most appropriate database of marine species density data, the Navy developed a protocol to select the best available data sources based on species, area, and time (season). The resulting Geographic Information System database, called the Navy Marine Species Density Database, includes seasonal density values for every marine mammal species present within the AFTT Study Area (Navy, 2012).

The Navy Marine Species Density Database includes a compilation of the best available density data from several primary sources and published works including survey data from NMFS within the U.S. Exclusive Economic Zone.

Additional information on the density data sources and how the database was applied to the AFTT Study Area is detailed in the Navy Marine Species Density Database Technical Report (*aftteis.com/DocumentsandReferences/AFTTDocuments/SupportingTechnicalDocuments.aspx*).

Marine Mammal Hearing and Vocalizations

Cetaceans have an auditory anatomy that follows the basic mammalian pattern, with some changes to adapt to the demands of hearing underwater. The typical mammalian ear is divided into an outer ear, middle ear, and inner ear. The outer ear is separated from the inner ear by a tympanic membrane, or eardrum. In terrestrial mammals, the outer ear, eardrum, and middle ear transmit airborne sound to the inner ear, where the sound waves are propagated through the cochlear fluid. Since the impedance of water is close to that of the tissues of a cetacean, the outer ear is not required to transduce sound energy as it does when sound waves travel from air to fluid (inner ear). Sound waves traveling through the inner ear cause the basilar membrane to vibrate. Specialized cells, called hair cells, respond to the vibration and produce nerve pulses that are transmitted to the central nervous system. Acoustic energy causes the basilar membrane in the cochlea to vibrate. Sensory cells at different positions along the basilar membrane are excited by different frequencies of sound (Pickles, 1998).

Marine mammal vocalizations often extend both above and below the range of human hearing; vocalizations with frequencies lower than 20 Hz are labeled as infrasonic and those higher than 20 kHz as ultrasonic (National Research Council (NRC), 2003; Figure 4–1). Measured data on the hearing abilities of cetaceans are sparse, particularly for the larger cetaceans such as the baleen whales. The auditory thresholds of some of the smaller odontocetes have been determined in captivity. It is generally believed that cetaceans should at least be sensitive to the frequencies of their own vocalizations. Comparisons of the anatomy of cetacean inner ears and models of the structural properties and the response to vibrations of the ear's components in different species provide an indication of likely sensitivity to various sound frequencies. The ears of small toothed whales are optimized for receiving high-frequency sound, while baleen whale inner ears are best in low to infrasonic frequencies (Ketten, 1992; 1997; 1998).

Baleen whale vocalizations are composed primarily of frequencies below 1 kHz, and some contain fundamental frequencies as low as 16 Hz (Watkins *et al.,* 1987; Richardson *et al.,* 1995; Rivers, 1997; Moore *et al.,* 1998; Stafford *et al.,* 1999; Wartzok and Ketten, 1999) but can be as high as 24 kHz (humpback whale; Au *et al.,* 2006). Clark and Ellison (2004) suggested that baleen whales use low-frequency sounds not only for long-range communication, but also as a simple form of echo ranging, using echoes to navigate and orient relative to physical features of the ocean. Information on auditory function in baleen whales is extremely lacking. Sensitivity to low-frequency sound by baleen whales has been inferred from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. Although there is apparently much variation, the source levels of most baleen whale vocalizations lie in the range of 150–190 dB re 1 µPa at 1 m. Low-frequency vocalizations made by baleen whales and their corresponding auditory anatomy suggest that they have good low-frequency hearing (Ketten, 2000), although specific data on sensitivity, frequency or intensity discrimination, or localization abilities are lacking. Marine mammals, like all mammals, have typical U-shaped audiograms that begin with relatively low sensitivity (high threshold) at some specified low frequency with increased sensitivity (low threshold) to a species specific optimum followed by a generally steep rise at higher frequencies (high threshold) (Fay, 1988).

The toothed whales produce a wide variety of sounds, which include species-specific broadband "clicks" with peak energy between 10 and 200 kHz, individually variable "burst pulse" click trains, and constant frequency or frequency-modulated (FM) whistles ranging from 4 to 16 kHz (Wartzok and Ketten, 1999). The general consensus is that the tonal vocalizations (whistles) produced by toothed whales play an important role in maintaining contact between dispersed individuals, while broadband clicks are used during echolocation (Wartzok and Ketten, 1999). Burst pulses have also been strongly implicated in communication, with some scientists suggesting that they play an important role in agonistic encounters (McCowan and Reiss, 1995), while others have proposed that they represent "emotive" signals in a broader sense, possibly representing graded communication signals (Herzing, 1996). Sperm whales, however, are known to produce only clicks, which are used for both communication and echolocation (Whitehead, 2003). Most of the energy of toothed whale social vocalizations is concentrated near 10 kHz, with source levels for whistles as high as 100 to 180 dB re 1 µPa at 1 m (Richardson *et al.,* 1995). No odontocete has been shown audiometrically to have acute hearing (<80 dB re 1 µPa) below 500 Hz (Southall *et al.,* 2007). Sperm whales produce clicks, which may be used to echolocate (Mullins *et al.,* 1988), with a frequency range from less than 100 Hz to 30 kHz and source levels up to 230 dB re 1 µPa 1 m or greater (Mohl *et al.,* 2000).

Brief Background on Sound

An understanding of the basic properties of underwater sound is necessary to comprehend many of the concepts and analyses presented in this document. A summary is included below.

Sound is a wave of pressure variations propagating through a medium (e.g., water). Sound measurements can be expressed in two forms: intensity and pressure. Acoustic intensity is the average rate of energy transmitted through a unit area in a specified direction and is expressed in watts per square meter (W/m^2). Acoustic intensity is rarely measured directly, but rather from ratios of pressures; the standard reference pressure for underwater sound is 1 microPascal (µPa); for airborne sound, the standard reference pressure is 20 µPa (Richardson *et al.,* 1995).

Acousticians have adopted a logarithmic scale for sound intensities, which is denoted in decibels (dB). Decibel measurements represent the ratio between a measured pressure value and a reference pressure value (in this case 1 µPa or, for airborne sound, 20 µPa.). The logarithmic nature of the scale means that each 10-dB increase is a ten-fold increase in acoustic power (and a 20-dB increase is then a 100-fold increase in power; and a 30-dB increase is a 1,000-fold increase in power). A ten-fold increase in acoustic power does not mean that the sound is perceived as being ten times louder. Humans perceive a 10-dB increase in sound level as a doubling of loudness, and a 10-dB decrease in sound level as a halving of loudness. The term ''sound pressure level'' implies a decibel measure and a reference pressure that is used as the denominator of the ratio. Throughout this document, NMFS uses 1 microPascal (denoted re: 1µPa) as a standard reference pressure unless noted otherwise.

It is important to note that decibels underwater and decibels in air are not the same and cannot be directly compared. To estimate a comparison between sound in air and underwater, because of the different densities of air and water and the different decibel standards (i.e., reference pressures) in air and water, a sound with the same intensity (i.e., power) in air and in water would be approximately 62 dB lower in air. Thus a sound that measures 160 dB (re 1µPa) underwater would have the same approximate effective level as a sound that is 98 dB (re 20 1µPa) in air.

Sound frequency is measured in cycles per second, or Hertz (abbreviated Hz), and is analogous to musical pitch; high-pitched sounds contain high frequencies and low-pitched sounds contain low frequencies. Natural sounds in the ocean span a huge range of frequencies: From earthquake noise at 5 Hz to harbor porpoise clicks at 150,000 Hz (150 kHz). These sounds are so low or so high in pitch that humans cannot even hear them; acousticians call these infrasonic (typically below 20 Hz) and ultrasonic (typically above 20,000 Hz) sounds, respectively. A single sound may be made up of many different frequencies together. Sounds made up of only a small range of frequencies are called ''narrowband,'' and sounds with a broad range of frequencies are called ''broadband''; tactical sonars are an example of a narrowband sound source and explosives are an example of a broadband sound source.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms derived using auditory evoked potential (AEP) techniques, anatomical modeling, and other data, Southall *et al.* (2007) designated ''functional hearing groups'' for marine mammals and estimated the lower and upper frequencies of functional hearing of the groups. Further, the frequency range in which each group's hearing is estimated as being most sensitive is represented in the flat part of the M-weighting functions (which are derived from the audiograms described above; see Figure 1 in Southall *et al.,* 2007) developed for each group. The functional groups and the associated frequencies are indicated below (though, again, animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range):

- Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 30 kHz.
- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz.
- High frequency cetaceans (eight species of true porpoises, six species of river dolphins, *Kogia,* the franciscana, and four species of cephalorhynchids): functional hearing is estimated to occur between approximately 200 Hz and 180 kHz.
- Pinnipeds in Water: functional hearing is estimated to occur between approximately 75 Hz and 75 kHz, with the greatest sensitivity between approximately 700 Hz and 20 kHz.

The estimated hearing range for low-frequency cetaceans has been slightly extended from previous analyses (from 22 to 30 kHz). This decision is based on data from Watkins *et al.* (1986) for numerous mysticete species, Au *et al.* (2006) for humpback whales, and abstract from Frankel (2005) and a paper from Lucifredi and Stein (2007) on gray whales, and an unpublished report (Ketten and Mountain, 2009) and abstract (Tubelli *et al.,* 2012) for minke whales. As more data from additional species become available, these estimated hearing ranges may require modification.

When sound travels away (propagates) from its source, its loudness decreases as the distance traveled by the sound increases. Thus, the loudness of a sound at its source is higher than the loudness of that same sound a kilometer distant. Acousticians often refer to the loudness of a sound at its source (typically referenced to one meter from the source) as the source level and the loudness of sound elsewhere as the received level (i.e., typically the receiver). For example, a humpback whale 3 kilometers from a device that has a source level of 230 dB re 1 µPa may only be exposed to sound that is 160 dB re 1 µPa loud, depending on how the sound travels through the water (in this example, it is spherical spreading [3 dB reduction with doubling of distance]). As a result, it is important to understand the difference between source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the

sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Metrics Used in This Document

This section includes a brief explanation of the two sound measurements (sound pressure level (SPL) and sound exposure level (SEL)) frequently used to describe sound levels in the discussions of acoustic effects in this document.

SPL

Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter. SPL is expressed as the ratio of a measured sound pressure and a reference level.

SPL (in dB) = 20 log (pressure/reference pressure)

The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re: 1 μPa. SPL is an instantaneous measurement and can be expressed as the peak, the peak-to-peak, or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to SPL in this document refer to the root mean square. SPL does not take the duration of a sound into account. SPL is the applicable metric used in the Behavioral Response Function (BRF), which is used to estimate behavioral harassment takes.

SEL

SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 μPa^2 s.

SEL = SPL + 10 log(duration in seconds)

As applied to sonar and other active acoustic sources, the SEL includes both the SPL of a sonar ping and the total duration. Longer duration pings and/or pings with higher SPLs will have a higher SEL. If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the cumulative SEL. The cumulative SEL depends on the SPL, duration, and number of pings received. The thresholds that NMFS uses to indicate at what received level the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing are likely to occur are expressed as cumulative SEL.

Potential Effects of Specified Activities on Marine Mammals

The Navy has requested authorization for the take of marine mammals that may occur incidental to training and testing activities in the AFTT Study Area. The Navy has analyzed the potential impacts on marine mammals from impulsive and non-impulsive sound sources and vessel strikes.

Other potential impacts on marine mammals from AFTT training and testing activities were analyzed in the Navy's AFTT EIS/OEIS, in consultation with NMFS as a cooperating agency, and determined to be unlikely to result in marine mammal harassment. Therefore, the Navy has not requested authorization for take of marine mammals that might occur incidental to other components of their proposed activities. In this document, NMFS analyzes the potential effects on marine mammals from exposure to non-impulsive (sonar and other active acoustic sources) and impulsive (underwater detonations, pile driving, and air guns) stressors, and vessel strikes.

For the purpose of MMPA authorizations, NMFS' effects assessments serve four primary purposes: (1) To prescribe the permissible methods of taking (i.e., Level B Harassment (behavioral harassment), Level A Harassment (injury), or mortality, including an identification of the number and types of take that could occur by harassment or mortality) and to prescribe other means of effecting the least practicable adverse impact on such species or stock and its habitat (i.e., mitigation); (2) to determine whether the specified activity would have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity would adversely affect the species or stock through effects on annual rates of recruitment or survival); (3) to determine whether the specified activity would have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (however, there are no subsistence communities that would be affected in the AFTT Study Area, so this determination is inapplicable to the AFTT rulemaking); and (4) to prescribe requirements pertaining to monitoring and reporting.

More specifically, for activities involving non-impulsive or impulsive sources, NMFS' analysis will identify the probability of lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), behavioral disturbance (that rises to the level of harassment), and social responses (effects to social relationships) that would be classified as a take and whether such take will have a negligible impact on such species or stocks. Vessel strikes, which have the potential to result in incidental take from direct injury and/or mortality, will be discussed in more detail in the Estimated Take of Marine Mammals Section. In this section, we will focus qualitatively on the different ways that non-impulsive and impulsive sources may affect marine mammals (some of which NMFS does not classify as harassment). Then, in the Estimated Take of Marine Mammals Section, we will relate the potential effects on marine mammals from non-impulsive and impulsive sources to the MMPA definitions of Level A and Level B Harassment, along with the potential effects from vessel strikes, and attempt to quantify those effects.

Non-Impulsive Sources

Direct Physiological Effects

Based on the literature, there are two basic ways that non-impulsive sources might directly result in direct physiological effects: Noise-induced loss of hearing sensitivity (more commonly-called "threshold shift") and acoustically mediated bubble growth. Separately, an animal's behavioral reaction to an acoustic exposure might lead to physiological effects that might ultimately lead to injury or death, which is discussed later in the Stranding Section.

Threshold Shift (Noise-Induced Loss of Hearing)

When animals exhibit reduced hearing sensitivity (i.e., sounds must be received at a higher level for an animal to recognize them) following exposure to a sufficiently intense sound, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (i.e., there is recovery), occurs in specific frequency ranges (i.e., an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz)), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced by only 6 dB or reduced by 30

dB). PTS is permanent, but some recovery is possible. PTS can also occurs in a specific frequency range and amount as mentioned above for TTS.

The following physiological mechanisms are thought to play a role in inducing auditory TSs: Effects on sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output (Southall *et al.,* 2007). The amplitude, duration, frequency, temporal pattern, and energy distribution of sound exposure all affect the amount of associated TS and the frequency range in which it occurs. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS, along with the recovery time. For continuous sounds, exposures of equal energy (the same SEL) will lead to approximately equal effects. For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur between intermittent exposures) (Kryter *et al.,* 1966; Ward, 1997). For example, one short but loud (higher SPL) sound exposure may induce the same impairment as one longer but softer sound, which in turn may cause more impairment than a series of several intermittent softer sounds with the same total energy (Ward, 1997). Additionally, though TTS is temporary, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985). Although in the case of sonar and other active acoustic sources, animals are not expected to be exposed to levels high enough or durations long enough to result in PTS.

PTS is considered auditory injury (Southall *et al.,* 2007). Irreparable damage to the inner or outer cochlear hair cells may cause PTS, however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007).

Although the published body of scientific literature contains numerous theoretical studies and discussion papers on hearing impairments that can occur with exposure to a loud sound, only a few studies provide empirical information on the levels at which noise-induced loss in hearing sensitivity occurs in nonhuman animals. For cetaceans, published data are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise (Finneran *et al.,* 2000, 2002b, 2003, 2005a, 2007, 2010a, 2010b; Finneran and Schlundt, 2010; Lucke et al, 2009; Mooney *et al.,* 2009a, 2009b; Popov *et al.,* 2011a, 2011b; Popov and Supin, 2012; Kastelein *et al.,* 2012a; Schlundt *et al.,* 2000; Nachtigall *et al.,* 2003, 2004). For pinnipeds in water, data are limited to measurement of TTS in harbor seals, one elephant seal, and California sea lions (Kastak *et al.,* 1999, 2005; Kastelien *et al.,* 2012b).

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (i.e., recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. Also, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a permanent condition. Of note, reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Acoustically Mediated Bubble Growth

A suggested indirect cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. The process depends on many factors, including the sound pressure level and duration. Under this hypothesis, microscopic bubbles assumed to exist in the tissues of marine mammals may experience one of three things: (1) Bubbles grow to the extent that tissue hemorrhage (injury) occurs; (2) bubbles develop to the extent that an immune response is triggered or nervous system tissue is subjected to enough localized pressure that pain or dysfunction occurs (a stress response without injury); or (3) the bubbles are cleared by the lung without negative consequence to the animal. The probability of rectified diffusion, or any other indirect tissue effect, will necessarily be based on what is known about the specific process involved. Rectified diffusion is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate nitrogen gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The dive patterns of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater nitrogen gas supersaturation (Houser *et al.,* 2001). If rectified diffusion were possible in marine mammals exposed to a high level of sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness (e.g., nausea, disorientation, localized pain, breathing problems, etc.).

It is unlikely that the short duration of sonar or explosion sounds would last long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis is also suggested: stable microbubbles could be destabilized by high-level sound exposures so bubble growth would occur through static diffusion of gas out of the tissues. In such a scenario, the marine mammal would need to be in a gas-supersaturated state for a long enough time for bubbles to become a problematic size. Recent research with *ex vivo* supersaturated bovine tissues suggests that for a 37 kHz signal, a sound exposure of approximately 215 dB re 1 µPa would be required before microbubbles became destabilized and grew (Crum *et al.,* 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 µPa, a whale would need to be within 33 ft. (10 m) of the sonar dome to be exposed to such sound levels. Furthermore, tissues in the study were supersaturated by exposing them to pressures of 400 to 700 kiloPascals (kPa) for periods of hours and then releasing them to

ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400 to 700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Houser *et al.,* 2001). It is improbable that this mechanism would be responsible for stranding events or traumas associated with beaked whale strandings. Both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

There is considerable disagreement among scientists as to the likelihood of bubble formation in diving marine mammals (Evans and Miller, 2003; Piantadosi and Thalmann, 2004). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Fernández *et al.,* 2005; Jepson *et al.,* 2003), nitrogen bubble formation as the cause of the traumas has not been verified. The presence of bubbles postmortem, particularly after decompression, is not necessarily indicative of bubble pathology. Prior experimental work demonstrates that the postmortem presence of bubbles following decompression in laboratory animals can occur as a result of invasive investigative procedures (Stock *et al.,* 1980). Also, variations in diving behavior or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.,* 2003). The mechanism for bubble formation would be different from rectified diffusion, but the effects would be similar. Although hypothetical, the potential process is under debate in the scientific community. The hypothesis speculates that if exposure to a startling sound elicits a rapid ascent to the surface, tissue gas saturation sufficient for the evolution of nitrogen bubbles might result (Fernández *et al.,* 2005; Jepson *et al.,* 2003). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation.

Recent modeling suggests that even unrealistically rapid rates of ascent from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected in beaked whales (Zimmer and Tyack, 2007). Tyack *et al.* (Tyack *et al.,* 2006) suggested that emboli observed in animals exposed to mid-frequency active sonar (Fernández *et al.,* 2005; Jepson *et al.,* 2003) could stem instead from a behavioral response that involves repeated dives, shallower than the depth of lung collapse. A bottlenose dolphin was trained to repetitively dive to specific depths to elevate nitrogen saturation to the point that asymptomatic nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of any nitrogen gas bubbles (Houser *et al.,* 2009).

More recently, modeling has suggested that the long, deep dives performed regularly by beaked whales over a lifetime could result in the saturation of long-halftime tissues (e.g. fat, bone lipid) to the point that they are supersaturated when the animals are at the surface (Hooker *et al.* 2009). Proposed adaptations for prevention of bubble formation under conditions of persistent tissue saturation have been suggested (Fahlman *et al.,* 2006; Hooker *et al.,* 2009), while the condition of supersaturation required for bubble formation has been demonstrated in bycatch animals drowned at depth and brought to the surface (Moore *et al.,* 2009). Since bubble formation is facilitated by compromised blood flow, it has been suggested that rapid stranding may lead to bubble formation in animals with supersaturated, long-halftime tissues because of the stress of stranding and the cardiovascular collapse that can accompany it (Houser *et al.,* 2009).

A fat embolic syndrome was identified by Fernández *et al.* (2005) coincident with the identification of bubble emboli in stranded beaked whales. The fat embolic syndrome was the first pathology of this type identified in marine mammals, and was thought to possibly arise from the formation of bubbles in fat bodies, which subsequently resulted in the release of fat emboli into the blood stream. Recently, Dennison *et al.* (2011) reported on investigations of dolphins stranded in 2009–2010 and, using ultrasound, identified gas bubbles in kidneys of 21 of 22 live-stranded dolphins and in the liver of two of 22. The authors postulated that stranded animals are unable to recompress by diving, and thus may retain bubbles that are otherwise re-absorbed in animals that can continue to dive. The researchers concluded that the minor bubble formation observed can be tolerated since the majority of stranded dolphins released did not re-strand. As a result, no marine mammals addressed in this analysis are given differential treatment due to the possibility for acoustically mediated bubble growth.

Acoustic Masking

Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication between individuals, navigation, foraging, reproduction, and learning about their environment (Erbe and Farmer 2000, Tyack 2000). Masking, or auditory interference, generally occurs when sounds in the environment are louder than and of a similar frequency to, auditory signals an animal is trying to receive. Masking is a phenomenon that affects animals that are trying to receive acoustic information about their environment, including sounds from other members of their species, predators, prey, and sounds that allow them to orient in their environment. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations.

The extent of the masking interference depends on the spectral, temporal, and spatial relationships between the signals an animal is trying to receive and the masking noise, in addition to other factors. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa.

Richardson *et al.* (1995b) argued that the maximum radius of influence of an industrial noise (including broadband low frequency sound transmission) on a marine mammal is the distance from the source to the point at which the noise can barely be heard. This range is determined by either the hearing sensitivity of the animal or the background noise level present. Industrial masking is most likely to affect some species' ability to detect communication calls and natural sounds (i.e., surf noise, prey noise, etc.; Richardson *et al.,* 1995).

The echolocation calls of toothed whales are subject to masking by high frequency sound. Human data indicate low-frequency sound can mask high-frequency sounds (i.e., upward masking). Studies on captive odontocetes by Au *et al.* (1974, 1985, 1993) indicate that some species may use various processes to reduce masking effects (e.g., adjustments in echolocation

call intensity or frequency as a function of background noise conditions). There is also evidence that the directional hearing abilities of odontocetes are useful in reducing masking at the high-frequencies these cetaceans use to echolocate, but not at the low-to-moderate frequencies they use to communicate (Zaitseva *et al.,* 1980). A recent study by Nachtigall and Supin (2008) showed that false killer whales adjust their hearing to compensate for ambient sounds and the intensity of returning echolocation signals.

As mentioned previously, the functional hearing ranges of mysticetes, odontocetes, and pinnipeds underwater all encompass the frequencies of the sonar sources used in the Navy's training exercises. Additionally, almost all species, vocal repertoires span across the frequencies of these sonar sources used by the Navy. The closer the characteristics of the masking signal to the signal of interest, the more likely masking is to occur. For hull-mounted sonar, the duty cycle of the signal makes it less likely that masking will occur as a result.

Impaired Communication

In addition to making it more difficult for animals to perceive acoustic cues in their environment, anthropogenic sound presents separate challenges for animals that are vocalizing. When they vocalize, animals are aware of environmental conditions that affect the ''active space'' of their vocalizations, which is the maximum area within which their vocalizations can be detected before it drops to the level of ambient noise (Brenowitz, 2004; Brumm *et al.,* 2004; Lohr *et al.,* 2003). Animals are also aware of environment conditions that affect whether listeners can discriminate and recognize their vocalizations from other sounds, which is more important than simply detecting that a vocalization is occurring (Brenowitz, 1982; Brumm *et al.,* 2004; Dooling, 2004, Marten and Marler, 1977; Patricelli *et al.,* 2006). Most animals that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability/distinguishability of their vocalizations in the face of temporary changes in background noise (Brumm *et al.,* 2004; Patricelli *et al.,* 2006). Vocalizing animals can make adjustments to vocalization characteristics such as the frequency structure, amplitude, temporal structure, and temporal delivery.

Many animals will combine several of these strategies to compensate for high levels of background noise. Anthropogenic sounds that reduce the signal-to-noise ratio of animal vocalizations, increase the masked auditory thresholds of animals listening for such vocalizations, or reduce the active space of an animal's vocalizations impair communication between animals. Most animals that vocalize have evolved strategies to compensate for the effects of short-term or temporary increases in background or ambient noise on their songs or calls. Although the fitness consequences of these vocal adjustments remain unknown, like most other trade-offs animals must make, some of these strategies probably come at a cost (Patricelli *et al.,* 2006). For example, vocalizing more loudly in noisy environments may have energetic costs that decrease the net benefits of vocal adjustment and alter a bird's energy budget (Brumm, 2004; Wood and Yezerinac, 2006). Shifting songs and calls to higher frequencies may also impose energetic costs (Lambrechts, 1996).

Stress Responses

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg, 2000; Sapolsky *et al.,* 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: Behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune response.

In the case of many stressors, an animal's first and most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical ''fight or flight'' response which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with ''stress.'' These responses have a relatively short duration and may or may not have significant long-term effect on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine or sympathetic nervous systems; the system that has received the most study has been the hypothalmus-pituitary-adrenal system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg, 1987; Rivier, 1995) and altered metabolism (Elasser *et al.,* 2000), reduced immune competence (Blecha, 2000) and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.,* 2004) have been equated with stress for many years.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose a risk to the animal's welfare. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic function, which impairs those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called ''distress'' (sensu Seyle 1950) or ''allostatic loading'' (sensu McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiment; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been

documented in both laboratory and free-living animals (for examples see, Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005; Reneerkens *et al.,* 2002; Thompson and Hamer, 2000). Information has also been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds (Fair and Becker, 2000; Romano *et al.,* 2002; Wright *et al.,* 2008). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. In a conceptual model developed by the Population Consequences of Acoustic Disturbance (PCAD) working group, serum hormones were identified as possible indicators of behavioral effects that translated into altered rates of reproduction and mortality. The Office of Naval Research hosted a workshop (Effects of Stress on Marine Mammals Exposed to Sound) in 2009 that focused on this very topic (ONR, 2009).

Studies of other marine animals and terrestrial animals would lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to high frequency, mid-frequency and low-frequency sounds. For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (for example, elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b) identified noise-induced physiological transient stress responses in hearing-specialist fish (i.e., goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and to communicate with conspecifics. Although empirical information on the relationship between sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC, 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg, 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

Behavioral Disturbance

Behavioral responses to sound are highly variable and context-specific. Many different variables can influence an animal's perception of and response to (nature and magnitude) an acoustic event. An animal's prior experience with a sound or sound source effects whether it is less likely (habituation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately pre-disposed to respond to certain sounds in certain ways) (Southall *et al.,* 2007). Related to the sound itself, the perceived nearness of the sound, bearing of the sound (approaching vs. retreating), similarity of a sound to biologically relevant sounds in the animal's environment (i.e., calls of predators, prey, or conspecifics), and familiarity of the sound may affect the way an animal responds to the sound (Southall *et al.,* 2007). Individuals (of different age, gender, reproductive status, etc.) among most populations will have variable hearing capabilities, and differing behavioral sensitivities to sounds that will be affected by prior conditioning, experience, and current activities of those individuals. Often, specific acoustic features of the sound and contextual variables (i.e., proximity, duration, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone.

Exposure of marine mammals to sound sources can result in no response or responses including, but not limited to increased alertness; orientation or attraction to a sound source; vocal modifications; cessation of feeding; cessation of social interaction; alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and, in severe cases, panic, flight, stampede, or stranding, potentially resulting in death (Southall *et al.,* 2007). A review of marine mammal responses to anthropogenic sound was first conducted by Richardson and others in 1995. A review by Nowacek *et al.* (2007) addresses studies conducted since 1995 and focuses on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. The following sub-sections provide examples of behavioral responses that provide an idea of the variability in behavioral responses that would be expected given the differential sensitivities of marine mammal species to sound and the wide range of potential acoustic sources to which a marine mammal may be exposed.

Flight Response—A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). Flight responses have been speculated as being a component of marine mammal strandings associated with sonar activities (Evans and England, 2001).

Response to Predator—Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke *et al.,* 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether or not this is a possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

Diving—Changes in dive behavior can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive. Variations in dive behavior may reflect interruptions in biologically significant activities (e.g., foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (e.g., increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Conversely, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating intepretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.,* 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths are provided between avoidance and diving and indirect tissue effects. This feedback accounts for the hypothesis that variations in diving behavior and/or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.,* 2003). Although hypothetical, discussions surrounding this potential process are controversial.

Foraging—Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (e.g., bubble nets or sediment plumes), or changes in dive behavior. Noise from seismic surveys was not found to impact the feeding behavior in western grey whales off the coast of Russia (Yazvenko *et al.,* 2007) and sperm whales engaged in foraging dives did not abandon dives when exposed to distant signatures of seismic airguns (Madsen *et al.,* 2006). Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.,* 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.,* 2004). Although the received sound pressure level at the animals was similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. A determination of whether foraging disruptions incur fitness consequences will require information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Breathing—Variations in respiration naturally vary with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.,* 2007). Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.,* 2001; Kastelein *et al.,* 2006a) and emissions for underwater data transmission (Kastelein *et al.,* 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.,* 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure.

Social relationships—Social interactions between mammals can be affected by noise via the disruption of communication signals or by the displacement of individuals. Disruption of social relationships therefore depends on the disruption of other behaviors (e.g., caused avoidance, masking, etc.) and no specific overview is provided here. However, social disruptions must be considered in context of the relationships that are affected. Long-term disruptions of mother/calf pairs or mating displays have the potential to affect the growth and survival or reproductive effort/success of individuals, respectively.

Vocalizations (also see Masking Section)—Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes may result in response to a need to compete with an increase in background noise or may reflect an increased vigilance or startle response. For example, in the presence of low-frequency active sonar, humpback whales have been observed to increase the length of their ''songs'' (Miller *et al.,* 2000; Fristrup *et al.,* 2003), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. A similar compensatory effect for the presence of low frequency vessel noise has been suggested for right whales; right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). Killer whales off the northwestern coast of the United States have been observed to increase the duration of primary calls once a threshold in observing vessel density (e.g., whale watching) was reached, which has been suggested as a response to increased masking noise produced by the vessels (Foote *et al.,* 2004). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test (Bowles *et al.,* 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or

the displacement of animals from the area.

Avoidance—Avoidance is the displacement of an individual from an area as a result of the presence of a sound. Richardson *et al.,* (1995) noted that avoidance reactions are the most obvious manifestations of disturbance in marine mammals. It is qualitatively different from the flight response, but also differs in the magnitude of the response (i.e., directed movement, rate of travel, etc.). Oftentimes avoidance is temporary, and animals return to the area once the noise has ceased. Longer term displacement is possible, however, which can lead to changes in abundance or distribution patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006). Acute avoidance responses have been observed in captive porpoises and pinnipeds exposed to a number of different sound sources (Kastelein *et al.,* 2001; Finneran *et al.,* 2003; Kastelein *et al.,* 2006a; Kastelein *et al.,* 2006b). Short term avoidance of seismic surveys, low frequency emissions, and acoustic deterrants has also been noted in wild populations of odontocetes (Bowles *et al.,* 1994; Goold, 1996; 1998; Stone *et al.,* 2000; Morton and Symonds, 2002) and to some extent in mysticetes (Gailey *et al.,* 2007), while longer term or repetitive/chronic displacement for some dolphin groups and for manatees has been suggested to be due to the presence of chronic vessel noise (Haviland-Howell *et al.,* 2007; Miksis-Olds *et al.,* 2007).

Maybaum (1993) conducted sound playback experiments to assess the effects of MFAS on humpback whales in Hawaiian waters. Specifically, she exposed focal pods to sounds of a 3.3-kHz sonar pulse, a sonar frequency sweep from 3.1 to 3.6 kHz, and a control (blank) tape while monitoring behavior, movement, and underwater vocalizations. The two types of sonar signals (which both contained mid- and low-frequency components) differed in their effects on the humpback whales, but both resulted in avoidance behavior. The whales responded to the pulse by increasing their distance from the sound source and responded to the frequency sweep by increasing their swimming speeds and track linearity. In the Caribbean, sperm whales avoided exposure to mid-frequency submarine sonar pulses, in the range of 1000 Hz to 10,000 Hz (IWC 2005).

Kvadsheim *et al.,* (2007) conducted a controlled exposure experiment in which killer whales fitted with D-tags were exposed to mid-frequency active sonar (Source A: a 1.0 second upsweep 209 dB @ 1–2 kHz every 10 seconds for 10 minutes; Source B: with a 1.0 second upsweep 197 dB @ 6–7 kHz every 10 seconds for 10 minutes). When exposed to Source A, a tagged whale and the group it was traveling with did not appear to avoid the source. When exposed to Source B, the tagged whales along with other whales that had been carousel feeding, ceased feeding during the approach of the sonar and moved rapidly away from the source. When exposed to Source B, Kvadsheim and his co-workers reported that a tagged killer whale seemed to try to avoid further exposure to the sound field by the following behaviors: Immediately swimming away (horizontally) from the source of the sound; engaging in a series of erratic and frequently deep dives that seemed to take it below the sound field; or swimming away while engaged in a series of erratic and frequently deep dives. Although the sample sizes in this study are too small to support statistical analysis, the behavioral responses of the orcas were consistent with the results of other studies.

In 2007, the first in a series of behavioral response studies conducted by NMFS and other scientists showed one beaked whale (*Mesoplodon densirostris*) responding to an MFAS playback. The BRS–07 cruise report indicates that the playback began when the tagged beaked whale was vocalizing at depth (at the deepest part of a typical feeding dive), following a previous control with no sound exposure. The whale appeared to stop clicking significantly earlier than usual, when exposed to mid-frequency signals in the 130–140 dB (rms) received level range. After a few more minutes of the playback, when the received level reached a maximum of 140–150 dB, the whale ascended on the slow side of normal ascent rates with a longer than normal ascent, at which point the exposure was terminated. The results are from a single experiment and that a greater sample size is needed before robust and definitive conclusions can be drawn.

Studies on the Atlantic Undersea Test and Evaluation Center instrumented range in the Bahamas have shown that some Blainville's beaked whales may be resident during all or part of the year in the area, and that individuals may move off of the range for several days during and following a sonar event. However, animals are thought to continue feeding at short distances (a few kilometers) from the range out of the louder sound fields (less than 157 dB re 1 µPa) (McCarthy *et al.,* 2011; Tyack *et al.,* 2011). With these studies, there are now statistically strong data suggesting that beaked whales tend to avoid both actual naval mid-frequency sonar in real anti-submarine training scenarios as well as sonar-like signals and other signals used during controlled sound exposure studies in the same area.

Results from a 2007–2008 study conducted near the Bahamas showed a change in diving behavior of an adult Blainville's beaked whale to playback of mid-frequency source and predator sounds (Boyd *et al.,* 2008; Tyack *et al.,* 2011). Reaction to mid-frequency sounds included premature cessation of clicking and termination of a foraging dive, and a slower ascent rate to the surface. Preliminary results from a similar behavioral response study in southern California waters have been presented for the 2010–2011 field season (Southall *et al.* 2011). Cuvier's beaked whale responses suggested particular sensitivity to sound exposure as consistent with results for Blainville's beaked whale. Similarly, beaked whales exposed to sonar during British training exercises stopped foraging (DSTL 2007), and preliminary results of controlled playback of sonar may indicate feeding/foraging disruption of killer whales and sperm whales (Miller *et al.* 2011).

Orientation—A shift in an animal's resting state or an attentional change via an orienting response represent behaviors that would be considered mild disruptions if occurring alone. As previously mentioned, the responses may co-occur with other behaviors; for instance, an animal may initially orient toward a sound source, and then move away from it. Thus, any orienting response should be considered in context of other reactions that may occur.

There are few empirical studies of avoidance responses of free-living cetaceans to mid-frequency sonars. Much more information is available on the avoidance responses of free-living cetaceans to other acoustic sources, such as seismic airguns and low frequency tactical sonar, than mid-frequency active sonar.

Behavioral Responses (Southall et al. (2007))

Southall *et al.,* (2007) reports the results of the efforts of a panel of experts in acoustic research from behavioral, physiological, and physical disciplines that convened and reviewed the available literature on marine mammal hearing and physiological and behavioral responses to human-made sound with the goal of proposing exposure criteria for certain effects. This peer-reviewed compilation of literature is very valuable, though Southall *et al.*

(2007) note that not all data are equal, some have poor statistical power, insufficient controls, and/or limited information on received levels, background noise, and other potentially important contextual variables—such data were reviewed and sometimes used for qualitative illustration but were not included in the quantitative analysis for the criteria recommendations. All of the studies considered, however, contain an estimate of the received sound level when the animal exhibited the indicated response.

In the Southall *et al.,* (2007) publication, for the purposes of analyzing responses of marine mammals to anthropogenic sound and developing critieria, the authors differentiate between single pulse sounds, multiple pulse sounds, and non-pulse sounds. Sonar and other active acoustic sources are considered a non-pulse sound. Southall *et al.,* (2007) summarize the studies associated with low-frequency, mid-frequency, and high-frequency cetacean and pinniped responses to non-pulse sounds, based strictly on received level, in Appendix C of their article (incorporated by reference and summarized in the three paragraphs below).

The studies that address responses of low frequency cetaceans to non-pulse sounds include data gathered in the field and related to several types of sound sources (of varying similarity to sonar and other active acoustic sources) including: vessel noise, drilling and machinery playback, low-frequency M-sequences (sine wave with multiple phase reversals) playback, tactical low-frequency active sonar playback, drill ships, Acoustic Thermometry of Ocean Climate (ATOC) source, and non-pulse playbacks. These studies generally indicate no (or very limited) responses to received levels in the 90 to 120 dB re: 1 μPa range and an increasing likelihood of avoidance and other behavioral effects in the 120 to 160 dB range. As mentioned earlier, though, contextual variables play a very important role in the reported responses and the severity of effects are not linear when compared to received level. Also, few of the laboratory or field datasets had common conditions, behavioral contexts or sound sources, so it is not surprising that responses differ.

The studies that address responses of mid-frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to sonar and other active acoustic sources) including: pingers, drilling playbacks, ship and ice-breaking noise, vessel noise, Acoustic Harassment Devices (AHDs), Acoustic Deterrent Devices (ADDs), MFAS, and non-pulse bands and tones. Southall *et al.* (2007) were unable to come to a clear conclusion regarding the results of these studies. In some cases, animals in the field showed significant responses to received levels between 90 and 120 dB, while in other cases these responses were not seen in the 120 to 150 dB range. The disparity in results was likely due to contextual variation and the differences between the results in the field and laboratory data (animals typically responded at lower levels in the field).

The studies that address responses of high frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to sonar and other active acoustic sources) including: pingers, AHDs, and various laboratory non-pulse sounds. All of these data were collected from harbor porpoises. Southall *et al.* (2007) concluded that the existing data indicate that harbor porpoises are likely sensitive to a wide range of anthropogenic sounds at low received levels (~90–120 dB), at least for initial exposures. All recorded exposures above 140 dB induced profound and sustained avoidance behavior in wild harbor porpoises (Southall *et al.,* 2007). Rapid habituation was noted in some but not all studies. There is no data to indicate whether other high frequency cetaceans are as sensitive to anthropogenic sound as harbor porpoises are.

The studies that address the responses of pinnipeds in water to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to sonar and other active acoustic sources) including: AHDs, ATOC, various non-pulse sounds used in underwater data communication; underwater drilling, and construction noise. Few studies exist with enough information to include them in the analysis. The limited data suggested that exposures to non-pulse sounds between 90 and 140 dB generally do not result in strong behavioral responses in pinnipeds in water, but no data exist at higher received levels.

In addition to summarizing the available data, the authors of Southall *et al.* (2007) developed a severity scaling system with the intent of ultimately being able to assign some level of biological significance to a response. Following is a summary of their scoring system, a comprehensive list of the behaviors associated with each score may be found in the report:

- 0–3 (Minor and/or brief behaviors) includes, but is not limited to: no response; minor changes in speed or locomotion (but with no avoidance); individual alert behavior; minor cessation in vocal behavior; minor changes in response to trained behaviors (in laboratory).
- 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival) includes, but is not limited to: moderate changes in speed, direction, or dive profile; brief shift in group distribution; prolonged cessation or modification of vocal behavior (duration > duration of sound), minor or moderate individual and/or group avoidance of sound; brief cessation of reproductive behavior; or refusal to initiate trained tasks (in laboratory).
- 7–9 (Behaviors considered likely to affect the aforementioned vital rates) includes, but is not limited to: extensive of prolonged aggressive behavior; moderate, prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms; long-term avoidance of an area; outright panic, stampede, stranding; threatening or attacking sound source (in laboratory).

Potential Effects of Behavioral Disturbance

The different ways that marine mammals respond to sound are sometimes indicators of the ultimate effect that exposure to a given stimulus will have on the well-being (survival, reproduction, etc.) of an animal. There is little marine mammal data quantitatively relating the exposure of marine mammals to sound to effects on reproduction or survival, though data exists for terrestrial species to which we can draw comparisons for marine mammals.

Attention is the cognitive process of selectively concentrating on one aspect of an animal's environment while ignoring other things (Posner, 1994). Because animals (including humans) have limited cognitive resources, there is a limit to how much sensory information they can process at any time. The phenomenon called ''attentional capture'' occurs when a stimulus (usually a stimulus that an animal is not concentrating on or attending to) ''captures'' an animal's attention. This shift in attention can occur consciously or unconsciously (for example, when an animal hears sounds that it associates with the approach of a predator) and the shift in attention can be sudden (Dukas, 2002; van Rij, 2007).

Once a stimulus has captured an animal's attention, the animal can respond by ignoring the stimulus, assuming a "watch and wait" posture, or treat the stimulus as a disturbance and respond accordingly, which includes scanning for the source of the stimulus or "vigilance" (Cowlishaw *et al.,* 2004).

Vigilance is normally an adaptive behavior that helps animals determine the presence or absence of predators, assess their distance from conspecifics, or to attend cues from prey (Bednekoff and Lima, 1998; Treves, 2000). Despite those benefits, however, vigilance has a cost of time: when animals focus their attention on specific environmental cues, they are not attending to other activities such as foraging. These costs have been documented best in foraging animals, where vigilance has been shown to substantially reduce feeding rates (Saino, 1994; Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002).

Animals will spend more time being vigilant, which may translate to less time foraging or resting, when disturbance stimuli approach them more directly, remain at closer distances, have a greater group size (for example, multiple surface vessels), or when they co-occur with times that an animal perceives increased risk (for example, when they are giving birth or accompanied by a calf). Most of the published literature, however, suggests that direct approaches will increase the amount of time animals will dedicate to being vigilant. For example, bighorn sheep and Dall's sheep dedicated more time being vigilant, and less time resting or foraging, when aircraft made direct approaches over them (Frid, 2001; Stockwell *et al.,* 1991).

Several authors have established that long-term and intense disturbance stimuli can cause population declines by reducing the body condition of individuals that have been disturbed, followed by reduced reproductive success, reduced survival, or both (Daan *et al.,* 1996; Madsen, 1994; White, 1983). For example, Madsen (1994) reported that pink-footed geese in undisturbed habitat gained body mass and had about a 46-percent reproductive success rate compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and had a 17 percent reproductive success rate. Similar reductions in reproductive success have been reported for mule deer (Odocoileus hemionus) disturbed by all-terrain vehicles (Yarmoloy *et al.,* 1988), caribou disturbed by seismic exploration blasts (Bradshaw *et al.,* 1998), caribou disturbed by low-elevation jet fights (Luick *et al.,* 1996; Harrington and Veitch, 1992. Similarly, a study of elk that were disturbed experimentally by pedestrians concluded that the ratio of young to mothers was inversely related to disturbance rate (Phillips and Alldredge, 2000).

The primary mechanism by which increased vigilance and disturbance appear to affect the fitness of individual animals is by disrupting an animal's time budget and, as a result, reducing the time they might spend foraging and resting (which increases an animal's activity rate and energy demand). For example, a study of grizzly bears reported that bears disturbed by hikers reduced their energy intake by an average of 12 kcal/minute (50.2×10^3kJ/minute), and spent energy fleeing or acting aggressively toward hikers (White *et al.* 1999). Alternately, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a 5-day period did not cause any sleep deprivation or stress effects such as changes in cortisol or epinephrine levels.

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007).

In response to the National Research Council of the National Academies (2005) review, the Office of Naval Research founded a working group to formalize the Population Consequences of Acoustic Disturbance (PCAD) framework. The PCAD model connects observable data through a series of transfer functions using a case study approach. The long-term goal is to improve the understanding of how effects of sound on marine mammals transfer between behavior and life functions and between life functions and vital rates of individuals. Then, this understanding of how disturbance can affect the vital rates of individuals will facilitate the further assessment of the population level effects of anthropogenic sound on marine mammals by providing a quantitative approach to evaluate effects and the relationship between takes and possible changes to adult survival and/or annual recruitment.

Stranding and Mortality

When a live or dead marine mammal swims or floats onto shore and becomes "beached" or incapable of returning to sea, the event is termed a "stranding" (Geraci *et al.,* 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; NMFS, 2007). The legal definition for a stranding within the United States is that (A) "a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance." (16 U.S.C. 1421h).

Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most stranding are unknown (Geraci *et al.,* 1976; Eaton, 1979, Odell *et al.,* 1980; Best, 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might pre-dispose them to strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Chroussos, 2000; Creel, 2005; DeVries *et al.,* 2003; Fair and Becker, 2000; Foley *et al.,* 2001; Moberg, 2000; Relyea, 2005a; 2005b, Romero, 2004; Sih *et al.,* 2004). For reference, between 2001–2009, there was an annual average of approximately 1,400 cetacean strandings and 4,300 pinniped strandings along the coasts of the continental United States and Alaska (NMFS, 2011).

Several sources have published lists of mass stranding events of cetaceans during attempts to identify relationships between those stranding events and

military sonar (Hildebrand, 2004; IWC, 2005; Taylor *et al.,* 2004). For example, based on a review of stranding records between 1960 and 1995, the International Whaling Commission (2005) identified ten mass stranding events of Cuvier's beaked whales had been reported and one mass stranding of four Baird's beaked whale. The IWC concluded that, out of eight stranding events reported from the mid-1980s to the summer of 2003, seven had been coincident with the use of tactical mid-frequency sonar, one of those seven had been associated with the use of tactical low-frequency sonar, and the remaining stranding event had been associated with the use of seismic airguns.

Most of the stranding events reviewed by the International Whaling Commission involved beaked whales. A mass stranding of Cuvier's beaked whales in the eastern Mediterranean Sea occurred in 1996 (Franzis, 1998) and mass stranding events involving Gervais' beaked whales, Blainville's beaked whales, and Cuvier's beaked whales occurred off the coast of the Canary Islands in the late 1980s (Simmonds and Lopez-Jurado, 1991). The stranding events that occurred in the Canary Islands and Kyparissiakos Gulf in the late 1990s and the Bahamas in 2000 have been the most intensively-studied mass stranding events and have been associated with naval maneuvers involving the use of tactical sonar.

Between 1960 and 2006, 48 strandings (68 percent) involved beaked whales, 3 (4 percent) involved dolphins, and 14 (20 percent) involved whale species. Cuvier's beaked whales were involved in the greatest number of these events (48 or 68 percent), followed by sperm whales (7 or 10 percent), and Blainville's and Gervais' beaked whales (4 each or 6 percent). Naval activities (not just activities conducted by the U.S. Navy) that might have involved active sonar are reported to have coincided with 9 (13 percent) or 10 (14 percent) of those stranding events. Between the mid-1980s and 2003 (the period reported by the International Whaling Commission), we identified reports of 44 mass cetacean stranding events of which at least seven were coincident with naval exercises that were using mid-frequency sonar.

Strandings Associated With Impulse Sound

During a Navy training event on March 4, 2011 at the Silver Strand Training Complex in San Diego, California, three or possibly four dolphins were killed in an explosion. During an underwater detonation training event, a pod of 100 to 150 long-beaked common dolphins were observed moving towards the 700-yd (640.1–m) exclusion zone around the explosive charge, monitored by personnel in a safety boat and participants in a dive boat. Approximately 5 minutes remained on a time-delay fuse connected to a single 8.76 lb. (3.97 kg) explosive charge (C–4 and detonation cord). Although the dive boat was placed between the pod and the explosive in an effort to guide the dolphins away from the area, that effort was unsuccessful and three long-beaked common dolphins near the explosion died. In addition to the three dolphins found dead on March 4, the remains of a fourth dolphin were discovered on March 7, 2011 near Ocean Beach, California (3 days later and approximately 11.8 mi. [19 km] from Silver Strand where the training event occurred), which might also have been related to this event. Association of the fourth stranding with the training event is uncertain because dolphins strand on a regular basis in the San Diego area. Details such as the dolphins' depth and distance from the explosive at the time of the detonation could not be estimated from the 250 yd (228.6 m) standoff point of the observers in the dive boat or the safety boat.

These dolphin mortalities are the only known occurrence of a U.S. Navy training or testing event involving impulse energy (underwater detonation) that caused mortality or injury to a marine mammal. Despite this being a rare occurrence, the Navy has reviewed training requirements, safety procedures, and possible mitigation measures and implemented changes to reduce the potential for this to occur in the future. Discussions of procedures associated with these and other training and testing events are presented in the Mitigation section.

Strandings Associated With MFAS

Over the past 16 years, there have been five stranding events coincident with military mid-frequency sonar use in which exposure to sonar is believed to have been a contributing factor: Greece (1996); the Bahamas (2000); Madeira (2000); Canary Islands (2002); and Spain (2006). Additionally, during the 2004 Rim of the Pacific (RIMPAC) exercises, between 150 and 200 usually pelagic melon-headed whales occupied the shallow waters of Hanalei Bay, Kaua'i, Hawaii for over 28 hours. NMFS determined that MFAS was a plausible, if not likely, contributing factor in what may have been a confluence of events that led to the stranding. A number of other stranding events coincident with the operation of mid-frequency sonar including the death of beaked whales or other species (minke whales, dwarf sperm whales, pilot whales) have been reported; however, the majority have not been investigated to the degree necessary to determine the cause of the stranding and only one of these stranding events, the Bahamas (2000), was associated with exercises conducted by the U.S. Navy.

Greece (1996)

Twelve Cuvier's beaked whales stranded atypically (in both time and space) along a 38.2-kilometer strand of the coast of the Kyparissiakos Gulf on May 12 and 13, 1996 (Frantzis, 1998). From May 11 through May 15, the NATO research vessel *Alliance* was conducting sonar tests with signals of 600 Hz and 3 kHz and source levels of 228 and 226 dB re: 1μPa, respectively (D'Amico and Verboom, 1998; D'Spain *et al.,* 2006). The timing and the location of the testing encompassed the time and location of the whale strandings (Frantzis, 1998).

Necropsies of eight of the animals were performed but were limited to basic external examination and sampling of stomach contents, blood, and skin. No ears or organs were collected, and no histological samples were preserved. No apparent abnormalities or wounds were found (Frantzis, 2004). Examination of photos of the animals, taken soon after their death, revealed that the eyes of at least four of the individuals were bleeding. Photos were taken soon after their death (Frantzis, 2004). Stomach contents contained the flesh of cephalopods, indicating that feeding had recently taken place (Frantzis, 1998).

All available information regarding the conditions associated with this stranding event were compiled, and many potential causes were examined including major pollution events, prominent tectonic activity, unusual physical or meteorological events, magnetic anomalies, epizootics, and conventional military activities (International Council for the Exploration of the Sea, 2005a). However, none of these potential causes coincided in time or space with the mass stranding, or could explain its characteristics (International Council for the Exploration of the Sea, 2005a). The robust condition of the animals, plus the recent stomach contents, is inconsistent with pathogenic causes (Frantzis, 2004). In addition, environmental causes can be ruled out as there were no unusual environmental circumstances or events before or during this time period and within the general proximity (Frantzis, 2004).

Because of the rarity of this mass stranding of Cuvier's beaked whales in the Kyparissiakos Gulf (first one in history), the probability for the two events (the military exercises and the strandings) to coincide in time and location, while being independent of each other, was extremely low (Frantzis, 1998). However, because full necropsies had not been conducted, and no abnormalities were noted, the cause of the strandings could not be precisely determined (Cox *et al.,* 2006). A Bioacoustics Panel convened by NATO concluded that the evidence available did not allow them to accept or reject sonar exposures as a causal agent in these stranding events. The analysis of this stranding event provided support for, but no clear evidence for, the cause-and-effect relationship of tactical sonar training activities and beaked whale strandings (Cox *et al.,* 2006).

Bahamas (2000)

NMFS and the Navy prepared a joint report addressing the multi-species stranding in the Bahamas in 2000, which took place within 24 hours of U.S. Navy ships using MFAS as they passed through the Northeast and Northwest Providence Channels on March 15–16, 2000. The ships, which operated both AN/SQS–53C and AN/SQS–56, moved through the channel while emitting sonar pings approximately every 24 seconds. Of the 17 cetaceans that stranded over a 36-hr period (Cuvier's beaked whales, Blainville's beaked whales, Minke whales, and a spotted dolphin), seven animals died on the beach (5 Cuvier's beaked whales, 1 Blainville's beaked whale, and the spotted dolphin), while the other 10 were returned to the water alive (though their ultimate fate is unknown). As discussed in the Bahamas report (DOC/DON, 2001), there is no likely association between the minke whale and spotted dolphin strandings and the operation of MFAS.

Necropsies were performed on five of the stranded beaked whales. All five necropsied beaked whales were in good body condition, showing no signs of infection, disease, ship strike, blunt trauma, or fishery related injuries, and three still had food remains in their stomachs. Auditory structural damage was discovered in four of the whales, specifically bloody effusions or hemorrhaging around the ears. Bilateral intracochlear and unilateral temporal region subarachnoid hemorrhage, with blood clots in the lateral ventricles, were found in two of the whales. Three of the whales had small hemorrhages in their acoustic fats (located along the jaw and in the melon).

A comprehensive investigation was conducted and all possible causes of the stranding event were considered, whether they seemed likely at the outset or not. Based on the way in which the strandings coincided with ongoing naval activity involving tactical MFAS use, in terms of both time and geography, the nature of the physiological effects experienced by the dead animals, and the absence of any other acoustic sources, the investigation team concluded that MFAS aboard U.S. Navy ships that were in use during the sonar exercise in question were the most plausible source of this acoustic or impulse trauma to beaked whales. This sound source was active in a complex environment that included the presence of a surface duct, unusual and steep bathymetry, a constricted channel with limited egress, intensive use of multiple, active sonar units over an extended period of time, and the presence of beaked whales that appear to be sensitive to the frequencies produced by these sonars. The investigation team concluded that the cause of this stranding event was the confluence of the Navy MFAS and these contributory factors working together, and further recommended that the Navy avoid operating MFAS in situations where these five factors would be likely to occur. This report does not conclude that all five of these factors must be present for a stranding to occur, nor that beaked whales are the only species that could potentially be affected by the confluence of the other factors. Based on this, NMFS believes that the operation of MFAS in situations where surface ducts exist, or in marine environments defined by steep bathymetry and/or constricted channels may increase the likelihood of producing a sound field with the potential to cause cetaceans (especially beaked whales) to strand, and therefore, suggests the need for increased vigilance while operating MFAS in these areas, especially when beaked whales (or potentially other deep divers) are likely present.

Madeira, Spain (2000)

From May 10–14, 2000, three Cuvier's beaked whales were found atypically stranded on two islands in the Madeira archipelago, Portugal (Cox *et al.,* 2006). A fourth animal was reported floating in the Madeiran waters by fisherman but did not come ashore (Woods Hole Oceanographic Institution, 2005). Joint NATO amphibious training peacekeeping exercises involving participants from 17 countries 80 warships, took place in Portugal during May 2–15, 2000.

The bodies of the three stranded whales were examined post mortem (Woods Hole Oceanographic Institution, 2005), though only one of the stranded whales was fresh enough (24 hours after stranding) to be necropsied (Cox *et al.,* 2006). Results from the necropsy revealed evidence of hemorrhage and congestion in the right lung and both kidneys (Cox *et al.,* 2006). There was also evidence of intercochlear and intracranial hemorrhage similar to that which was observed in the whales that stranded in the Bahamas event (Cox *et al.,* 2006). There were no signs of blunt trauma, and no major fractures (Woods Hole Oceanographic Institution, 2005). The cranial sinuses and airways were found to be clear with little or no fluid deposition, which may indicate good preservation of tissues (Woods Hole Oceanographic Institution, 2005).

Several observations on the Madeira stranded beaked whales, such as the pattern of injury to the auditory system, are the same as those observed in the Bahamas strandings. Blood in and around the eyes, kidney lesions, pleural hemorrhages, and congestion in the lungs are particularly consistent with the pathologies from the whales stranded in the Bahamas, and are consistent with stress and pressure related trauma. The similarities in pathology and stranding patterns between these two events suggest that a similar pressure event may have precipitated or contributed to the strandings at both sites (Woods Hole Oceanographic Institution, 2005).

Even though no definitive causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas, 2004): exercises were conducted in areas of at least 547 fathoms (1000 m) depth near a shoreline where there is a rapid change in bathymetry on the order of 547 to 3,281 fathoms (1000–6000 m) occurring a cross a relatively short horizontal distance (Freitas, 2004); multiple ships were operating around Madeira, though it is not known if MFA sonar was used, and the specifics of the sound sources used are unknown (Cox *et al.,* 2006, Freitas, 2004); and exercises took place in an area surrounded by landmasses separated by less than 35 nm (65 km) and at least 10 nm (19 km) in length, or in an embayment. Exercises involving multiple ships employing MFA near land may produce sound directed towards a channel or embayment that may cut off the lines of egress for marine mammals (Freitas, 2004).

Canary Islands, Spain (2002)

The southeastern area within the Canary Islands is well known for aggregations of beaked whales due to its ocean depths of greater than 547 fathoms (1,000 m) within a few hundred meters of the coastline (Fernandez *et al.,* 2005). On September 24, 2002, 14 beaked whales were found stranded on Fuerteventura and Lanzarote Islands in the Canary Islands (International Council for Exploration of the Sea, 2005a). Seven whales died, while the remaining seven live whales were returned to deeper waters (Fernandez *et al.,* 2005). Four beaked whales were found stranded dead over the next 3 days either on the coast or floating offshore. These strandings occurred within near proximity of an international naval exercise that utilized MFAS and involved numerous surface warships and several submarines. Strandings began about 4 hours after the onset of MFA sonar activity (International Council for Exploration of the Sea, 2005a; Fernandez *et al.,* 2005).

Eight Cuvier's beaked whales, one Blainville's beaked whale, and one Gervais' beaked whale were necropsied, six of them within 12 hours of stranding (Fernandez *et al.,* 2005). No pathogenic bacteria were isolated from the carcasses (Jepson *et al.,* 2003). The animals displayed severe vascular congestion and hemorrhage especially around the tissues in the jaw, ears, brain, and kidneys, displaying marked disseminated microvascular hemorrhages associated with widespread fat emboli (Jepson *et al.,* 2003; International Council for Exploration of the Sea, 2005a). Several organs contained intravascular bubbles, although definitive evidence of gas embolism in vivo is difficult to determine after death (Jepson *et al.,* 2003). The livers of the necropsied animals were the most consistently affected organ, which contained macroscopic gas-filled cavities and had variable degrees of fibrotic encapsulation. In some animals, cavitary lesions had extensively replaced the normal tissue (Jepson *et al.,* 2003). Stomachs contained a large amount of fresh and undigested contents, suggesting a rapid onset of disease and death (Fernandez *et al.,* 2005). Head and neck lymph nodes were enlarged and congested, and parasites were found in the kidneys of all animals (Fernandez *et al.,* 2005).

The association of NATO MFAS use close in space and time to the beaked whale strandings, and the similarity between this stranding event and previous beaked whale mass strandings coincident with sonar use, suggests that a similar scenario and causative mechanism of stranding may be shared between the events. Beaked whales stranded in this event demonstrated brain and auditory system injuries, hemorrhages, and congestion in multiple organs, similar to the pathological findings of the Bahamas and Madeira stranding events. In addition, the necropsy results of Canary Islands stranding event lead to the hypothesis that the presence of disseminated and widespread gas bubbles and fat emboli were indicative of nitrogen bubble formation, similar to what might be expected in decompression sickness (Jepson *et al.,* 2003; Fernández *et al.,* 2005).

Hanalei Bay (2004)

On July 3 and 4, 2004, approximately 150 to 200 melon-headed whales occupied the shallow waters of the Hanalei Bay, Kaua'i, Hawaii for over 28 hours. Attendees of a canoe blessing observed the animals entering the Bay in a single wave formation at 7 a.m. on July 3, 2004. The animals were observed moving back into the shore from the mouth of the Bay at 9 a.m. The usually pelagic animals milled in the shallow bay and were returned to deeper water with human assistance beginning at 9:30 a.m. on July 4, 2004, and were out of sight by 10:30 a.m.

Only one animal, a calf, was known to have died following this event. The animal was noted alive and alone in the Bay on the afternoon of July 4, 2004 and was found dead in the Bay the morning of July 5, 2004. A full necropsy, magnetic resonance imaging, and computerized tomography examination were performed on the calf to determine the manner and cause of death. The combination of imaging, necropsy and histological analyses found no evidence of infectious, internal traumatic, congenital, or toxic factors. Cause of death could not be definitively determined, but it is likely that maternal separation, poor nutritional condition, and dehydration contributed to the final demise of the animal. Although we do not know when the calf was separated from its mother, the animals' movement into the Bay and subsequent milling and re-grouping may have contributed to the separation or lack of nursing, especially if the maternal bond was weak or this was a primiparous calf.

Environmental factors, abiotic and biotic, were analyzed for any anomalous occurrences that would have contributed to the animals entering and remaining in Hanalei Bay. The Bay's bathymetry is similar to many other sites within the Hawaiian Island chain and dissimilar to sites that have been associated with mass strandings in other parts of the U.S. The weather conditions appeared to be normal for that time of year with no fronts or other significant features noted. There was no evidence of unusual distribution, occurrence of predator or prey species, or unusual harmful algal blooms, although Mobley *et al.,* 2007 suggested that the full moon cycle that occurred at that time may have influenced a run of squid into the Bay. Weather patterns and bathymetry that have been associated with mass strandings elsewhere were not found to occur in this instance.

The Hanalei event was spatially and temporally correlated with RIMPAC. Official sonar training and tracking exercises in the Pacific Missile Range Facility (PMRF) warning area did not commence until approximately 8 a.m. on July 3 and were thus ruled out as a possible trigger for the initial movement into the Bay. However, six naval surface vessels transiting to the operational area on July 2 intermittently transmitted active sonar (for approximately 9 hours total from 1:15 p.m. to 12:30 a.m.) as they approached from the south. The potential for these transmissions to have triggered the whales' movement into Hanalei Bay was investigated. Analyses with the information available indicated that animals to the south and east of Kaua'i could have detected active sonar transmissions on July 2, and reached Hanalei Bay on or before 7 a.m. on July 3. However, data limitations regarding the position of the whales prior to their arrival in the Bay, the magnitude of sonar exposure, behavioral responses of melon-headed whales to acoustic stimuli, and other possible relevant factors preclude a conclusive finding regarding the role of sonar in triggering this event. Propagation modeling suggest that transmissions from sonar use during the July 3 exercise in the PMRF warning area may have been detectable at the mouth of the Bay. If the animals responded negatively to these signals, it may have contributed to their continued presence in the Bay. The U.S. Navy ceased all active sonar transmissions during exercises in this range on the afternoon of July 3. Subsequent to the cessation of sonar use, the animals were herded out of the Bay.

While causation of this stranding event may never be unequivocally determined, we consider the active sonar transmissions of July 2–3, 2004, a plausible, if not likely, contributing factor in what may have been a confluence of events. This conclusion is based on the following: (1) The evidently anomalous nature of the

stranding; (2) its close spatiotemporal correlation with wide-scale, sustained use of sonar systems previously associated with stranding of deep-diving marine mammals; (3) the directed movement of two groups of transmitting vessels toward the southeast and southwest coast of Kauai; (4) the results of acoustic propagation modeling and an analysis of possible animal transit times to the Bay; and (5) the absence of any other compelling causative explanation. The initiation and persistence of this event may have resulted from an interaction of biological and physical factors. The biological factors may have included the presence of an apparently uncommon, deep-diving cetacean species (and possibly an offshore, non-resident group), social interactions among the animals before or after they entered the Bay, and/or unknown predator or prey conditions. The physical factors may have included the presence of nearby deep water, multiple vessels transiting in a directed manner while transmitting active sonar over a sustained period, the presence of surface sound ducting conditions, and/or intermittent and random human interactions while the animals were in the Bay.

A separate event involving melon-headed whales and rough-toothed dolphins took place over the same period of time in the Northern Mariana Islands (Jefferson *et al.,* 2006), which is several thousand miles from Hawaii. Some 500 to 700 melon-headed whales came into Sasanhaya Bay on July 4, 2004 near the island of Rota and then left of their own accord after 5.5 hours; no known active sonar transmissions occurred in the vicinity of that event. The Rota incident led to scientific debate regarding what, if any, relationship the event had to the simultaneous events in Hawaii and whether they might be related by some common factor (e.g., there was a full moon on July 2, 2004 as well as during other melon-headed whale strandings and nearshore aggregations (Brownell *et al.,* 2009; Lignon *et al.,* 2007; Mobley *et al.,* 2007). Brownell *et al.* (2009) compared the two incidents, along with one other stranding incident at Nuka Hiva in French Polynesia and normal resting behaviors observed at Palmyra Island, in regard to physical features in the areas, melon-headed whale behavior, and lunar cycles. Brownell *et al.,* (2009) concluded that the rapid entry of the whales into Hanalei Bay, their movement into very shallow water far from the 100-m contour, their milling behavior (typical pre-stranding behavior), and their reluctance to leave the bay constituted an unusual event that was not similar to the events that occurred at Rota (but was similar to the events at Palmyra), which appear to be similar to observations of melon-headed whales resting normally at Palmyra Island. Additionally, there was no correlation between lunar cycle and the types of behaviors observed in the Brownell *et al.* (2009) examples.

Spain (2006)

The Spanish Cetacean Society reported an atypical mass stranding of four beaked whales that occurred January 26, 2006, on the southeast coast of Spain, near Mojacar (Gulf of Vera) in the Western Mediterranean Sea. According to the report, two of the whales were discovered the evening of January 26 and were found to be still alive. Two other whales were discovered during the day on January 27, but had already died. The first three animals were located near the town of Mojacar and the fourth animal was found dead, a few kilometers north of the first three animals. From January 25–26, 2006, Standing North Atlantic Treaty Organization (NATO) Response Force Maritime Group Two (five of seven ships including one U.S. ship under NATO Operational Control) had conducted active sonar training against a Spanish submarine within 50 nm (93 km) of the stranding site.

Veterinary pathologists necropsied the two male and two female Cuvier's beaked whales. According to the pathologists, the most likely primary cause of this type of beaked whale mass stranding event was anthropogenic acoustic activities, most probably anti-submarine MFAS used during the military naval exercises. However, no positive acoustic link was established as a direct cause of the stranding. Even though no causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas, 2004): Exercises were conducted in areas of at least 547 fathoms (1,000 m) depth near a shoreline where there is a rapid change in bathymetry on the order of 547 to 3,281 fathoms (1,000–6,000 m) occurring across a relatively short horizontal distance (Freitas, 2004); multiple ships (in this instance, five) were operating MFAS in the same area over extended periods of time (in this case, 20 hours) in close proximity; and exercises took place in an area surrounded by landmasses, or in an embayment. Exercises involving multiple ships employing MFAS near land may have produced sound directed towards a channel or embayment that may have cut off the lines of egress for the affected marine mammals (Freitas, 2004).

Association Between Mass Stranding Events and Exposure to MFAS

Several authors have noted similarities between some of these stranding incidents: They occurred in islands or archipelagoes with deep water nearby, several appeared to have been associated with acoustic waveguides like surface ducting, and the sound fields created by ships transmitting MFAS (Cox *et al.,* 2006, D'Spain *et al.,* 2006). Although Cuvier's beaked whales have been the most common species involved in these stranding events (81 percent of the total number of stranded animals), other beaked whales (including *Mesoplodon europeaus, M. densirostris,* and *Hyperoodon ampullatus*) comprise 14 percent of the total. Other species (*Stenella coeruleoalba, Kogia breviceps* and *Balaenoptera acutorostrata*) have stranded, but in much lower numbers and less consistently than beaked whales.

Based on the evidence available, however, we cannot determine whether: (a) Cuvier's beaked whale is more prone to injury from high-intensity sound than other species; (b) their behavioral responses to sound makes them more likely to strand; or (c) they are more likely to be exposed to MFAS than other cetaceans (for reasons that remain unknown). Because the association between active sonar exposures and marine mammals mass stranding events is not consistent—some marine mammals strand without being exposed to sonar and some sonar transmissions are not associated with marine mammal stranding events despite their co-occurrence—other risk factors or a groupings of risk factors probably contribute to these stranding events.

Behaviorally Mediated Responses to MFAS That May Lead to Stranding

Although the confluence of Navy MFAS with the other contributory factors noted in the report was identified as the cause of the Bahamas (2000) stranding event, the specific mechanisms that led to that stranding (or the others) are not understood, and there is uncertainty regarding the ordering of effects that led to the stranding. It is unclear whether beaked whales were directly injured by sound (acoustically mediated bubble growth, addressed above) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to be injured and strand.

Although causal relationships between beaked whale stranding events and active sonar remain unknown, several authors have hypothesized that stranding events involving these species in the Bahamas and Canary Islands may have been triggered when the whales changed their dive behavior in a startled response to exposure to active sonar or to further avoid exposure (Cox *et al.,* 2006, Rommel *et al.,* 2006). These authors proposed three mechanisms by which the behavioral responses of beaked whales upon being exposed to active sonar might result in a stranding event. These include the following: gas bubble formation caused by excessively fast surfacing; remaining at the surface too long when tissues are supersaturated with nitrogen; or diving prematurely when extended time at the surface is necessary to eliminate excess nitrogen. More specifically, beaked whales that occur in deep waters that are in close proximity to shallow waters (for example, the ''canyon areas'' that are cited in the Bahamas stranding event; see D'Spain and D'Amico, 2006), may respond to active sonar by swimming into shallow waters to avoid further exposures and strand if they were not able to swim back to deeper waters. Second, beaked whales exposed to active sonar might alter their dive behavior. Changes in their dive behavior might cause them to remain at the surface or at depth for extended periods of time which could lead to hypoxia directly by increasing their oxygen demands or indirectly by increasing their energy expenditures (to remain at depth) and increase their oxygen demands as a result. If beaked whales are at depth when they detect a ping from an active sonar transmission and change their dive profile, this could lead to the formation of significant gas bubbles, which could damage multiple organs or interfere with normal physiological function (Cox *et al.,* 2006; Rommel *et al.,* 2006; Zimmer and Tyack, 2007). Baird *et al.* (2005) found that slow ascent rates from deep dives and long periods of time spent within 50 m of the surface were typical for both Cuvier's and Blainville's beaked whales, the two species involved in mass strandings related to naval sonar. These two behavioral mechanisms may be necessary to purge excessive dissolved nitrogen concentrated in their tissues during their frequent long dives (Baird *et al.,* 2005). Baird *et al.* (2005) further suggests that abnormally rapid ascents or premature dives in response to high-intensity sonar could indirectly result in physical harm to the beaked whales, through the mechanisms described above (gas bubble formation or non-elimination of excess nitrogen).

Because many species of marine mammals make repetitive and prolonged dives to great depths, it has long been assumed that marine mammals have evolved physiological mechanisms to protect against the effects of rapid and repeated decompressions. Although several investigators have identified physiological adaptations that may protect marine mammals against nitrogen gas supersaturation (alveolar collapse and elective circulation; Kooyman *et al.,* 1972; Ridgway and Howard, 1979), Ridgway and Howard (1979) reported that bottlenose dolphins that were trained to dive repeatedly had muscle tissues that were substantially supersaturated with nitrogen gas. Houser *et al.* (2001) used these data to model the accumulation of nitrogen gas within the muscle tissue of other marine mammal species and concluded that cetaceans that dive deep and have slow ascent or descent speeds would have tissues that are more supersaturated with nitrogen gas than other marine mammals. Based on these data, Cox *et al.* (2006) hypothesized that a critical dive sequence might make beaked whales more prone to stranding in response to acoustic exposures. The sequence began with (1) very deep (to depths as deep as 2 kilometers) and long (as long as 90 minutes) foraging dives with (2) relatively slow, controlled ascents, followed by (3) a series of ''bounce'' dives between 100 and 400 meters in depth (also see Zimmer and Tyack, 2007). They concluded that acoustic exposures that disrupted any part of this dive sequence (for example, causing beaked whales to spend more time at surface without the bounce dives that are necessary to recover from the deep dive) could produce excessive levels of nitrogen supersaturation in their tissues, leading to gas bubble and emboli formation that produces pathologies similar to decompression sickness.

Zimmer and Tyack (2007) modeled nitrogen tension and bubble growth in several tissue compartments for several hypothetical dive profiles and concluded that repetitive shallow dives (defined as a dive where depth does not exceed the depth of alveolar collapse, approximately 72 m for Ziphius), perhaps as a consequence of an extended avoidance reaction to sonar sound, could pose a risk for decompression sickness and that this risk should increase with the duration of the response. Their models also suggested that unrealistically rapid ascent rates from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected. Tyack *et al.* (2006) suggested that emboli observed in animals exposed to mid-frequency range sonar (Jepson *et al.,* 2003; Fernandez *et al.,* 2005) could stem from a behavioral response that involves repeated dives shallower than the depth of lung collapse. Given that nitrogen gas accumulation is a passive process (i.e. nitrogen is metabolically inert), a bottlenose dolphin was trained to repetitively dive a profile predicted to elevate nitrogen saturation to the point that nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of asymptomatic nitrogen gas bubbles (Houser *et al.,* 2007). Baird *et al.* (2008), in a beaked whale tagging study off Hawaii, showed that deep dives are equally common during day or night, but ''bounce dives'' are typically a daytime behavior, possibly associated with visual predator avoidance. This may indicate that ''bounce dives'' are associated with something other than behavioral regulation of dissolved nitrogen levels, which would be necessary day and night.

If marine mammals respond to a Navy vessel that is transmitting active sonar in the same way that they might respond to a predator, their probability of flight responses should increase when they perceive that Navy vessels are approaching them directly, because a direct approach may convey detection and intent to capture (Burger and Gochfeld, 1981, 1990; Cooper, 1997, 1998). The probability of flight responses should also increase as received levels of active sonar increase (and the ship is, therefore, closer) and as ship speeds increase (that is, as approach speeds increase). For example, the probability of flight responses in Dall's sheep (*Ovis dalli dalli*) (Frid 2001a, b), ringed seals (*Phoca hispida*) (Born *et al.,* 1999), Pacific brant (*Branta bernic nigricans*) and Canada geese (*B. Canadensis*) increased as a helicopter or fixed-wing aircraft approached groups of these animals more directly (Ward *et al.,* 1999). Bald eagles (*Haliaeetus leucocephalus*) perched on trees alongside a river were also more likely to flee from a paddle raft when their perches were closer to the river or were closer to the ground (Steidl and Anthony, 1996).

Despite the many theories involving bubble formation (both as a direct cause of injury (see Acoustically Mediated Bubble Growth Section) and an indirect cause of stranding (See Behaviorally Mediated Bubble Growth Section),

Southall *et al.,* (2007) summarizes that there is either scientific disagreement or a lack of information regarding each of the following important points: (1) Received acoustical exposure conditions for animals involved in stranding events; (2) pathological interpretation of observed lesions in stranded marine mammals; (3) acoustic exposure conditions required to induce such physical trauma directly; (4) whether noise exposure may cause behavioral reactions (such as atypical diving behavior) that secondarily cause bubble formation and tissue damage; and (5) the extent the post mortem artifacts introduced by decomposition before sampling, handling, freezing, or necropsy procedures affect interpretation of observed lesions.

During AFTT exercises there will be use of multiple sonar units in areas where six species of beaked whale species may be present. A surface duct may be present in a limited area for a limited period of time. Although most of the ASW training events will take place in the deep ocean, some will occur in areas of high bathymetric relief. However, none of the training events will take place in a location having a constricted channel with limited egress similar to the Bahamas (because none exist in the AFTT Study Area). None of the AFTT exercise areas will have a convergence of all five of the environmental factors believed to contribute to the Bahamas stranding (mid-frequency sonar, beaked whale presence, surface ducts, steep bathymetry, and constricted channels with limited egress). However, as mentioned previously, NMFS recommends caution when steep bathymetry, surface ducting conditions, or a constricted channel is present when mid-frequency tactical sonar is employed and cetaceans (especially beaked whales) are present.

Impulsive Sources

Underwater explosive detonations send a shock wave and sound energy through the water and can release gaseous by-products, create an oscillating bubble, or cause a plume of water to shoot up from the water surface. The shock wave and accompanying noise are of most concern to marine animals. Depending on the intensity of the shock wave and size, location, and depth of the animal, an animal can be injured, killed, suffer non-lethal physical effects, experience hearing related effects with or without behavioral responses, or exhibit temporary behavioral responses or tolerance from hearing the blast sound. Generally, exposures to higher levels of impulse and pressure levels would result in greater impacts on an individual animal.

Injuries resulting from a shock wave take place at boundaries between tissues of different densities. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg, 2000). Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner, 1982; Hill, 1978; Yelverton *et al.,* 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton *et al.,* 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound-related damage associated with sound energy from detonations can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten, 1995). Sound-related trauma can be lethal or sublethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten, 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten, 1995).

There have been fewer studies addressing the behavioral effects of explosives on marine mammals compared to sonar and other active acoustic sources. However, though the nature of the sound waves emitted from an explosion are different (in shape and rise time) from sonar and other active acoustic sources, we still anticipate the same sorts of behavioral responses to result from repeated explosive detonations (a smaller range of likely less severe responses (i.e., not rising to the level of MMPA harassment) would be expected to occur as a result of exposure to a single explosive detonation that was not powerful enough or close enough to the animal to cause TTS or injury).

Vessel Strike

Commercial and Navy ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Vanderlaan and Taggart, 2007).

The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (e.g., the sperm whale). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.,* 2004). These species are primarily large, slow moving whales. Smaller marine mammals (e.g., bottlenose dolphin) move quickly through the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; Vanderlaan and Taggart, 2007). In assessing records in which vessel speed was known, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 knots.

Jensen and Silber (2003) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58

cases. Of these cases, 39 (or 67 percent) resulted in serious injury or death (19 of those resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79 percent) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 knots, and exceeded 90 percent at 17 knots. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death by pulling whales toward the vessel. Computer simulation modeling showed that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne, 1999; Knowlton *et al.,* 1995).

The Jensen and Silber (2003) report notes that the database represents a minimum number of collisions, because the vast majority probably goes undetected or unreported. In contrast, Navy vessels are likely to detect any strike that does occur, and they are required to report all ship strikes involving marine mammals. Overall, the percentages of Navy traffic relative to overall reported large shipping traffic are very small (on the order of 2 percent).

Over a period of 18 years from 1995 to 2012 there have been a total of 19 Navy vessel strikes in the Study Area. Eight of the strikes resulted in a confirmed death; but in 11 of the 19 strikes, the fate of the animal was unknown. It is possible that some of the 11 reported strikes resulted in recoverable injury or were not marine mammals at all, but another large marine species (e.g., basking shark). However, it is prudent to consider that all of the strikes could have resulted in the death of a marine mammal. The maximum number of strikes in any given year was three strikes, which occurred in 2001 and 2004. The highest average number of strikes over any five year period was two strikes per year from 2001 to 2005. The average number of strikes for the entire 18-year period is 1.055 strikes per year. Since the implementation of the Navy's Marine Species Awareness Training in 2007, strikes in the Study Area have decreased to an average of 0.5 per year. Over the last five years on the east coast, the Navy was involved in two strikes, with no confirmed marine mammal deaths as a result of the vessel strike.

Mitigation

In order to issue an incidental take authorization (ITA) under Section 101(a)(5)(A) of the MMPA, NMFS must set forth the ''permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.'' The NDAA of 2004 amended the MMPA as it relates to military-readiness activities and the incidental take authorization process such that ''least practicable adverse impact'' shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the ''military readiness activity.'' The training and testing activities described in the AFTT application are considered military readiness activities.

NMFS reviewed the proposed activities and the proposed mitigation measures as described in the Navy's LOA application to determine if they would result in the least practicable adverse effect on marine mammals, which includes a careful balancing of the likely benefit of any particular measure to the marine mammals with the likely effect of that measure on personnel safety, practicality of implementation, and impact on the effectiveness of the ''military readiness activity.'' Included below are the mitigation measures the Navy proposed in its LOA application.

Proposed Mitigation Measures

In general, mitigation measures are modifications to the proposed activities that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. These do not include standard operating procedures, which are established for reasons other than environmental benefit. Most of the following proposed mitigation measures are currently implemented, and the remainder were developed where there was no mitigation for new systems. The Navy's overall approach to assessing potential mitigation measures is provided in Section 5.2.2 of the AFTT DEIS/OEIS. It may be necessary for NMFS to require additional mitigation or monitoring beyond those presented below based on information and comments received during the public comment period as well as through the consultation process required under section 7 of the ESA.

Lookouts

The use of lookouts is a critical component of Navy procedural measures and implementation of mitigation zones. Navy lookouts are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (OOD) (e.g., trash, a periscope, marine mammals, sea turtles) and all disturbances (e.g., surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel standing watch on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

The Navy would have two types of lookouts for purposes of conducting visual observations: (1) Those positioned on surface ships, and (2) those positioned in aircraft or on boats. Lookouts positioned on surface ships would be dedicated solely to diligent observation of the air and surface of the water. They would have multiple observation objectives, which include but are not limited to detecting the presence of biological resources and recreational or fishing boats, observing mitigation zones, and monitoring for vessel and personnel safety concerns.

Due to aircraft and boat manning and space restrictions, lookouts positioned in aircraft or on boats would consist of the aircraft crew, pilot, or boat crew. Lookouts positioned in aircraft and boats may necessarily be responsible for tasks in addition to observing the air or surface of the water (for example, navigation of a helicopter or rigid hull inflatable boat). However, aircraft and boat lookouts would, to the maximum extent practicable and consistent with aircraft and boat safety and training and testing requirements, comply with the observation objectives described above for lookouts positioned on surface ships.

The Navy proposes to use at least one lookout during the training and testing activities provided in Table 10. Additional details on lookout procedures are provided in Chapter 11 of the Navy's LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*).

TABLE 10—LOOKOUT MITIGATION MEASURES FOR TRAINING AND TESTING ACTIVITIES WITHIN THE AFTT STUDY AREA

Number of lookouts	Training and testing activities	Benefit
2 to 4	Mine countermeasure and neutralization activities using time delay would use 4 lookouts. If applicable, aircrew and divers would report sightings of marine mammals. Ship shock trials would have a minimum of 2–4 lookouts depending on the size of the charge.	Lookouts can visually detect marine mammals so that potentially harmful impacts from explosives use can be avoided. Trained lookouts can more quickly and effectively relay sighting information so that corrective action can be taken. Support from aircrew and divers, if they are involved, would increase the probability of sightings, reducing the potential for impacts.
1 to 2	Vessels using low-frequency active sonar or hull-mounted mid-frequency active sonar associated with ASW activities would have either one or two lookouts, depending on the size of the vessel and the status/location of the vessel.	Lookouts can visually detect marine mammals so that potentially harmful impacts from Navy sonar and explosives use can be avoided. Trained lookouts can more quickly and effectively relay sighting information so that corrective action can be taken. Support from aircrew and divers, if they are involved, would increase the probability of sightings, reducing the potential for impacts. Mine countermeasure and neutralization activities with positive control would use one or two lookouts (depending on net explosive weight), with at least one on each support vessel. If applicable, aircrew and divers would also report the presence of marine mammals. Mine neutralization activities involving diver placed charges of up to 100 lb (45 kg) net explosive weight detonation would use two lookouts. Sinking exercises would use two lookouts (one in an aircraft and one on a vessel). At sea explosives testing would have at least one lookout.
1	Surface ships and aircraft conducting ASW, ASUW, or MIW activities using high-frequency active sonar; non-hull mounted mid-frequency active sonar; helicopter dipping mid-frequency active sonar; anti-swimmer grenades; IEER sonobuoys; line charge testing; surface gunnery activities using a surface target; surface missile activities using a surface target; bombing activities; explosive torpedo testing; elevated causeway system pile driving; towed in-water devices; full power propulsion testing of surface vessels; vessel movements; and activities using non-explosive practice munitions, would have one lookout.	Lookouts can visually detect marine mammals so that potentially harmful impacts from Navy sonar; explosives; sonobuoys; gunnery rounds and missiles using a surface target; explosive torpedoes; pile driving; towed systems; surface vessel propulsion; vessel movements; and non-explosive munitions can be avoided. A trained lookout can more quickly and effectively relay sighting information so that corrective action can be taken.

Personnel standing watch on the bridge, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare helicopter crews, civilian equivalents, and lookouts would complete the NMFS-approved Marine Species Awareness Training (MSAT) prior to standing watch or serving as a lookout. Additional details on the Navy's MSAT program are provided in Chapter 5 of the AFTT Draft EIS/OEIS.

Mitigation Zones

The Navy proposes to use mitigation zones to reduce the potential impacts on marine mammals from training and testing activities. Mitigation zones are measured as the radius from a source and represent a distance that the Navy would monitor. Mitigation zones are applied to acoustic stressors (i.e., non-impulsive and impulsive sound), and physical strike and disturbance (e.g., vessel movement and bombing exercises). In each instance, visual detections of marine mammals would be communicated immediately to a watch station for information dissemination and appropriate action. Acoustic detections would be communicated to lookouts posted in aircraft and on surface vessels.

Most of the current mitigation zones for activities that involve the use of impulsive and non-impulsive sources were originally designed to reduce the potential for onset of TTS. The Navy updated their acoustic modeling to incorporate new hearing threshold metrics (i.e., upper and lower frequency limits), new marine mammal density data, and factors such as an animal's likely presence at various depths. An explanation of the acoustic modeling process can be found in the Marine Species Modeling Team Technical Report (U.S. Department of the Navy, 2012a).

As a result of updates to the acoustic modeling, some of the ranges to effects are larger than previous model outputs. Due to the ineffectiveness associated with mitigating such large areas, the Navy is unable to mitigate for onset of TTS during every activity. However, some ranges to effects are smaller than previous models estimated, and the mitigation zones were adjusted accordingly to provide consistency across the measures. The Navy developed each proposed mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, permanent threshold shift (PTS), out to the predicted maximum range (except for shock trials; a detailed discussion of how shock trial mitigation zones were developed is presented in Chapter 6.1.7.1 of the Navy's LOA application). Mitigating to the predicted maximum range to PTS also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also covers the predicted average range to

TTS. Tables 11 and 12 summarize the predicted average range to TTS, average range to PTS, maximum range to PTS, and recommended mitigation zone for each activity category, based on the Navy's acoustic propagation modeling results. It is important for the Navy to have standardized mitigation zones wherever training and testing may be conducted. The information in Tables 11 and 12 was developed in consideration of both Atlantic and Pacific Ocean conditions, marine mammal species, environmental factors, effectiveness, and operational assessments. Therefore, the ranges to effects in Tables 11 and 12 provide effective values that ensure appropriate mitigation ranges for both Atlantic Fleet and Pacific Fleet activities, and may not align with range to effects values found in other tables of the Navy's LOA application.

The Navy's proposed mitigation zones are based on the longest range for all the marine mammal and sea turtle functional hearing groups. Most mitigation zones were driven by the high-frequency cetaceans or sea turtles functional hearing group. Therefore, the mitigation zones are more conservative for the remaining functional hearing groups (low-frequency and mid-frequency cetaceans, and pinnipeds), and likely cover a larger portion of the potential range to onset of TTS. Additional information on the estimated range to effects for each acoustic stressor is detailed in Chapter 11 of the Navy's LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*).

TABLE 11—PREDICTED AVERAGE RANGE TO TTS AND AVERAGE AND MAXIMUM RANGE TO PTS AND RECOMMENDED MITIGATION ZONES

Activity category	Representative source (bin) *	Predicted average range to TTS	Predicted average range to PTS	Predicted maximum range to PTS	Recommended mitigation zone
Non-Impulsive Sound					
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar.	SQS–53 ASW hull-mounted sonar (MF1).	4,251 yd. (3,887 m) ..	281 yd. (257 m)	<292 yd. (<267 m)	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd. (183 m).
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar.	AQS–22 ASW dipping sonar (MF4).	226 yd. (207 m)	<55 yd. (<50 m)	<55 yd. (<50 m)	200 yd. (183 m).
Explosive and Impulsive Sound					
Improved Extended Echo Ranging Sonobuoys.	Explosive sonobuoy (E4).	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	600 yd. (549 m).
Explosive Sonobuoys using 0.6–2.5 lb. NEW.	Explosive sonobuoy (E3).	290 yd. (265 m)	113 yd. (103 m)	309 yd. (283 m)	350 yd. (320 m).
Anti-Swimmer Grenades.	Up to 0.5 lb. NEW (E2).	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m).
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices.	Dependent on charge size (see Table 12)				
Mine Neutralization Diver Placed Mines Using Time-Delay Firing Devices.	Up to 20 lb. NEW (E6).	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	1,000 yd. (915 m).
Ordnance Testing (Line Charge Testing).	Numerous 5 lb. charges (E4).	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	900 yd. (823 m).**
Gunnery Exercises—Small- and Medium-Caliber (Surface Target).	40 mm projectile (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m).
Gunnery Exercises—Large-Caliber (Surface Target).	5 in. projectiles (E5 at the surface ***).	453 yd. (414 m)	186 yd. (170 m)	526 yd. (481 m)	600 yd. (549 m).
Missile Exercises up to 250 lb. NEW (Surface Target).	Maverick missile (E9)	949 yd. (868 m)	398 yd. (364 m)	699 yd. (639 m)	900 yd. (823 m).
Missile Exercises up to 500 lb. NEW (Surface Target).	Harpoon missile (E10).	1,832 yd. (1,675 m) ..	731 yd. (668 m)	1,883 yd. (1,721 m) ..	2,000 yd. (1.8 km).
Bombing Exercises	MK–84 2,000 lb. bomb (E12).	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2,500 yd. (2.3 km).**

TABLE 11—PREDICTED AVERAGE RANGE TO TTS AND AVERAGE AND MAXIMUM RANGE TO PTS AND RECOMMENDED MITIGATION ZONES—Continued

Activity category	Representative source (bin) *	Predicted average range to TTS	Predicted average range to PTS	Predicted maximum range to PTS	Recommended mitigation zone
Torpedo (Explosive) Testing.	MK–48 torpedo (E11)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km).
Sinking Exercises	Various sources up to the MK–84 2,000 lb. bomb (E12).	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2.5 nm (4.6 km).**
Ship Shock Trials in JAX Range Complex.	10,000 lb. charge (HBX).	5.8 nm (10.8 km)	2.7 nm (4.9 km)	4.8 nm (8.9 km)	3.5 nm (6.5 km).
	40,000 lb. charge (HBX).	9.2 nm (17 km)	3.6 nm (6.6 km)	6.4 nm (11.9 km)	3.5 nm (6.5 km).
Ship Shock Trials in VACAPES Range Complex.	10,000 lb. charge (HBX).	9 nm (16.7 km)	2 nm (3.6 km)	4.7 nm (8.7 km)	3.5 nm (6.5 km).
	40,000 lb. charge (HBX).	10.3 nm (19.2 km)	3.7 nm (6.8 km)	7.6 nm (14 km)	3.5 nm (6.5 km).
At-Sea Explosive Testing.	Various sources less than 10 lb. NEW (E5 at various depths***).	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	1,600 yd. (1.4 km).**
Elevated Causeway System—Pile Driving.	24 in. steel impact hammer.	1,094 yd. (1,000 m) ..	51 yd. (46 m)	51 yd. (46 m)	60 yd. (55 m).

ASW: Anti-submarine warfare; JAX: Jacksonville; NEW: Net explosive weight; PTS: Permanent threshold shift; TTS: Temporary threshold shift;
* This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.
** Recommended mitigation zones are larger than the modeled injury zones to account for multiple types of sources or charges being used.
*** The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

TABLE 12—PREDICTED RANGE TO EFFECTS AND MITIGATION ZONE RADIUS FOR MINE COUNTERMEASURE AND NEUTRALIZATION ACTIVITIES USING POSITIVE CONTROL FIRING DEVICES

Charge size net explosive weight (bins)	General mine countermeasure and neutralization activities using positive control firing devices*				Mine countermeasure and neutralization activities using diver placed charges under positive control **			
	Predicted average range to TTS	Predicted average range to PTS	Predicted maximum range to PTS	Recommended mitigation zone	Predicted average range to TTS	Predicted average range to PTS	Predicted maximum range to PTS	Recommended mitigation zone
2.6–5 lb. (E4)	434 yd. (474 m).	197 yd. (180 m).	563 yd. (515 m).	600 yd. (549 m).	545 yd. (498 m).	169 yd. (155 m).	301 yd. (275 m).	350 yd. (320 m).
6–10 lb. (E5)	525 yd. (480 m).	204 yd. (187 m).	649 yd. (593 m).	800 yd. (732 m).	587 yd. (537 m).	203 yd. (185 m).	464 yd. (424 m).	500 yd. (457 m).
11–20 lb. (E6)	766 yd. (700 m).	288 yd. (263 m).	648 yd. (593 m).	800 yd. (732 m).	647 yd. (592 m).	232 yd. (212 m).	469 yd. (429 m).	500 yd. (457 m).
21–60 lb. (E7) ***.	1,670 yd. (1,527 m).	581 yd. (531 m).	964 yd. (882 m).	1,200 yd. (1.1 km).	1,532 yd. (1,401 m).	473 yd. (432 m).	789 yd. (721 m).	800 yd. (732 m).
61–100 lb. (E8) ****.	878 yd. (802 m).	383 yd. (351 m).	996 yd. (911 m).	1,600 yd. (1.4 m).	969 yd. (886 m).	438 yd. (400 m).	850 yd. (777 m).	850 yd. (777 m).
250–500 lb. (E10).	1,832 yd. (1,675 m).	731 yd. (668 m).	1,883 yd. (1,721 m).	2,000 yd. (1.8 km).	.....	.....	.....	Not Applicable.
501–650 lb. (E11).	1,632 yd. (1,492 m).	697 yd. (637 m).	2,021 yd. (1,848 m).	2,100 yd. (1.9 km).	.....	.....	.....	Not Applicable.

PTS: Permanent threshold shift; TTS: Temporary threshold shift.
* These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations that Tables 2.8–1 through 2.8–5 in the AFTT DEIS/OEIS specifies.
** These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver placed charges. These activities are conducted in shallow-water and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).
*** The E7 bin was only modeled in shallow-water locations so there is no difference for the diver placed charges category.
**** The E8 bin was only modeled for surface explosions, so some of the ranges are shorter than for sources modeled in the E7 bin which occur at depth.

When mine neutralization activities using diver placed charges (up to a 20 lb. NEW) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot

be terminated once the fuse is initiated due to human safety concerns. The Navy is proposing to modify the number of lookouts currently used for mine neutralization activities using diver-placed time-delay firing devices. As a reference, the current mitigation involves the use of six lookouts and three small rigid hull inflatable boats (two lookouts positioned in each of the three boats) for mitigation zones equal to or larger than 1,400 yd. (1,280 m), or four lookouts and two boats for mitigation zones smaller than 1,400 yd. (1,280 m), which was incorporated into the current Silver Strand Training Complex IHA to minimize the possibility of take by serious injury or mortality (which is not authorized under an IHA). The Navy has determined that using six lookouts and three boats in the long-term is impracticable to implement from an operational standpoint due to the impact that it is causing on resource requirements (i.e., limited personnel resources and boat availability). During activities using up to a 20 lb. NEW (bin E6) detonation, the Navy is proposing to have four lookouts and two small rigid hull inflatable boats (two lookouts positioned in each of the two boats). In addition, when aircraft are used, the pilot or member of the aircrew will serve as an additional lookout.

NMFS believes that the Navy's proposed modification to this mitigation measure will still reduce the potential for injury or mortality for several reasons: (1) The Navy's acoustic propagation modeling results show that the predicted ranges to TTS and PTS for mine neutralization diver place mines using time-delay firing devices do not exceed 647 yd (592 m), which is well within the proposed 1,000-yd (915-m) mitigation zone; (2) the number of lookouts for a 1,000-yd (915-m) mitigation zone would not change; (3) the maximum net explosive weight would decrease from 29 lb (currently) to 20 lb (proposed); (4) the Navy would continue to monitor the mitigation zone for 30 minutes before, during, and 30 after the activity to ensure that the area is clear of marine mammals; and (5) time-delay firing device activities are only conducted during daylight hours.

Mitigation Areas

The Navy proposes to implement several mitigation measures within pre-defined habitat areas in the AFTT Study Area. NMFS and the Navy refer to these areas as ''mitigation areas.'' It is important to note that the mitigation measures proposed for implementation only apply within each area as described.

North Atlantic Right Whale Mitigation Area Off the Southeast United States

Several mitigation measures are proposed for implementation within pre-defined boundaries of a North Atlantic right whale mitigation area off the southeast United States annually during calving season between November 15 and April 15. The southeast United States mitigation area is defined as follows (and depicted in Figure 4–1 of the LOA application): A 5 nm (9.3 km) buffer around the coastal waters between 31°15′ North and 30°15′ North from the coast out 15 nm (27.8 km); and the coastal waters between 30°15′ North and 28°00′ North from the coast out 5 nm (9.3 km).

The Navy would not conduct the following activities within the mitigation area:

- High-frequency and non-hull mounted mid-frequency active sonar (excluding helicopter dipping)
- Missile activities (explosive and non-explosive)
- Bombing exercises (explosive and non-explosive)
- Underwater detonations
- Improved extended echo ranging sonobuoy exercises
- Torpedo exercises (explosive)
- Small-, medium-, and large-caliber gunnery exercises

The Navy would minimize, to the maximum extent practicable, the use of the following systems within the mitigation area:

- Helicopter dipping using active sonar
- Low-frequency and hull-mounted mid-frequency active sonar used for navigation training
- Low-frequency and hull-mounted mid-frequency active sonar used for object detection exercises

Before transiting through or conducting any training or testing activities within the mitigation area, the Navy would communicate with the Fleet Area Control and Surveillance Facility, Jacksonville to obtain Early Warning System North Atlantic right whale sightings data. The Fleet Area Control and Surveillance Facility, Jacksonville, would advise ships of all reported whale sightings in the vicinity of the mitigation area to help ships and aircraft reduce potential interactions with North Atlantic right whales. Commander Submarine Force United States Atlantic Fleet would coordinate any submarine operations that may require approval from the Fleet Area Control and Surveillance Facility, Jacksonville. When transiting within the mitigation area, all Navy vessels would exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. Vessels would implement speed reductions under any of the following conditions: (1) After they observe a North Atlantic right whale; (2) if they are within 5 nm (9 km) of a sighting reported within the past 12 hours.; or (3) when operating at night or during periods of poor visibility. The Navy would minimize to the maximum extent practicable north-south transits through the mitigation area. The Navy may periodically travel in a north-south direction during training and testing activities due to operational requirements. If north-south directional travel is required during training or testing activities, the Navy would implement the increased caution and speed reductions described above when applicable.

North Atlantic Right Whale Mitigation Area Off the Northeast United States

Two important North Atlantic right whale foraging habitats, the Great South Channel and Cape Cod Bay, are located off the northeast United States. These two areas comprise the northeast United States mitigation area, which apply year-round and are defined as follows:

- Great South Channel: The area bounded by 41°40′ North/69°45′ West; 41°00′ North/69°05′ West; 41°38′ North/68°13′ West; and 42°10′ North/68°31′ West
- Cape Cod Bay: The area bounded by 42°04.8′ North/70°10′ West; 42°12′ North/70°15′ West; 42°12′ North/70°30′ West; 41°46.8′ North/70°30′ West and on the south and east by the interior shoreline of Cape Cod, Massachusetts

The Navy would not conduct the following activities within the boundaries of the mitigation area or within additional specified distances from the mitigation area:

- Improved extended echo ranging sonobuoy exercises in or within 3 nm (5.6 km) of the mitigation area
- Bombing exercises (explosive and non-explosive)
- Underwater detonations
- Torpedo exercises (explosive)

The Navy would minimize to the maximum extent practicable the use of the following systems within the boundaries of the mitigation area:

- Low-frequency and hull-mounted active sonar
- High-frequency and non-hull mounted mid-frequency active sonar, including helicopter dipping

Before transiting the mitigation area with a surface vessel, the Navy would conduct a prior web query or email inquiry to the NMFS Northeast U.S.

Right Whale Sighting Advisory System in order to obtain the latest North Atlantic right whale sighting information. When transiting within the mitigation area, Navy vessels would exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. Vessels would implement speed reductions under the following conditions: (1) After they observe a North Atlantic right whale; (2) if they are within 5 nm (9 km) of a sighting reported within the past week; or (3) when operating at night or during periods of poor visibility. These additional speed reductions shall be implemented according to Rule 6 of the International Navigation Rules ((COLREGS, 1972).

Additional mitigation would be required when conducting Torpedo Exercises (TORPEXs) in the Northeast Right Whale Mitigation Area. Surface vessels and submarines would maintain a speed of no more than 10 knots (19 km/hr.) during transit; and torpedo exercise firing vessel speeds would range from 10 knots (19 km/hr.) during normal firing, 18 knots (33.3 km/hr.) during submarine target firing, and in excess of 18 knots (33.3 km/hr.) during surface vessel target firing (speeds in excess of 18 knots would occur for a short time [e.g., 10–15 min.]).

The Navy would conduct all non-explosive torpedo testing during daylight hours in Beaufort sea states of 3 or less to increase the probability of marine mammal detection. Mitigation would include visual observation immediately before and during the exercise within the immediate vicinity of the activity. During the conduct of the test, visual surveys of the test area would be conducted by all vessels and aircraft involved in the exercise to detect the presence of marine mammals. The test scenario would not commence if concentrations of floating vegetation (*Sargassum* or kelp patties) are observed in the immediate vicinity of the activity. The test scenario would cease if a North Atlantic right whale is visually detected within the immediate vicinity of the activity. The test scenario would re-commence if any one of the following conditions are met: (1) The animal is observed exiting the immediate vicinity of the activity, (2) the animal is thought to have exited the immediate vicinity of the activity based on its course and speed, or (3) the immediate vicinity of the activity has been clear from any additional sightings for a period of 30 minutes.

North Atlantic Right Whale Mid-Atlantic Mitigation Area

A North Atlantic right whale migratory route is located off the mid-Atlantic coast of the United States. When transiting within the mitigation area, the Navy would practice increased vigilance, exercise extreme caution, and proceed at the slowest speed that is consistent with safety, mission, and training and testing objectives. This mitigation area would apply from November 1 through April 30 and would be defined as follows:

- Block Island Sound: The area bounded by 40°51′53.7″ North/070°36′44.9″ West; 41°20′14.1″ North/070°49′44.1″ West
- New York and New Jersey: 20 nm (37 km) seaward of the line between 40°29′42.2″ North/073°55′57.6″ West
- Delaware Bay: 38°52′27.4″ North/075°01′32.1″ West
- Chesapeake Bay: 37°00′36.9″ North/075°57″50.5″ West
- Morehead City, North Carolina: 34°41′32.0″ North/076°40′08.3″ West
- Wilmington, North Carolina, through South Carolina, and to Brunswick, Georgia: Within a continuous area 20 nm from shore and west back to shore bounded by 34°10′30″ North/077°49′12″ West; 33°56′42″ North/077°31′30″ West; 33°36′30″ North/077°47′06″ West; 33°28′24″ North/078°32′30″ West; 32°59′06″ North/078°50′18″ West; 31°50′00″North/080°33′12″ West; 31°27′00″ North/080°51′36″ West

Planning Awareness Areas

The Navy has designated several planning awareness areas (PAAs) based on locations of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales.

For events involving active sonar, the Navy would avoid planning major exercises in planning awareness areas (Figure 11–1 in the LOA application) when feasible. To the extent operationally feasible, the Navy would not conduct more than one of the five major exercises or similar scale events per year in the Gulf of Mexico planning awareness area. If national security needs require the conduct of more than five major exercises or similar scale events in the planning awareness areas per year, or more than one within the Gulf of Mexico planning awareness area per year, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.

Cetacean and Sound Mapping

NMFS Office of Protected Resources standardly considers available information about marine mammal habitat use to inform discussions with applicants regarding potential spatio-temporal limitations of their activities that might help effect the least practicable adverse impact (e.g., Planning Awareness Areas). Through the Cetacean and Sound Mapping effort (*www.cetsound.noaa.gov*), NOAA's Cetacean Density and Distribution Mapping Working Group (CetMap) is currently involved in a process to compile available literature and solicit expert review to identify areas and times where species are known to concentrate for specific behaviors (e.g., feeding, breeding/calving, or migration) or be range-limited (e.g., small resident populations). These areas, called Biologically Important Areas (BIAs), are useful tools for planning and impact assessments and are being provided to the public via the CetSound Web site, along with a summary of the supporting information. While these BIAs are useful tools for analysts, any decisions regarding protective measures based on these areas must go through the normal MMPA evaluation process (or any other statutory process that the BIAs are used to inform)—the designation of a BIA does not pre-suppose any specific management decision associated with those areas. Additionally, the BIA process is iterative and the areas will be updated as new information becomes available. Currently, NMFS has published BIAs for the Arctic Slope and some in Hawaii. The BIAs in other regions, such as the Atlantic and West Coast of the continental U.S. are still in development. We have indicated to the Navy that once these BIAs are complete and put on the Web site, we may need to discuss whether (in the context of the nature and scope of any Navy activities planned in and around the BIAs, what impacts might be anticipated, and practicability) additional protective measures might be appropriate.

Stranding Response Plan

NMFS and the Navy developed Stranding Response Plans for the Study Areas and Range Complexes that make up the AFTT Study Area in 2009 as part of the previous incidental take authorization process. The Stranding Response Plans are specifically

intended to outline the applicable requirements the authorizations are conditioned upon in the event that a marine mammal stranding is reported in the east coast Range Complexes and AFAST Study Area during a major training exercise. NMFS considers all plausible causes within the course of a stranding investigation and these plans in no way presume that any strandings in a Navy range complex are related to, or caused by, Navy training and testing activities, absent a determination made during investigation. The plans are designed to address mitigation, monitoring, and compliance. The Navy is currently working with NMFS to refine these plans for the new AFTT Study Area. The current Stranding Response Plans are available for review here: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*.

Mitigation Conclusions

NMFS has carefully evaluated the Navy's proposed mitigation measures and considered a broad range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts on marine mammals; the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and the practicability of the measure for applicant implementation, including consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

In some cases, additional mitigation measures are required beyond those that the applicant proposes. Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(a) Avoidance or minimization of injury or death of marine mammals wherever possible (goals b, c, and d may contribute to this goal).

(b) A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of sonar and other active acoustic sources, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(c) A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of sonar and other active acoustic sources, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(d) A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of sonar and other active acoustic sources, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing the severity of harassment takes only).

(e) Avoidance or minimization of adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

(f) For monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

Based on our evaluation of the Navy's proposed measures, as well as other measures considered by NMFS or recommended by the public, NMFS has determined preliminarily that the Navy's proposed mitigation measures (especially when the adaptive management component is taken into consideration (see Adaptive Management, below)) are adequate means of effecting the least practicable adverse impacts on marine mammals species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, while also considering personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. Further detail is included below.

The proposed rule comment period will afford the public an opportunity to submit recommendations, views, and/or concerns regarding this action and the proposed mitigation measures. While NMFS has determined preliminarily that the Navy's proposed mitigation measures would effect the least practicable adverse impact on the affected species or stocks and their habitat, NMFS will consider all public comments to help inform our final decision. Consequently, the proposed mitigation measures may be refined, modified, removed, or added to prior to the issuance of the final rule based on public comments received, and where appropriate, further analysis of any additional mitigation measures.

Monitoring

In order to issue an ITA for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for LOAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present.

Monitoring measures prescribed by NMFS should accomplish one or more of the following general goals:

(1) An increase in the probability of detecting marine mammals, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the analyses mentioned below

(2) An increase in our understanding of how many marine mammals are likely to be exposed to levels of sonar and other active acoustic sources (or explosives or other stimuli) that we associate with specific adverse effects, such as behavioral harassment, TTS, or PTS.

(3) An increase in our understanding of how marine mammals respond to sonar and other active acoustic sources (at specific received levels), explosives, or other stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival) through any of the following methods:

- Behavioral observations in the presence of sonar and other active acoustic sources compared to observations in the absence of sonar (need to be able to accurately predict received level and report bathymetric conditions, distance from source, and other pertinent information)
- Physiological measurements in the presence of sonar and other active acoustic sources compared to observations in the absence of tactical sonar (need to be able to accurately predict received level and report

bathymetric conditions, distance from source, and other pertinent information)

- Pre-planned and thorough investigation of stranding events that occur coincident to naval activities
- Distribution and/or abundance comparisons in times or areas with concentrated sonar and other active acoustic sources versus times or areas without sonar and other active acoustic sources
- An increased knowledge of the affected species
- An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

Overview of Navy Monitoring Program

The current Navy monitoring program is composed of a collection of ''range-specific'' monitoring plans, each developed individually as part of the previous MMPA/ESA authorization processes. These individual plans established specific monitoring requirements for each range complex based on a set of effort-based metrics (e.g., 20 days of aerial survey). Concurrent with implementation of the initial range-specific monitoring plans, the Navy and NMFS began development of the Integrated Comprehensive Monitoring Program (ICMP). The ICMP has been developed in direct response to Navy permitting requirements established in various MMPA final rules, ESA consultations, Biological Opinions, and applicable regulations. The ICMP is intended to coordinate monitoring efforts across all regions and to allocate the most appropriate level and type of effort for each range complex based on a set of standardized objectives, and in acknowledgement of regional expertise and resource availability. The ICMP is designed to be flexible, scalable, and adaptable plan, through the adaptive management and strategic planning processes to periodically assess progress, and re-evaluate objectives.

Although the ICMP does not specify actual monitoring field work or projects, it does establish top-level goals that have been developed in coordination with NMFS. As the ICMP is implemented, detailed and specific studies will be developed which support the Navy's top-level monitoring goals. In essence, the ICMP directs that monitoring activities relating to the effects of Navy training and testing activities on marine species should be designed to accomplish one or more of the following top-level goals:

- An increase in our understanding of the likely occurrence of marine mammals and/or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and/or density of species);
- An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and/or ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulsive sound), through better understanding of one or more of the following: (1) The action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels); (2) the affected species (e.g., life history or dive patterns); (3) the likely co-occurrence of marine mammals and/or ESA-listed marine species with the action (in whole or part) associated with specific adverse effects, and/or; (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and/or ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving or feeding areas);
- An increase in our understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level);
- An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) The long-term fitness and survival of an individual; or (2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival);
- An increase in our understanding of the effectiveness of mitigation and monitoring measures;
- A better understanding and record of the manner in which the authorized entity complies with the ITA and Incidental Take Statement;
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the safety zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

While the ICMP only directly applies to monitoring activities under applicable MMPA and ESA authorizations, it also serves to facilitate coordination among the Navy's marine species monitoring program and the basic and applied research programs discussed in the Research Section of this document.

An October 2010 Navy monitoring meeting initiated a process to critically evaluate current Navy monitoring plans and begin development of revisions to existing range-specific monitoring plans and associated updates to the ICMP. Discussions at that meeting and through the Navy/NMFS adaptive management process established a way ahead for continued refinement of the Navy's monitoring program. This process included establishing a Scientific Advisory Group (SAG) composed of technical experts to provide objective scientific guidance for Navy consideration. The Navy established the SAG in early 2011 with the initial task of evaluating current Navy monitoring approaches under the ICMP and existing LOAs and developing objective scientific recommendations that would serve as the basis for a Strategic Planning Process for Navy monitoring to be incorporated as a major component of the ICMP. The SAG convened in March 2011, composed of leading academic and civilian scientists with significant expertise in marine species monitoring, acoustics, ecology, and modeling. The SAG's final report laid out both over-arching and range-specific recommendations for the Navy's Marine Species Monitoring program and is available through the US Navy Marine Species Monitoring web portal at *http://www.navymarinespeciesmonitoring.us/*. Adaptive management discussions between the Navy and NMFS established a way ahead for continued refinement of the Navy's monitoring program. Consensus was that the ICMP and associated implementation components would continue the evolution of Navy marine species monitoring towards a single integrated program, incorporate SAG recommendations when appropriate and logistically feasible, and establish a more collaborative framework for evaluating, selecting, and implementing future monitoring across the all Navy range complexes through the adaptive management and strategic planning process.

Past and Current Monitoring in the AFTT Study Area

NMFS has received multiple years' worth of annual exercise and monitoring reports addressing active sonar use and explosive detonations within the AFTT Study Area. The data and information contained in these reports have been considered in developing mitigation and monitoring measures for the proposed training and testing activities within the AFTT Study Area. The Navy's annual exercise and

monitoring reports may be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*; or at the Navy's marine species monitoring Web site: *http://www.navymarinespeciesmonitoring.us/*.

NMFS has reviewed these reports and summarized the results, as related to marine mammal monitoring, below.

(1) The Navy has shown significant initiative in developing its marine species monitoring program and made considerable progress toward reaching goals and objectives of the ICMP.

(2) Observation data from watchstanders aboard Navy vessels is generally useful to indicate the presence or absence of marine mammals within the mitigation zones (and sometimes without) and to document the implementation of mitigation measures, but does not provide useful species-specific information or behavioral data.

(3) Data gathered by experienced marine mammal observers can provide very valuable information at a level of detail not possible with watchstanders.

(4) Though it is by no means conclusive, it is worth noting that no instances of obvious behavioral disturbance have been observed by Navy watchstanders or experienced marine mammal observers conducting visual monitoring.

(5) Visual surveys generally provide suitable data for addressing questions of distribution and abundance of marine mammals but are much less effective at providing information on movements and behavior, with a few notable exceptions where sightings are most frequent.

(6) Passive acoustics and animal tagging have significant potential for applications addressing animal movements and behavioral response to Navy training activities but require a longer time horizon and heavy investment in analysis to produce relevant results.

(7) NMFS and the Navy should more carefully consider what and how information should be gathered during training exercises and monitoring events, as some reports contain different information, making cross-report comparisons difficult.

The Navy has invested over $10M in monitoring activities in the AFAST and east coast range complex portions of AFTT Study Area since 2009 and has accomplished the following:

- Covered over 150,000 km of visual survey effort;
- Sighted over 30,000 individual marine mammals;
- Monitored 20 individual training exercise events;
- Taken over 23,000 digital photos;
- Collected over 100 biopsy samples;
- Deployed 11 DTags and conducted 6 playback exposures on short finned pilot whales;
- Made 23 HARP deployments and collected over 28,000 hours of passive acoustic recordings;
- Deployed 3 temporary bottom-mounted passive acoustic arrays during training exercises.

In addition, 518 sightings for an estimated 2,645 marine mammals were reported by watchstanders aboard navy ships within the AFTT Study Area from 2009 to 2012. These observations were mainly during major at-sea training events and there were no reported observations of adverse reactions by marine mammals and no dead or injured animals reported associated with navy training activities.

Proposed Monitoring for the AFTT Study Area

Based on discussions between the Navy and NMFS, future monitoring would address the ICMP top-level goals through a collection of specific regional and ocean basin studies based on scientific objectives. Quantitative metrics of monitoring effort (e.g., 20 days of aerial survey) would not be a specific requirement. The adaptive management process and reporting requirements would serve as the basis for evaluating performance and compliance, primarily considering the quality of the work and results produced as well as peer review and publications, and public dissemination of information, reports, and data. The strategic planning process (see below) would be used to set intermediate scientific objectives, identify potential species of interest at a regional scale, and evaluate and select specific monitoring projects to fund or continue supporting for a given fiscal year. The strategic planning process would also address relative investments to different range complexes based on goals across all range complexes, and monitoring would leverage multiple techniques for data acquisition and analysis whenever possible.

Research

Overview

The Navy is working towards a better understanding of marine mammals and sound in ways that are not directly related to the MMPA process. The Navy highlights some of those ways in the section below. Further, NMFS is working on a long-term stranding study that will be supported by the Navy by way of a funding and information sharing component (see below).

Navy Research

The Navy is one of the world's leading organizations in assessing the effects of human activities on the marine environment, and provides a significant amount of funding and support to marine research. They also develop approaches to ensure that these resources are minimally impacted by current and future Navy operations. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and non-governmental conservation organizations in collecting, evaluating, and modeling information on marine resources, including working towards a better understanding of marine mammals and sound. From 2004 to 2012, the Navy has provided over $230 million for marine species research. The U.S. Navy sponsors 70 percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported marine species research directly applicable to AFTT activities include the following:

- Better understanding of marine species distribution and important habitat areas;
- Developing methods to detect and monitor marine species before and during training;
- Understanding the impacts of sound on marine mammals, sea turtles, fish, and birds;
- Developing tools to model and estimate potential impacts of sound.

It is imperative that the Navy's research and development (R&D) efforts related to marine mammals are conducted in an open, transparent manner with validated study needs and requirements. The goal of the Navy's R&D program is to enable collection and publication of scientifically valid research as well as development of techniques and tools for Navy, academic, and commercial use. The two Navy organizations that account for most funding and oversight of the Navy marine mammal research program are the Office of Naval Research (ONR) Marine Mammals and Biology (MMB) Program, and the Office of the Chief of Naval Operations (CNO) Energy and Environmental Readiness Division (N45) Living Marine Resources (LMR) Program. The primary focus of these programs has been on understanding the effects of sound on marine mammals, including physiological, behavioral and ecological effects.

The ONR Marine Mammals and Biology program supports basic and applied research and technology

development related to understanding the effects of sound on marine mammals, including physiological, behavioral, ecological effects and population-level effects. Current program thrusts include, but are not limited to:

- Monitoring and detection;
- Integrated ecosystem research including sensor and tag development;
- Effects of sound on marine life [including hearing, behavioral response studies, diving and stress, physiology, and Population Consequences of Acoustic Disturbance (PCAD); and
- Models and databases for environmental compliance.

The mission of the LMR program is to develop, demonstrate, and assess information and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. This mission is accomplished by:

- Providing science-based information to support Navy environmental effects assessments for research, development, acquisition, testing and evaluation (RDAT&E) as well as Fleet at-sea training, exercises, maintenance and support activities;
- Improving knowledge of the status and trends of marine species of concern and the ecosystems of which they are a part;
- Developing the scientific basis for the criteria and thresholds to measure the effects of Navy generated sound;
- Improving understanding of underwater sound and sound field characterization unique to assessing the biological consequences resulting from underwater sound (as opposed to tactical applications of underwater sound or propagation loss modeling for military communications or tactical applications); and
- Developing technologies and methods to monitor and, where possible, mitigate biologically significant consequences to living marine resources resulting from naval activities, emphasizing those consequences that are most likely to be biologically significant.

The program is focused on three primary objectives that influence program management priorities and directly affect the program's success in accomplishing its mission:

(1) Collect, Validate and Rank R&D Needs: Expand awareness of R&D program opportunities within the Navy marine resource community to encourage and facilitate the submittal of well-defined and appropriate needs statements.

(2) Address High Priority Needs: Ensure that program investments and the resulting projects maintain a direct and consistent link to the defined user needs.

(3) Transition Solutions and Validate Benefits: Maximize the number of program-derived solutions that are successfully transitioned to the Fleet and system commands (SYSCOMs). The LMR program primarily invests in the following areas:

- Developing Data to Support Risk Threshold Criteria;
- Improved Data Collection on Protected Species, Critical Habitat within Navy Ranges;
- New Monitoring and Mitigation Technology Demonstrations;
- Database and Model Development;
- Education and Outreach, Emergent Opportunities.

The Navy has also developed the technical reports and supporting data referenced used for analysis in the AFTT EIS/OEIS and this proposed rule, which include the Navy Marine Species Density Database (NMSDD), Acoustic Criteria and Thresholds, and Determination of Acoustic Effects on Marine Mammals and Sea Turtles. Furthermore, research cruises by the NMFS and by academic institutions have received funding from the U.S. Navy. For instance, the ONR contributed financially to the Sperm Whale Seismic Study (SWSS) in the Gulf of Mexico, and CNO–N45 currently supports the Atlantic Marine Assessment Program for Protected Species (AMAPPS). Both the ONR and CNO–N45 programs are partners in the multi-year Southern California Behavioral Response Study (SOCAL–BRS). All of this research helps in understanding the marine environment and the effects that may arise from underwater noise in the oceans. Further, NMFS is working on a long-term stranding study that will be supported by the Navy by way of a funding and information sharing component (see below).

Adaptive Management and Strategic Planning Process

The final regulations governing the take of marine mammals incidental to Navy training and testing exercises in the AFTT Study Area would continue to contain an adaptive management component carried over from previous authorizations. Although better than five years ago, our understanding of the effects of Navy training and testing (e.g., sonar and other active acoustic sources and explosives) on marine mammals is still relatively limited, and yet the science in this field is evolving fairly quickly. These circumstances make the inclusion of an adaptive management component both valuable and necessary within the context of 5-year regulations for activities that have been associated with marine mammal mortality in certain circumstances and locations (though not the AFTT Study Area). The proposed reporting requirements are designed to provide NMFS with monitoring data from the previous year, which allows NMFS to consider whether any changes are appropriate. NMFS and the Navy would meet to discuss the monitoring reports, Navy R&D developments, and current science and whether mitigation or monitoring modifications are appropriate. The use of adaptive management would allow the Navy and NMFS to consider new data from different sources to determine if modified mitigation or monitoring measures are warranted (including possible additions or deletions). Mitigation and monitoring measures could be modified, added, or deleted if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects on marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring and exercises reports; (2) compiled results of Navy funded research and development (R&D) studies; (3) results from specific stranding investigations; (4) results from general marine mammal and sound research; and (5) any information which reveals that marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

The Navy is currently establishing a strategic planning process under the ICMP in coordination with NMFS. The objective of the strategic planning process is to guide the continued evolution of Navy marine species monitoring towards a single integrated program, incorporating expert review and recommendations, and establishing a more structured and collaborative framework for evaluating, selecting, and implementing future monitoring across the all Navy range complexes. The Strategic Plan is intended to be a primary component of the ICMP and provide a ''vision'' for Navy monitoring across geographic regions—serving as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address ICMP top-level goals and satisfy MMPA monitoring requirements.

This process is being designed to integrate various elements including:

- Integrated Comprehensive monitoring Program top-level goals;
- Scientific Advisory Group recommendations;
- Integration of regional scientific expert input;
- Ongoing adaptive management review dialog between NMFS and Navy;
- Lessons learned from past and future monitoring at Navy training and testing ranges;
- Leveraged research and lessons learned from other Navy funded marine science programs

NMFS and the Navy continue to coordinate on the strategic planning process through the regulatory process of this proposed rule; however, these discussions are still ongoing and we anticipate that more specific details will be available by the time it is finalized in advance of the issuance of the final rule. Additionally, the process and associated monitoring requirements may be modified or supplemented based on comments or new information received from the public during the public comment period.

Reporting

In order to issue an ITA for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking.'' Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring. Some of the reporting requirements are still in development and the final rule may contain additional details not contained in the proposed rule. Additionally, proposed reporting requirements may be modified, eliminated, or added based on information or comments received during the public comment period. Reports from individual monitoring events, results of analyses, publications, and periodic progress reports for specific monitoring projects will be posted to the U.S. Navy Marine Species Monitoring web portal as they become available. Currently, there are several specific reporting requirements pursuant to these proposed regulations:

General Notification of Injured or Dead Marine Mammals

Navy personnel would ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercise utilizing MFAS, HFAS, or underwater explosive detonations. The Navy would provide NMFS with species identification or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photographs or video (if available). The AFTT Stranding Response Plan would contain more specific reporting requirements for specific circumstances.

Annual Monitoring and Exercise Report

As noted above, reports from individual monitoring events, results of analyses, publications, and periodic progress reports for specific monitoring projects would be posted to the Navy's Marine Species Monitoring web portal as they become available. Progress and results from all monitoring activity conducted within the AFTT Study Area, as well as required Major Training Event exercise activity, would be summarized in an annual report. A draft of this report would be submitted to NMFS for review by April 15 of each year. NMFS would review the report and provide comments for incorporation within 3 months.

Comprehensive Monitoring and Exercise Summary Report

The Navy would submit to NMFS a draft report that analyzes, compares, and summarizes all multi-year marine mammal data gathered during training and testing exercises for which individual annual reports are required under the proposed regulations. This report would be submitted at the end of the fourth year of the rule (December 2018), covering activities that have occurred through June 1, 2018. The Navy would respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 3 months after the submittal of the draft if NMFS does not provide comments.

Estimated Take of Marine Mammals

In the potential effects section, NMFS' analysis identified the lethal responses, physical trauma, sensory impairment (PTS, TTS, and acoustic masking), physiological responses (particular stress responses), and behavioral responses that could potentially result from exposure to sonar and other active acoustic sources and explosives and other impulsive sources. In this section, we will relate the potential effects to marine mammals from these sound sources to the MMPA regulatory definitions of Level A and Level B Harassment and attempt to quantify the effects that might occur from the specific training and testing activities that the Navy proposes in the AFTT Study Area.

As mentioned previously, behavioral responses are context-dependent, complex, and influenced to varying degrees by a number of factors other than just received level. For example, an animal may respond differently to a sound emanating from a ship that is moving towards the animal than it would to an identical received level coming from a vessel that is moving away, or to a ship traveling at a different speed or at a different distance from the animal. At greater distances, though, the nature of vessel movements could also potentially not have any effect on the animal's response to the sound. In any case, a full description of the suite of factors that elicited a behavioral response would require a mention of the vicinity, speed and movement of the vessel, or other factors. So, while sound sources and the received levels are the primary focus of the analysis and those that are laid out quantitatively in the regulatory text, it is with the understanding that other factors related to the training are sometimes contributing to the behavioral responses of marine mammals, although they cannot be quantified.

Definition of Harassment

As mentioned previously, with respect to military readiness activities, section 3(18)(B) of the MMPA defines ''harassment'' as: (i) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Level B Harassment

Of the potential effects that were described in the Potential Effects of Exposure of Marine Mammal to Non-Impulsive and Impulsive Sound Sources Section, the following are the types of effects that fall into the Level B Harassment category:

Behavioral Harassment—Behavioral disturbance that rises to the level described in the definition above, when resulting from exposures to non-impulsive or impulsive sound, is considered Level B Harassment. Some of the lower level physiological stress

responses discussed earlier would also likely co-occur with the predicted harassments, although these responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. When Level B Harassment is predicted based on estimated behavioral responses, those takes may have a stress-related physiological component as well.

Earlier in this document, we described the Southall *et al.,* (2007) severity scaling system and listed some examples of the three broad categories of behaviors: 0–3 (Minor and/or brief behaviors); 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival); 7–9 (Behaviors considered likely to affect the aforementioned vital rates). Generally speaking, MMPA Level B Harassment, as defined in this document, would include the behaviors described in the 7–9 category, and a subset, dependent on context and other considerations, of the behaviors described in the 4–6 categories. Behavioral harassment does not generally include behaviors ranked 0–3 in Southall *et al.,* (2007).

Acoustic Masking and Communication Impairment—Acoustic masking is considered Level B Harassment as it can disrupt natural behavioral patterns by interrupting or limiting the marine mammal's receipt or transmittal of important information or environmental cues.

TTS—As discussed previously, TTS can affect how an animal behaves in response to the environment, including conspecifics, predators, and prey. The following physiological mechanisms are thought to play a role in inducing auditory fatigue: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output. Ward (1997) suggested that when these effects result in TTS rather than PTS, they are within the normal bounds of physiological variability and tolerance and do not represent a physical injury. Additionally, Southall *et al.* (2007) indicate that although PTS is a tissue injury, TTS is not because the reduced hearing sensitivity following exposure to intense sound results primarily from fatigue, not loss, of cochlear hair cells and supporting structures and is reversible. Accordingly, NMFS classifies TTS (when resulting from exposure sonar and other active acoustic sources and explosives and other impulsive sources) as Level B Harassment, not Level A Harassment (injury).

Level A Harassment

Of the potential effects that were described earlier, following are the types of effects that fall into the Level A Harassment category:

PTS—PTS (resulting either from exposure to sonar and other active acoustic sources or explosive detonations) is irreversible and considered an injury. PTS results from exposure to intense sounds that cause a permanent loss of inner or outer cochlear hair cells or exceed the elastic limits of certain tissues and membranes in the middle and inner ears and result in changes in the chemical composition of the inner ear fluids.

Tissue Damage due to Acoustically Mediated Bubble Growth—A few theories suggest ways in which gas bubbles become enlarged through exposure to intense sounds (sonar and other active acoustic sources) to the point where tissue damage results. In rectified diffusion, exposure to a sound field would cause bubbles to increase in size. A short duration of sonar pings (such as that which an animal exposed to MFAS would be most likely to encounter) would not likely be long enough to drive bubble growth to any substantial size. Alternately, bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. The degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert because of how close an animal would need to be to the sound source to be exposed to high enough levels, especially considering the likely avoidance of the sound source and the required mitigation. Still, possible tissue damage from either of these processes would be considered an injury.

Tissue Damage due to Behaviorally Mediated Bubble Growth—Several authors suggest mechanisms in which marine mammals could behaviorally respond to exposure to sonar and other active acoustic sources by altering their dive patterns in a manner (unusually rapid ascent, unusually long series of surface dives, etc.) that might result in unusual bubble formation or growth ultimately resulting in tissue damage (emboli, etc.) In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation.

There is considerable disagreement among scientists as to the likelihood of this phenomenon (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.,* 2003; Fernandez *et al.,* 2005), nitrogen bubble formation as the cause of the traumas has not been verified. If tissue damage does occur by this phenomenon, it would be considered an injury.

Physical Disruption of Tissues Resulting from Explosive Shock Wave—Physical damage of tissues resulting from a shock wave (from an explosive detonation) is classified as an injury. Blast effects are greatest at the gas-liquid interface (Landsberg, 2000) and gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner, 1982; Hill 1978; Yelverton *et al.,* 1973). Nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). Severe damage (from the shock wave) to the ears can include tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear.

Vessel or Ordnance Strike—Vessel strike or ordnance strike associated with the specified activities would be considered Level A harassment, serious injury, or mortality.

Take Criteria

For the purposes of an MMPA authorization, three types of take are identified: Level B Harassment; Level A Harassment; and mortality (or serious injury leading to mortality). The categories of marine mammal responses (physiological and behavioral) that fall into the two harassment categories were described in the previous section.

Because the physiological and behavioral responses of the majority of the marine mammals exposed to non-impulse and impulse sounds cannot be detected or measured (not all responses visible external to animal, portion of exposed animals underwater (so not visible), many animals located many miles from observers and covering very large area, etc.) and because NMFS must authorize take prior to the impacts on marine mammals, a method is needed to estimate the number of individuals that will be taken, pursuant to the MMPA, based on the proposed action. To this end, the Navy's application and the AFTT DEIS/OEIS contain proposed acoustic criteria and thresholds that would, in some instances, represent changes from what NMFS has used to

evaluate the Navy's proposed activities for past incidental take authorizations. The revised thresholds are based on evaluations of recent scientific studies; a detailed explanation of how they were derived is provided in the AFTT DEIS/OEIS Criteria and Thresholds Technical Report. NMFS is currently updating and revising all of its acoustic criteria and thresholds. Until that process is complete, NMFS will continue its long-standing practice of considering specific modifications to the acoustic criteria and thresholds currently employed for incidental take authorizations only after providing the public with an opportunity for review and comment. NMFS is requesting comments on all aspects of the proposed rule, and specifically requests comment on the proposed acoustic criteria and thresholds. The acoustic criteria for non-impulse and impulse sounds are discussed below.

Non-Impulse Acoustic Criteria

NMFS utilizes three acoustic criteria for non-impulse sounds: PTS (injury—Level A Harassment), TTS (Level B Harassment), and behavioral harassment (Level B Harassment). Because the TTS and PTS criteria are derived similarly and the PTS criteria were extrapolated from the TTS data, the TTS and PTS acoustic criteria will be presented first, before the behavioral criteria.

For more information regarding these criteria, please see the Navy's DEIS/OEIS for AFTT.

Level B Harassment Threshold (TTS)

Behavioral disturbance, acoustic masking, and TTS are all considered Level B Harassment. Marine mammals would usually be behaviorally disturbed at lower received levels than those at which they would likely sustain TTS, so the levels at which behavioral disturbance are likely to occur is considered the onset of Level B Harassment. The behavioral responses of marine mammals to sound are variable, context specific, and, therefore, difficult to quantify (see Risk Function section, below). Alternately, TTS is a physiological effect that has been studied and quantified in laboratory conditions. Because data exist to support an estimate of the received levels at which marine mammals will incur TTS, NMFS uses an acoustic criteria to estimate the number of marine mammals that might sustain TTS. TTS is a subset of Level B Harassment (along with sub-TTS behavioral harassment) and we are not specifically required to estimate those numbers; however, the more specifically we can estimate the affected marine mammal responses, the better the analysis.

Level A Harassment Threshold (PTS)

For acoustic effects, because the tissues of the ear appear to be the most susceptible to the physiological effects of sound, and because threshold shifts tend to occur at lower exposures than other more serious auditory effects, NMFS has determined that PTS is the best indicator for the smallest degree of injury that can be measured. Therefore, the acoustic exposure associated with onset-PTS is used to define the lower limit of Level A harassment.

PTS data do not currently exist for marine mammals and are unlikely to be obtained due to ethical concerns. However, PTS levels for these animals may be estimated using TTS data from marine mammals and relationships between TTS and PTS that have been discovered through study of terrestrial mammals.

We note here that behaviorally mediated injuries (such as those that have been hypothesized as the cause of some beaked whale strandings) could potentially occur in response to received levels lower than those believed to directly result in tissue damage. As mentioned previously, data to support a quantitative estimate of these potential effects (for which the exact mechanism is not known and in which factors other than received level may play a significant role) does not exist. However, based on the number of years (more than 60) and number of hours of MFAS per year that the U.S. (and other countries) has operated compared to the reported (and verified) cases of associated marine mammal strandings, NMFS believes that the probability of these types of injuries is very low. Tables 13 and 14 provide a summary of non-impulsive and impulsive thresholds to TTS and PTS for marine mammals. A detailed explanation of how these thresholds were derived is provided in the AFTT DEIS/OEIS Criteria and Thresholds Technical Report (*http://aftteis.com/DocumentsandReferences/AFTT Documents/SupportingTechnical Documents.aspx*) and summarized in Chapter 6 of the Navy's LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*).

TABLE 13—ONSET TTS AND PTS THRESHOLDS FOR NON-IMPULSE SOUND

Group	Species	Onset TTS	Onset PTS
Low-Frequency Cetaceans	All mysticetes	178 dB re 1μPa²-sec(LF_{II})	198 dB re 1μPa²-sec(LF_{II}).
Mid-Frequency Cetaceans	Most delphinids, beaked whales, medium and large toothed whales.	178 dB re 1μPa²-sec(MF_{II})	198 dB re 1μPa²-sec(MF_{II}).
High-Frequency Cetaceans	Porpoises, Kogia spp.	152 dB re 1μPa²-sec(HF_{II})	172 dB re 1μPa²-secSEL (HF_{II}).
Phocidae In-water	Harbor, Gray, Bearded, Harp, Hooded, and Ringed seals.	183 dB re 1μPa²-sec(P_{WI})	197 dB re 1μPa²-sec(P_{WI}).

TABLE 14—IMPULSIVE SOUND EXPLOSIVE CRITERIA AND THRESHOLDS FOR PREDICTING ONSET INJURY AND MORTALITY

Group	Species	Onset TTS	Onset PTS	Onset GI tract injury	Onset slight lung	Onset mortality (1% mortality)
Low-frequency Cetaceans.	All mysticetes	172 dB SEL (LF_{II}) or 224 dB Peak SPL.	187 dB SEL (LF_{II}) or 230 dB Peak SPL.	237 dB SPL (unweighted)	Equation 1.	Equation 2.
Mid-frequency Cetaceans.	Most delphinids, medium and large toothed whales.	172 dB SEL (MF_{II}) or 224 dB Peak SPL.	187 dB SEL (MF_{II}) or 230 dB Peak SPL.			
High-frequency Cetaceans.	Porpoises and *Kogia* spp..	146 dB SEL (HF_{II}) or 195 dB Peak SPL.	161 dB SEL (HF_{II}) or 201dB Peak SPL.			

TABLE 14—IMPULSIVE SOUND EXPLOSIVE CRITERIA AND THRESHOLDS FOR PREDICTING ONSET INJURY AND MORTALITY—Continued

Group	Species	Onset TTS	Onset PTS	Onset GI tract injury	Onset slight lung	Onset mortality (1% mortality)
Phocidae	Harbor, Gray, Bearded, Harp, Hooded, and Ringed seals.	177 dB SEL (P_{WI}) or 212 dB Peak SPL.	192 dB SEL (P_{WI}) or 218 dB Peak SPL.			

Equation 1:

$= 39.1M^{1/3} (1+[D_{Rm}/10.081])^{1/2}$ Pa-sec

Equation 2:

$= 91.4M^{1/3} (1+[D_{Rm}/10.081])^{1/2}$ Pa-sec

Where:

M = mass of the animals in kg.

D_{Rm} = depth of the receiver (animal) in meters.

SPL = sound pressure level.

Level B Harassment Risk Function (Behavioral Harassment)

In 2006, NMFS issued the first MMPA authorization to allow the take of marine mammals incidental to MFAS (to the Navy for RIMPAC). For that authorization, NMFS used 173 dB SEL as the criterion for the onset of behavioral harassment (Level B Harassment). This type of single number criterion is referred to as a step function, in which (in this example) all animals estimated to be exposed to received levels above 173 dB SEL would be predicted to be taken by Level B Harassment and all animals exposed to less than 173 dB SEL would not be taken by Level B Harassment. As mentioned previously, marine mammal behavioral responses to sound are highly variable and context specific (affected by differences in acoustic conditions; differences between species and populations; differences in gender, age, reproductive status, or social behavior; or the prior experience of the individuals), which does not support the use of a step function to estimate behavioral harassment.

Unlike step functions, acoustic risk continuum functions (which are also called ''exposure-response functions,'' ''dose-response functions,'' or ''stress-response functions'' in other risk assessment contexts) allow for probability of a response that NMFS would classify as harassment to occur over a range of possible received levels (instead of one number) and assume that the probability of a response depends first on the ''dose'' (in this case, the received level of sound) and that the probability of a response increases as the ''dose'' increases (see Figures 6–5 and 6–6 in the LOA application). In January 2009, NMFS issued three final rules governing the incidental take of marine mammals (within Navy's HRC, SOCAL, and Atlantic Fleet Active Sonar Training (AFAST)) that used a risk continuum to estimate the percent of marine mammals exposed to various levels of MFAS that would respond in a manner NMFS considers harassment.

The Navy and NMFS have previously used acoustic risk functions to estimate the probable responses of marine mammals to acoustic exposures for other training and research programs. Examples of previous application include the Navy FEISs on the SURTASS LFA sonar (U.S. Department of the Navy, 2001c); the North Pacific Acoustic Laboratory experiments conducted off the Island of Kauai (Office of Naval Research, 2001), and the Supplemental EIS for SURTASS LFA sonar (U.S. Department of the Navy, 2007d). As discussed earlier, factors other than received level (such as distance from or bearing to the sound source) can affect the way that marine mammals respond; however, data to support a quantitative analysis of those (and other factors) do not currently exist. NMFS will continue to modify these criteria as new data that meet NMFS standards of quality become available and can be appropriately and effectively incorporated.

The particular acoustic risk functions developed by NMFS and the Navy (see Figures 6–5 and 6–6 in the LOA application) estimate the probability of behavioral responses to MFAS/HFAS (interpreted as the percentage of the exposed population) that NMFS would classify as harassment for the purposes of the MMPA given exposure to specific received levels of MFAS/HFAS. The mathematical function (below) underlying this curve is a cumulative probability distribution adapted from a solution in Feller (1968) and was also used in predicting risk for the Navy's SURTASS LFA MMPA authorization as well.

$$R = \frac{1-\left(\frac{L-B}{K}\right)^{-A}}{1-\left(\frac{L-B}{K}\right)^{-2A}}$$

Where:

R = Risk (0–1.0)

L = Received level (dB re: 1 µPa)

B = Basement received level = 120 dB re: 1 µPa

K = Received level increment above B where 50-percent risk = 45 dB re: 1 µPa

A = Risk transition sharpness parameter = 10 (odontocetes and pinnipeds) or 8 mysticetes)

Detailed information on the above equation and its parameters is available in the AFTT DEIS/OEIS and previous Navy documents listed above.

The inclusion of a special behavioral response criterion for beaked whales of the family Ziphiidae is new to these criteria. It has been speculated for some time that beaked whales might have unusual sensitivities to sonar sound due to their likelihood of stranding in conjunction with MFAS use, even in areas where other species were more abundant (D'Amico *et al.* 2009), but there were not sufficient data to support a separate treatment for beaked whales until recently. With the recent publication of results from Blainville's beaked whale monitoring and experimental exposure studies on the instrumented Atlantic Undersea Test and Evaluation Center range in the Bahamas (McCarthy *et al.* 2011; Tyack *et al.* 2011), there are now statistically strong data suggesting that beaked whales tend to avoid both actual naval MFAS in real anti-submarine training scenarios as well as sonar-like signals and other signals used during controlled sound exposure studies in the same area. An unweighted 140 dB re 1 µPa sound pressure level threshold has been adopted by the Navy for takes of all beaked whales (family: Ziphiidae).

If more than one impulsive event involving explosives (i.e., not pile driving) occurs within any given 24-hour period within a training or testing event, criteria are applied to predict the number of animals that may be taken by

Level B Harassment. For multiple impulsive events (with the exception of pile driving) the behavioral threshold used in this analysis is 5 dB less than the TTS onset threshold (in sound exposure level). This value is derived from observed onsets of behavioral response by test subjects (bottlenose dolphins) during non-impulse TTS testing (Schlundt *et al.* 2000). Some multiple impulsive events, such as certain naval gunnery exercises, may be treated as a single impulsive event because a few explosions occur closely spaced within a very short period of time (a few seconds). For single impulses at received sound levels below hearing loss thresholds, the most likely behavioral response is a brief alerting or orienting response. Since no further sounds follow the initial brief impulses, Level B take in the form of behavioral harassment beyond that associated with potential TTS would not be expected to occur. This reasoning was applied to previous shock trials (63 FR 66069; 66 FR 22450; 73 FR 43130). Explosive criteria and thresholds are summarized in Table 6–3 in the LOA application.

Since impulse events can be quite short, it may be possible to accumulate multiple received impulses at sound pressure levels considerably above the energy-based criterion and still not be considered a behavioral take. The Navy treats all individual received impulses as if they were one second long for the purposes of calculating cumulative sound exposure level for multiple impulse events. For example, five air gun impulses, each 0.1 second long, received at 178 dB sound pressure level would equal a 175 dB sound exposure level, and would not be predicted as leading to a take. However, if the five 0.1 second pulses are treated as a 5 second exposure, it would yield an adjusted value of approximately 180 dB, exceeding the threshold. For impulses associated with explosions that have durations of a few microseconds, this assumption greatly overestimates effects based on sound exposure level metrics such as TTS and PTS and behavioral responses. Appropriate weighting values will be applied to the received impulse in one-third octave bands and the energy summed to produce a total weighted sound exposure level value. For impulsive behavioral criteria, the Navy's new weighting functions (detailed in the LOA application) are applied to the received sound level before being compared to the threshold.

TABLE 15—BEHAVIORAL THRESHOLDS FOR IMPULSIVE SOUND

Hearing group	Impulsive behavioral threshold for >2 pulses/24 hrs
Low-Frequency Cetaceans	167 dB SEL (LF_{II}).
Mid-Frequency Cetaceans	167 dB SEL (MF_{II}).
High-Frequency Cetaceans	141 dB SEL (HF_{II}).
Phocid Seals (in water)	172 dB SEL (P_{WI}).

Existing NMFS criteria was applied to sounds generated by pile driving and airguns (Table 16).

TABLE 16—THRESHOLDS FOR PILE DRIVING AND AIRGUNS

Species groups	Underwater vibratory pile driving criteria (sound pressure level, dB re 1 μPa)		Underwater impact pile driving and airgun criteria (sound pressure level, dB re 1 μPa)	
	Level A injury threshold	Level B disturbance threshold	Level A injury threshold	Level B disturbance threshold
Cetaceans (whales, dolphins, porpoises)	180 dB rms	120 dB rms	180 dB rms	160 dB rms.
Pinnipeds (seals)	190 dB rms	120 dB rms	190 dB rms	160 dB rms.

Quantitative Modeling for Impulsive and Non-Impulsive Sound

The Navy performed a quantitative analysis to estimate the number of marine mammals that could be harassed by acoustic sources or explosives used during Navy training and testing activities. Inputs to the quantitative analysis included marine mammal density estimates; marine mammal depth occurrence distributions; oceanographic and environmental data; marine mammal hearing data; and criteria and thresholds for levels of potential effects. The quantitative analysis consists of computer-modeled estimates and a post-model analysis to determine the number of potential mortalities and harassments. The model calculates sound energy propagation from sonars, other active acoustic sources, and explosives during naval activities; the sound or impulse received by animat dosimeters representing marine mammals distributed in the area around the modeled activity; and whether the sound or impulse received by a marine mammal exceeds the thresholds for effects. The model estimates are then further analyzed to consider animal avoidance and implementation of mitigation measures, resulting in final estimates of effects due to Navy training and testing. This process results in a reduction of take numbers and is detailed in Chapter 6 (section 6.1.5) of the Navy's LOA application.

A number of computer models and mathematical equations can be used to predict how energy spreads from a sound source (e.g., sonar or underwater detonation) to a receiver (e.g., dolphin or sea turtle). Basic underwater sound models calculate the overlap of energy and marine life using assumptions that account for the many variables, and often unknown factors that can greatly influence the result. Assumptions in previous and current Navy models have intentionally erred on the side of overestimation when there are unknowns or when the addition of other variables was not likely to substantively change the final analysis. For example,

because the ocean environment is extremely dynamic and information is often limited to a synthesis of data gathered over wide areas and requiring many years of research, known information tends to be an average of a seasonal or annual variation. The Equatorial Pacific El Nino disruption of the ocean-atmosphere system is an example of dynamic change where unusually warm ocean temperatures are likely to redistribute marine life and alter the propagation of underwater sound energy. Previous Navy modeling therefore made some assumptions indicative of a maximum theoretical propagation for sound energy (such as a perfectly reflective ocean surface and a flat seafloor). More complex computer models build upon basic modeling by factoring in additional variables in an effort to be more accurate by accounting for such things as bathymetry and an animal's likely presence at various depths.

The Navy has developed a set of data and new software tools for quantification of estimated marine mammal impacts from Navy activities. This new approach is the resulting evolution of the basic model previously used by the Navy and reflects a more complex modeling approach as described below. Although this more complex computer modeling approach accounts for various environmental factors affecting acoustic propagation, the current software tools do not consider the likelihood that a marine mammal would attempt to avoid repeated exposures to a sound or avoid an area of intense activity where a training or testing event may be focused. Additionally, the software tools do not consider the implementation of mitigation (e.g., stopping sonar transmissions when a marine mammal is within a certain distance of a ship or range clearance prior to detonations). In both of these situations, naval activities are modeled as though an activity would occur regardless of proximity to marine mammals and without any horizontal movement by the animal away from the sound source or human activities (e.g., without accounting for likely animal avoidance). Therefore, the final step of the quantitative analysis of acoustic effects is to consider the implementation of mitigation and the possibility that marine mammals would avoid continued or repeated sound exposures.

The quantified results of the marine mammal acoustic effects analysis presented in the Navy's LOA application differ from the quantified results presented in the AFTT DEIS/OEIS. Presentation of the results in this new manner for MMPA, ESA, and other regulatory analyses is well within the framework of the previous NEPA analyses presented in the DEIS. The differences are due to three main factors: (1) Changes to the tempo or location of certain proposed activities; (2) refinement to the modeling inputs for training and testing; and (3) additional post-model analysis of acoustic effects to include animal avoidance of repeated sound sources, avoidance of areas of activity before use of a sound source or explosive by sensitive species, and implementation of mitigation. The Navy's tempo and location of certain proposed activities has been modified in response to new training and testing requirements developed in response to the ever-evolving security environment requiring an increased use of high frequency mine detection sonar for training and testing, an increased use of mid-frequency ASW sonobuoys for testing, relocation of countermeasure testing from NSWC Panama City to GOMEX, and the elimination of the Submarine Navigation Training at Kings Bay, GA. The proposal also includes refinement of the modeling inputs, including the addition of modeling results for Surface to Surface MISSILEX, which was analyzed but not modeled in the DEIS, and the elimination of over-calculation for several activities which occur only once every five years. This additional post-model analysis of acoustic effects was performed to clarify potential misunderstandings of the numbers presented as modeling results in the AFTT DEIS/OEIS. Some comments indicated that the readers believed the acoustic effects to marine mammals presented in the DEIS/OEIS were representative of the actual expected effects, although the AFTT DEIS/OEIS did not account for animal avoidance of an area prior to commencing sound-producing activities, animal avoidance of repeated explosive noise exposures, and the protections due to standard Navy mitigations. Therefore, the numbers presented in Navy's LOA application, which will be reflected in the AFTT FEIS/OEIS, have been refined to better quantify the expected effects by fully accounting for animal avoidance or movement and implementation of standard Navy mitigations. With the application of the post-modeling assessment process, the net result of these changes is an overall decrease in takes by mortality and Level A takes within the LOA application compared with the DEIS, a net reduction in Level B takes for training, and a net increase in Level B takes for testing. The Navy has advised NMFS that all comments received on the proposed rule that address (1) changes to the tempo or location of certain proposed activities; (2) refinement to the modeling inputs for training and testing; and (3) additional post-model analysis of acoustic effects and implementation of mitigation, will be reviewed and addressed by the Navy in its FEIS/OEIS for AFTT.

The steps of the quantitative analysis of acoustic effects, the values that went into the Navy's model, and the resulting ranges to effects are detailed in Chapter 6 of the Navy's LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*).

Take Request

The AFTT DEIS/OEIS considered all training and testing activities proposed to occur in the Study Area that have the potential to result in the MMPA defined take of marine mammals. The stressors associated with these activities included the following:

- Acoustic (sonar and other active non-impulse sources, explosives, pile driving, swimmer defense airguns, weapons firing, launch and impact noise, vessel noise, aircraft noise)
- Energy (electromagnetic devices)
- Physical disturbance or strikes (vessels, in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables, guidance wires, parachutes)
- Ingestion (munitions, military expended materials other than munitions)

The Navy determined, and NMFS agrees, that three stressors could potentially result in the incidental taking of marine mammals from training and testing activities within the Study Area: (1) Non-impulsive stressors (sonar and other active acoustic sources), (2) impulsive stressors (explosives, pile driving and removal), and (3) vessel strikes. Non-impulsive and impulsive stressors have the potential to result in incidental takes of marine mammals by harassment, injury, or mortality (explosives only). Vessel strikes have the potential to result in incidental take from direct injury and/or mortality.

Training Activities—Based on the Navy's model and post-model analysis (described in detail in Chapter 6 of its LOA application), Table 17 summarizes the Navy's take request for training activities for an annual maximum year (a notional 12-month period when all annual and non-annual events would occur) and the summation over a 5-year period (with consideration of the varying schedule of non-annual activities). Table 18 summarizes the

Navy's take request (Level A and Level B harassment) for training activities by species.

While the Navy does not anticipate any mortalities would occur from training activities involving explosives, the Navy requests annual authorization for take by mortality of up to 17 small odontocetes (i.e., dolphins) to include any combination of such species that may be present in the Study Area. In addition, the Navy does not anticipate any beaked whale strandings or mortalities from sonar and other active sources, but in order to account for unforeseen circumstances that could lead to such effects the Navy requests the annual take, by mortality, of up to 10 beaked whales in any given year, and no more than 10 beaked whales over the 5-year LOA period, as part of training activities.

Vessel strike to marine mammals is not associated with any specific training activity but rather a limited, sporadic, and accidental result of Navy vessel movement within the Study Area. In order to account for the accidental nature of vessel strikes to large whales in general, and the potential risk from any vessel movement within the Study Area, the Navy requests take authorization in the event a Navy vessel strike does occur while conducting training. The Navy's take authorization request is based on the probabilities of whale strikes suggested by the data from NMFS Northeast Science Center, NMFS Southeast Science Center, the Navy, and the calculations detailed in Chapter 6 of the Navy's LOA application. The number of Navy and commercial whale strikes for which the species has been positively identified suggests that the probability of striking a humpback whale in the Study Area is greater than striking other species. However, since species identification has not been possible in most vessel strike cases, the Navy cannot quantifiably predict what species may be taken. Therefore, the Navy seeks take authorization by mortality from vessel strike for any combined number of marine mammal species to include fin whale, blue whale, humpback whale, Bryde's whale, sei whale, minke whale, sperm whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species. The Navy requests takes of large marine mammals over the course of the 5-year regulations from training activities as discussed below:

- The take by vessel strike during training activities in any given year of no more than three marine mammals total of any combination of species including fin whale, blue whale, humpback whale, Bryde's whale, sei whale, minke whale, sperm whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species.
- The take by vessel strike of no more than 10 marine mammals from training activities over the course of the five years of the AFTT regulations.

Over a period of 18 years from 1995 to 2012 there have been a total of 19 Navy vessel strikes in the Study Area. Eight of the strikes resulted in a confirmed death; but in 11 of the 19 strikes, the fate of the animal was unknown. It is possible that some of the 11 reported strikes resulted in recoverable injury or were not marine mammals at all, but another large marine species (e.g., basking shark). However, it is prudent to consider that all of the strikes could have resulted in the death of a marine mammal. The maximum number of strikes in any given year was three strikes, which occurred in 2001 and 2004. The highest average number of strikes over any five year period was two strikes per year from 2001 to 2005. The average number of strikes for the entire 18-year period is 1.055 strikes per year. Since the implementation of the Navy's Marine Species Awareness Training in 2007, strikes in the Study Area have decreased to an average of 0.5 per year. Over the last five years on the east coast, the Navy was involved in two strikes, with no confirmed marine mammal deaths as a result of the vessel strike. Also as discussed in Chapter 6 of the Navy's LOA application, the probability of striking as many as two large whales in a single year in the AFTT Study Area is only 19 percent.

TABLE 17—SUMMARY OF ANNUAL AND 5-YEAR TAKE REQUESTS FOR TRAINING ACTIVITIES

MMPA category	Source	Annual authorization sought	5-Year authorization sought
		Training activities [4]	Training activities
Mortality	Impulsive	17 mortalities applicable to any small odontocete in any given year.	85 mortalities applicable to any small odontocete over 5 years.
	Unspecified	10 mortalities to beaked whales in any given year. [1]	10 mortalities to beaked whales over 5 years. [1]
	Vessel strike	No more than three large whale mortalities in any given year. [2]	No more than 10 large whale mortalities over 5 years. [2]
Level A	Impulsive and Non-Impulsive.	351	1,753.
Level B	Impulsive and Non-Impulsive.	2,053,473	10,263,631.

[1] Ten Ziphiidae beaked whale to include any combination of Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, northern bottlenose whale, and Sowerby's beaked whale, and True's beaked whale (not to exceed 10 beaked whales total over the 5-year length of requested authorization).

[2] *For Training:* Because of the number of incidents in which the species of the stricken animal has remained unidentified, Navy cannot predict that proposed takes (either 3 per year or the 10 over the course of 5 years) will be of any particular species, and therefore seeks take authorization for any combination of large whale species (e.g., fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species), excluding the North Atlantic right whale.

TABLE 18—SPECIES-SPECIFIC TAKE REQUESTS FROM IMPULSIVE AND NON-IMPULSIVE SOURCE EFFECTS FOR ALL TRAINING ACTIVITIES

Species	Annual [1]		Total over 5-year period	
	Level B	Level A	Level B	Level A
Mysticetes:				

TABLE 18—SPECIES-SPECIFIC TAKE REQUESTS FROM IMPULSIVE AND NON-IMPULSIVE SOURCE EFFECTS FOR ALL TRAINING ACTIVITIES—Continued

Species	Annual[1]		Total over 5-year period	
	Level B	Level A	Level B	Level A
Blue Whale *	147	0	735	0
Bryde's Whale	955	0	4,775	0
Minke Whale	60,402	16	302,010	80
Fin Whale *	4,490	1	22,450	5
Humpback Whale *	1,643	1	8,215	5
North Atlantic Right Whale *	112	0	560	0
Sei Whale *	10,188	1	50,940	5
Odontocetes—Delphinids:				
Atlantic Spotted Dolphin	177,570	12	887,550	60
Atlantic White-Sided Dolphin	31,228	3	156,100	15
Bottlenose Dolphin	284,728	8	1,422,938	40
Clymene Dolphin	19,588	1	97,938	5
Common Dolphin	465,014	17	2,325,022	85
False Killer Whale	713	0	3,565	0
Fraser's Dolphin	2,205	0	11,025	0
Killer Whale	14,055	0	70,273	0
Melon-Headed Whale	20,876	0	104,380	0
Pantropical Spotted Dolphin	70,968	1	354,834	5
Pilot Whale	101,252	3	506,240	15
Pygmy Killer Whale	1,487	0	7,435	0
Risso's Dolphin	238,528	3	1,192,618	15
Rough Toothed Dolphin	1,059	0	5,293	0
Spinner Dolphin	20,414	0	102,068	0
Striped Dolphin	224,305	7	1,121,511	35
White-Beaked Dolphin	1,613	0	8,027	0
Odontocetes—Sperm Whales:				
Sperm Whale *	14,749	0	73,743	0
Odontocetes—Beaked Whales:				
Blainville's Beaked Whale	28,179	0	140,893	0
Cuvier's Beaked Whale	34,895	0	174,473	0
Gervais' Beaked Whale	28,255	0	141,271	0
Northern Bottlenose Whale	18,358	0	91,786	0
Sowerby's Beaked Whale	9,964	0	49,818	0
True's Beaked Whale	16,711	0	83,553	0
Odontocetes—Kogia Species and Porpoises:				
Kogia spp.	5,090	15	25,448	75
Harbor Porpoise	142,811	262	711,727	1,308
Phocid Seals:				
Bearded Seal	0	0	0	0
Gray Seal	82	0	316	0
Harbor Seal	83	0	329	0
Harp Seal	4	0	12	0
Hooded Seal	5	0	25	0
Ringed Seal **	0	0	0	0

[1] Predictions shown are for the theoretical maximum year, which would consist of all annual training and one Civilian Port Defense activity. Civilian Port Defense training would occur biennially.
* ESA-Listed Species; ** ESA-proposed; PTS: Permanent threshold shift; TTS: Temporary threshold shift.

Testing Activities

Based on the Navy's model and post-model analysis (described in detail in Chapter 6 of its LOA application), Table 19 summarizes the Navy's take request for testing activities for an annual maximum year (a notional 12-month period when all annual and non-annual events would occur) and the summation over a 5-year period (with consideration of the varying schedule of non-annual activities). Table 20 summarizes the Navy's take request (Level A and Level B harassment) for testing activities by species.

The Navy requests annual authorization for take by mortality of up to 11 small odontocetes (i.e., dolphins) to include any combination of such species with potential presence in the Study Area as part of testing activities using impulsive sources (excluding ship shock trials). Over the 5-year periods of the rule, the Navy requests authorization for take by mortality of up to 25 marine mammals incidental to ship shock trials (10 for aircraft carrier trials and 15 for guided missile destroyer and Littoral Combat Ship trials).

The Navy does not anticipate vessel strikes of marine mammals would occur during testing activities in the Study Area in any given year. Most testing conducted in the Study Area that involves surface ships is conducted on Navy ships during training exercises. Therefore, the vessel strike take request for training activities covers those activities. For the smaller number of testing activities not conducted in conjunction with fleet training, the Navy requests a smaller number of takes resulting incidental to vessel strike. However, in order to account for the accidental nature of vessel strikes to large whales in general, and potential risk from any vessel movement within the Study Area, the Navy is seeking take authorization in the event a Navy vessel strike does occur while conducting

testing during the five year period of NMFS' final authorization as follows:

- The take by vessel strike during testing activities in any given year of no more than one marine mammal of any of the following species including fin whale, blue whale, humpback whale, Bryde's whale, sei whale, minke whale, sperm whale Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species.
- The take by vessel strike of no more than one large whale from testing activities over the course of the 5-year regulations.

TABLE 19—SUMMARY OF ANNUAL AND 5-YEAR TAKE REQUESTS FOR TESTING ACTIVITIES

[Excluding ship shock trials]

MMPA category	Source	Annual authorization sought	5-Year authorization sought
		Testing activities[3]	Testing activities[3]
Mortality	Impulsive	11 mortalities applicable to any small odontocete in any given year[3].	55 mortalities applicable to any small odontocete over 5 years.
	Unspecified	None	None.
	Vessel strike	No more than one large whale mortality in any given year.[2]	No more than one large whale mortality over 5 years.[2]
Level A	Impulsive and non-Impulsive.	375	1,735.
Level B	Impulsive and non-Impulsive.	2,441,640	11,559,236.

[1] Ten Ziphiidae beaked whale to include any combination of Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, northern bottlenose whale, and Sowerby's beaked whale, and True's beaked whale (not to exceed 10 beaked whales total over the 5-year length of requested authorization).

[2] *For Testing:* Because of the number of incidents in which the species of the stricken animal has remained unidentified, the Navy cannot predict that the proposed takes (one over the course of 5 years) will be of any particular species, and therefore seeks take authorization for any large whale species (e.g., fin whale, humpback whale, minke whale, sei whale, Bryde's whale, sperm whale, blue whale, Blainville's beaked whale, Cuvier's beaked whale, Gervais' beaked whale, and unidentified whale species), excluding the North Atlantic right whale.

[3] Excluding ship shock trials.

TABLE 20—SPECIES-SPECIFIC TAKE REQUESTS FROM IMPULSIVE AND NON-IMPULSIVE SOURCE EFFECTS FOR ALL TESTING ACTIVITIES

Species	Annual[1,2]		Total over 5-year period	
	Level B	Level A	Level B	Level A
Mysticetes:				
Blue Whale*	18	0	82	0
Bryde's Whale	64	0	304	0
Minke Whale	7,756	15	34,505	28
Fin Whale*	599	0	2,784	0
Humpback Whale*	200	0	976	0
North Atlantic Right Whale*	87	0	395	0
Sei Whale*	796	0	3,821	0
Odontocetes—Delphinids:				
Atlantic Spotted Dolphin	24,429	1,854	104,647	1,964
Atlantic White-Sided Dolphin	10,330	147	50,133	166
Bottlenose Dolphin	33,708	149	146,863	190
Clymene Dolphin	2,173	80	10,169	87
Common Dolphin	52,173	2,203	235,493	2,369
False Killer Whale	109	0	497	0
Fraser's Dolphin	171	0	791	0
Killer Whale	1,540	2	7,173	2
Melon-Headed Whale	1,512	28	6,950	30
Pantropical Spotted Dolphin	7,985	71	38,385	92
Pilot Whale	15,701	153	74,614	163
Pygmy Killer Whale	135	3	603	3
Risso's Dolphin	24,356	70	113,682	89
Rough Toothed Dolphin	138	0	618	0
Spinner Dolphin	2,862	28	13,208	34
Striped Dolphin	21,738	2,599	97,852	2,751
White-Beaked Dolphin	1,818	3	8,370	3
Odontocetes—Sperm Whales:				
Sperm Whale*	1,786	5	8,533	6
Odontocetes—Beaked Whales:				
Blainville's Beaked Whale	4,753	3	23,561	3
Cuvier's Beaked Whale	6,144	1	30,472	1
Gervais' Beaked Whale	4,764	4	23,388	4
Northern Bottlenose Whale	12,096	5	60,409	6
Sowerby's Beaked Whale	2,698	0	13,338	0
True's Beaked Whale	3,133	1	15,569	1
Odontocetes—Kogia Species and Porpoises:				

TABLE 20—SPECIES-SPECIFIC TAKE REQUESTS FROM IMPULSIVE AND NON-IMPULSIVE SOURCE EFFECTS FOR ALL TESTING ACTIVITIES—Continued

Species	Annual [1,2]		Total over 5-year period	
	Level B	Level A	Level B	Level A
Kogia spp.	1,163	12	5,536	36
Harbor Porpoise	2,182,872	216	10,358,300	1,080
Phocid Seals:				
Bearded Seal	33	0	161	0
Gray Seal	3,293	14	14,149	46
Harbor Seal	8,668	78	38,860	330
Harp Seal	3,997	14	16,277	30
Hooded Seal	295	0	1,447	0
Ringed Seal **	359	0	1,795	0

[1] Predictions shown are for the theoretical maximum year, which would consist of all annual testing; one CVN ship shock trial and two other ship shock trials (DDG or LCS); and Unmanned Underwater Vehicle (UUV) Demonstrations at each of three possible sites. One CVN, one DDG, and two LCS ship shock trials could occur within the 5-year period. Typically, one UUV Demonstration would occur annually at one of the possible sites.

[2] Ship shock trials could occur in either the VACAPES (year-round, except a CVN ship shock trial would not occur in the winter) or JAX (spring, summer, and fall only) Range Complexes. Actual location and time of year of a ship shock trial would depend on platform development, site availability, and availability of ship shock trial support facilities and personnel. For the purpose of requesting takes, the maximum predicted effects to a species for either location in any possible season are included in the species' total predicted effects.

* ESA-Listed Species; ** ESA-proposed; PTS: Permanent threshold shift; TTS: Temporary threshold shift.

For one aircraft carrier (CVN) ship shock trial, the Navy requests a maximum of 6,591 takes by Level A harassment and 4,607 takes by Level B harassment over the 5-year LOA period. Based on no observed mortalities during previous ship shock trials, the Navy does not anticipate the mortalities predicted by the acoustic analysis, but requests authorization for take by mortality of up to 10 small odontocetes (any combination of species known to be present in the Study Area).

For the guided missile destroyer (DDG) and two Littoral Combat Ship (LCS) ship shock trials (three events total), the Navy requests a maximum of 1,188 takes by Level A harassment and 867 takes by Level B harassment over the course of the 5-year LOA period. Based on no observed mortalities during previous ship shock trials, the Navy does not anticipate the mortalities predicted by the acoustic analysis, but requests authorization for take by mortality of up to 15 small odontocetes (any combination of species known to be present in the Study Area).

TABLE 21—SUMMARY OF ANNUAL AND 5-YEAR TAKE REQUEST FOR AFTT SHIP SHOCK TRIALS

MMPA category	Annual authorization sought [1]	5-Year authorization sought
Mortality	20 mortalities applicable to any small odontocete in any given year.	25 mortalities applicable to any small odontocete over 5 years.
Level A	7,383	7,779.
Level B	5,185	5,474.

[1] Up to three ship shock trials could occur in any one year (one CVN and two DDG/LCS ship shock trials), with one CVN, one DDG, and two LCS ship shock trials over the 5-year period. Ship shock trials could occur in either the VACAPES (year-round, except a CVN ship shock trial would not occur in the winter) or JAX (spring, summer, and fall only) Range Complexes. Actual location and time of year of a ship shock trial would depend on platform development, site availability, and availability of ship shock trial support facilities and personnel. For the purpose of requesting Level A and Level B takes, the maximum predicted effects to a species for either location in any possible season are included in the species' total predicted effects.

Marine Mammal Habitat

The Navy's proposed training and testing activities could potentially affect marine mammal habitat through the introduction of sound into the water column, impacts to the prey species of marine mammals, bottom disturbance, or changes in water quality. Each of these components was considered in the AFTT DEIS/OEIS and was determined by the Navy to have no effect on marine mammal habitat. Based on the information below and the supporting information included in the AFTT DEIS/OEIS, NMFS has preliminarily determined that the proposed training and testing activities would not have adverse or long-term impacts on marine mammal habitat.

Important Marine Mammal Habitat

The only ESA-listed marine mammal with designated critical habitat within the AFTT Study Area is for the North Atlantic right whale. Three critical habitats—Cape Cod Bay, Great South Channel, and the coastal waters of Georgia and Florida—were designated by NMFS in 1994 (59 FR 28805, June 3, 1994). Recently, in a response to a 2009 petition to revise North Atlantic right whale critical habitat, NMFS stated that the revision is appropriate and the ongoing rulemaking process would continue (75 FR 61690, October 6, 2010).

New England waters (where the Cape Cod Bay and Great South Channel critical habitats are located) are an important feeding habitat for right whales, which feed primarily on copepods in this area (largely of the genera *Calanus* and *Pseudocalanus*). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx, 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer and fall right whale habitats (Kenney *et al.,* 1986; Kenney *et al.,* 1995). While feeding in the coastal

waters off Massachusetts has been better studied than in other areas, right whale feeding has also been observed on the margins of Georges Bank, in the Great South Channel, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are beginning to emerge (Baumgartner and Mate, 2003; Baumgartner and Mate, 2005). NMFS and Provincetown Center for Coastal Studies aerial surveys during springs of 1999–2006 found right whales along the northern edge of Georges Bank, in the Great South Channel, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank and Wilkinson Basin. The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats.

Since 2004, consistent aerial survey efforts have been conducted during the migration and calving season (15 November to 15 April) in coastal areas of Georgia and South Carolina, to the north of currently defined critical habitat (Glass and Taylor, 2006; Khan and Taylor, 2007; Sayre and Taylor, 2008; Schulte and Taylor, 2010). Results suggest that this region may not only be part of the migratory route but also a seasonal residency area. Results from an analysis by Schick *et al.* (2009) suggest that the migratory corridor of North Atlantic right whales is broader than initially estimated and that suitable habitat exists beyond the 20 nm coastal buffer presumed to represent the primary migratory pathway (NMFS, 2008b). Results were based on data modeled from two females tagged with satellite-monitored radio tags as part of a previous study.

Three right whale observations (four individuals) were recorded during aerial surveys sponsored by the Navy in the vicinity of the planned Undersea Warfare Training Range approximately 50 mi. (80 km) offshore of Jacksonville, Florida in 2009 and 2010, including a female that was observed giving birth (Foley *et al.,* 2011). These sightings occurred well outside existing critical habitat for the right whale and suggest that the calving area may be broader than currently assumed (Foley *et al.,* 2011; U.S. Department of the Navy, 2010). Offshore (greater than 30 mi. [48.3 km]) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 documented 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000 and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). Several of the years that offshore surveys were flown were some of the lowest count years for calves and for numbers of right whales in the southeast recorded since comprehensive surveys in the calving grounds were initiated. Therefore, the frequency with which right whales occur in offshore waters in the southeastern United States remains unclear.

Activities involving sound or energy from sonar and other active acoustic sources will not occur or will be minimized to the maximum extent practicable in designated North Atlantic right whale critical habitat and would have no effect on the primary constituent elements (i.e., water temperature and depth in the southeast and copepods in the northeast).

Expected Effects on Habitat

Training and testing activities may introduce water quality constituents into the water column. Based on the analysis of the AFTT EIS/OEIS, military expended materials (e.g., undetonated explosive materials) would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. High-order explosions consume most of the explosive material, creating typical combustion products. For example, in the case of Royal Demolition Explosive, 98 percent of the products are common seawater constituents and the remainder is rapidly diluted below threshold effect level. Explosion by-products associated with high order detonations present no secondary stressors to marine mammals through sediment or water. However, low order detonations and unexploded ordnance present elevated likelihood of impacts on marine mammals.

Indirect effects of explosives and unexploded ordnance to marine mammals via sediment is possible in the immediate vicinity of the ordnance. Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6–12 in. (0.15–0.3 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3–6 ft. (1–2 m) from the degrading ordnance. Taken together, it is possible that marine mammals could be exposed to degrading explosives, but it would be within a very small radius of the explosive (1–6 ft. [0.3–2 m]).

Anthropogenic noise attributable to training and testing activities in the Study Area emanates from multiple sources including low-frequency and hull-mounted mid-frequency active sonar, high-frequency and non-hull mounted mid-frequency active sonar, and explosives and other impulsive sounds. Such sound sources include improved extended echo ranging sonobuoys; anti-swimmer grenades; mine countermeasure and neutralization activities; ordnance testing; gunnery, missile, and bombing exercises; torpedo testing, sinking exercises; ship shock trials; vessels; and aircraft. Sound produced from training and testing activities in the Study Area is temporary and transitory. The sounds produced during training and testing activities can be widely dispersed or concentrated in small areas for varying periods. Any anthropogenic noise attributed to training and testing activities in the Study Area would be temporary and the affected area would be expected to immediately return to the original state when these activities cease. Military expended materials resulting from training and testing activities could potentially result in minor long-term changes to benthic habitat. Military expended materials may be colonized over time by benthic organisms that prefer hard substrate and would provide structure that could attract some species of fish or invertebrates. Overall, the combined impacts of sound exposure, explosions, vessel strikes, and military expended materials resulting from the proposed activities would not be expected to have measurable effects on populations of marine mammal prey species.

Equipment used by the Navy within the Study Area, including ships and other marine vessels, aircraft, and other equipment, may also introduce materials into the marine environment. All equipment is properly maintained in accordance with applicable Navy or legal requirements. All such operating equipment meets federal water quality standards, where applicable.

Effects on Marine Mammal Prey

Invertebrates—Prey sources such as marine invertebrates could potentially be impacted by sound stressors as a result of the proposed activities. However, most marine invertebrates' ability to sense sounds is very limited. In most cases, marine invertebrates would not respond to impulsive and non-impulsive sounds, although they may detect and briefly respond to

nearby low-frequency sounds. These short-term responses would likely be inconsequential to invertebrate populations. Explosions and pile driving would likely kill or injure nearby marine invertebrates. Vessels also have the potential to impact marine invertebrates by disturbing the water column or sediments, or directly striking organisms (Bishop, 2008). The propeller wash (water displaced by propellers used for propulsion) from vessel movement and water displaced from vessel hulls can potentially disturb marine invertebrates in the water column and is a likely cause of zooplankton mortality (Bickel et al., 2011). The localized and short-term exposure to explosions or vessels could displace, injure, or kill zooplankton, invertebrate eggs or larvae, and macro-invertebrates. Therefore, mortality or long-term consequences for a few animals is unlikely to have measurable effects on overall stocks or populations. Long-term consequences to marine invertebrate populations would not be expected as a result of exposure to sounds or vessels in the Study Area.

Fish—If fish are exposed to explosions and impulsive sound sources, they may show no response at all or may have a behavioral reaction. Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. Animals that experience hearing loss (PTS or TTS) as a result of exposure to explosions and impulsive sound sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. It is possible for fish to be injured or killed by an explosion. Physical effects from pressure waves generated by underwater sounds (e.g., underwater explosions) could potentially affect fish within proximity of training or testing activities. The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Keevin and Hempen, 1997; Wright, 1982). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Edds-Walton and Finneran, 2006; O'Keeffe, 1984; O'Keeffe and Young, 1984; Wiley *et al.,* 1981; Yelverton *et al.,* 1975). Species with gas-filled organs have higher mortality than those without them (Continental Shelf Associates Inc., 2004; Goertner *et al.,* 1994).

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright, 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation. The abundances of various fish and invertebrates near the detonation point could be altered for a few hours before animals from surrounding areas repopulate the area; however these populations would likely be replenished as waters near the detonation point are mixed with adjacent waters. Repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. Long-term consequences for fish populations would not be expected.

Vessels and in-water devices do not normally collide with adult fish, most of which can detect and avoid them. Exposure of fishes is to vessel strike stressors is limited to those fish groups that are large, slow-moving, and may occur near the surface, such as sturgeon, ocean sunfish, whale sharks, basking sharks, and manta rays. With the exception of sturgeon, these species are distributed widely in offshore portions of the Study Area. Any isolated cases of a Navy vessel striking an individual could injure that individual, impacting the fitness of an individual fish. Vessel strikes would not pose a risk to most of the other marine fish groups, because many fish can detect and avoid vessel movements, making strikes rare and allowing the fish to return to their normal behavior after the ship or device passes. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (e.g., swimming away and increased heart rate) as the passing vessel displaces them. However, such reactions are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

Marine Mammal Avoidance

Marine mammals may be temporarily displaced from areas where Navy training is occurring, but the area should be utilized again after the activities have ceased. Avoidance of an area can help the animal avoid further acoustic effects by avoiding or reducing further exposure. The intermittent or short duration of many activities should prevent animals from being exposed to stressors on a continuous basis. In areas of repeated and frequent acoustic disturbance, some animals may habituate or learn to tolerate the new baseline or fluctuations in noise level. While some animals may not return to an area, or may begin using an area differently due to training and testing activities, most animals are expected to return to their usual locations and behavior.

Other Expected Effects

Other sources that may affect marine mammal habitat were considered and potentially include the introduction of fuel, debris, ordnance, and chemical residues into the water column. The effects of each of these components were considered in the Navy's AFTT DEIS/OEIS. Based on the detailed review within the AFTT EIS/OEIS, there would be no effects to marine mammals resulting from loss or modification of marine mammal habitat including water and sediment quality, food resources, vessel movement, and expendable material.

Analysis and Negligible Impact Preliminary Determination

NMFS has defined "negligible impact" in 50 CFR 216.103 as "* * * an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." In making a negligible impact determination, NMFS considers:

(1) The number of anticipated mortalities;

(2) The number and nature of anticipated injuries;

(3) The number, nature, and intensity, and duration of Level B harassment; and

(4) The context in which the takes occur.

As mentioned previously, NMFS estimates that 42 species of marine mammals could be potentially affected by Level A or Level B harassment over the course of the five-year period. In addition, 16 species could potentially be lethally taken over the course of the five-year period from explosives and 11

species could potentially be lethally taken from ship strikes over the course of the five-year period.

Pursuant to NMFS' regulations implementing the MMPA, an applicant is required to estimate the number of animals that will be "taken" by the specified activities (i.e., takes by harassment only, or takes by harassment, injury, and/or death). This estimate informs the analysis that NMFS must perform to determine whether the activity will have a "negligible impact" on the affected species or stock. Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects (e.g., pink-footed geese (*Anser brachyrhynchus*) in undisturbed habitat gained body mass and had about a 46-percent reproductive success compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and has a 17-percent reproductive success). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes, alone, is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, and effects on habitat. Generally speaking, and especially with other factors being equal, the Navy and NMFS anticipate more severe effects from takes resulting from exposure to higher received levels (though this is in no way a strictly linear relationship throughout species, individuals, or circumstances) and less severe effects from takes resulting from exposure to lower received levels.

The Navy's specified activities have been described based on best estimates of the number of activity hours, items, or detonations that the Navy would conduct. There may be some flexibility in the exact number of hours, items, or detonations may vary from year to year, but totals would not exceed the 5-year totals. Furthermore, the Navy's take request is based on their model and post-model analysis. The requested number of Level B takes does not equate to the number of individual animals the Navy expects to harass (which is lower), but rather to the instances of take (i.e., exposures) that may occur. Depending on the location, duration, and frequency of activities, along with the distribution and movement of marine mammals, individual animals may be exposed multiple times to impulse or non-impulse sounds at or above the Level B harassment threshold. However, the Navy is currently unable to estimate the number of individuals that may be taken during training and testing activities. The model results are over- estimates of the number of takes that may occur to a smaller number of individuals. While the model shows that an increased number of takes may occur (compared to the 2009 rulemakings for AFAST and the east coast range complexes), the types and severity of individual responses to training and testing activities are not expected to change.

Taking the above into account, considering the sections discussed below, and dependent upon the implementation of the proposed mitigation measures, NMFS has preliminarily determined that Navy's proposed training and testing exercises would have a negligible impact on the marine mammal species and stocks present in the Study Area.

Behavioral Harassment

As discussed previously in this document, marine mammals can respond to sound in many different ways, a subset of which qualifies as harassment (see Behavioral Harassment Section). As also discussed earlier, the take estimates do take into account the fact that marine mammals will likely avoid strong sound sources to one extent or another. Although an animal that avoids the sound source will likely still be taken in some instances (such as if the avoidance results in a missed opportunity to feed, interruption of reproductive behaviors, etc.) in other cases avoidance may result in fewer instances of take than were estimated or in the takes resulting from exposure to a lower received level than was estimated, which could result in a less severe response. For sonar and other active acoustic sources, the Navy provided information (Tables 22 and 23) estimating the percentage of behavioral harassment that would occur within the 6-dB bins (without considering mitigation or avoidance). As mentioned above, an animal's exposure to a higher received level is more likely to result in a behavioral response that is more likely to adversely affect the health of the animal. As the table illustrates, the vast majority (~79%, at least for hull-mounted sonar, which is responsible for most of the sonar takes) of calculated takes for mid-frequency sonar result from exposures between 150dB and 162dB. Less than 0.5% of the takes are expected to result from exposures above 180dB.

TABLE 22—NON-IMPULSIVE RANGES IN 6 DB BINS AND PERCENTAGE OF BEHAVIORAL HARASSMENT

[Low-frequency cetaceans]

Received level in 6-dB Bins	Sonar Bin MF1 (e.g., SQS–53; ASW Hull-mounted Sonar)		Sonar Bin MF4 (e.g., AQS–22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ–62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ–32; MIW Sonar)	
	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)
120 ≤ SPL<126	179,213–147,800	0.00	60,983–48,317	0.00	19,750–15,275	0.00	3,338–2,438	0.00
126 ≤ SPL<132	147,800–136,575	0.00	48,317–18,300	0.09	15,275–9,825	0.11	2,438–1,463	0.04
132 ≤ SPL<138	136,575–115,575	0.12	18,300–16,113	0.20	9,825–5,925	2.81	1,463–1,013	0.78
138 ≤ SPL<144	115,575–74,913	2.60	16,113–11,617	4.95	5,925–2,700	18.73	1,013–788	4.16
144 ≤ SPL<150	74,913–66,475	2.94	11,617–5,300	31.26	2,700–1,375	26.76	788–300	40.13
150 ≤ SPL<156	66,475–37,313	34.91	5,300–2,575	29.33	1,375–388	40.31	300–150	23.87
156 ≤ SPL<162	37,313–13,325	43.82	2,575–1,113	23.06	388–100	10.15	150–100	13.83
162 ≤ SPL<168	13,325–7,575	8.98	1,113–200	10.60	100–<50	1.13	100–<50	17.18
168 ≤ SPL<174	7,575–3,925	4.59	200–100	0.39	<50	0.00	<50	0.00
174 ≤ SPL<180	3,925–1,888	1.54	100–<50	0.12	<50	0.00	<50	0.00
180 ≤ SPL<186	1,888–400	0.48	<50	0.00	<50	0.00	<50	0.00

TABLE 22—NON-IMPULSIVE RANGES IN 6 DB BINS AND PERCENTAGE OF BEHAVIORAL HARASSMENT—Continued
[Low-frequency cetaceans]

Received level in 6-dB Bins	Sonar Bin MF1 (e.g., SQS–53; ASW Hull-mounted Sonar)		Sonar Bin MF4 (e.g., AQS–22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ–62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ–32; MIW Sonar)	
	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)
186 ≤ SPL<192	400–200	0.02	<50	0.00	<50	0.00	<50	0.00
192 ≤ SPL<198	200–100	0.00	<50	0.00	<50	0.00	<50	0.00

TABLE 23—NON-IMPULSIVE RANGES IN 6 DB BINS AND PERCENTAGE OF BEHAVIORAL HARASSMENT
[Mid-frequency cetaceans]

Received level in 6-dB Bins	Sonar Bin MF1 (e.g., SQS–53; ASW Hull-mounted Sonar)		Sonar Bin MF4 (e.g., AQS–22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ–62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ–32; MIW Sonar)	
	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)	Distance over which levels occur (m)	Percentage of behavioral harassments occurring at given levels (percent)
120 <= SPL < 126	179,525–147,875	0.00	61,433–48,325	0.00	20,638–16,350	0.00	4,388–4,050	0.00
126 <= SPL < 132	147,875–136,625	0.00	48,325–18,350	0.09	16,350–10,883	0.07	4,050–3,150	0.01
132 <= SPL < 138	136,625–115,575	0.12	18,350–16,338	0.18	10,883–7,600	1.68	3,150–2,163	0.38
138 <= SPL < 144	115,575–74,938	2.58	16,338–11,617	5.11	7,600–3,683	18.02	2,163–1,388	2.97
144 <= SPL < 150	74,938–66,525	2.92	11,617–5,425	30.08	3,683–1,738	31.66	1,388–1,013	7.15
150 <= SPL < 156	66,525–37,325	34.71	5,425–2,625	30.03	1,738–425	39.81	1,013–725	18.55
156 <= SPL < 162	37,325–13,850	43.02	2,625–1,125	23.44	425–150	6.94	725–250	53.79
162 <= SPL < 168	13,850–7,750	9.77	1,125–200	10.58	150–<50	1.82	250–150	9.62
168 <= SPL < 174	7,750–4,088	4.70	200–100	0.38	<50	0.00	150–100	4.40
174 <= SPL < 180	4,088–1,888	1.69	100–<50	0.11	<50	0.00	100–<50	3.13
180 <= SPL < 186	1,888–450	0.47	<50	0.00	<50	0.00	<50	0.00
186 <= SPL < 192	450–200	0.02	<50	0.00	<50	0.00	<50	0.00
192 <= SPL < 198	200–100	0.00	<50	0.00	<50	0.00	<50	0.00

ASW: anti-submarine warfare; MIW: mine warfare; m: meter; SPL: sound pressure level.

Although the Navy has been monitoring to discern the effects of sonar and other active acoustic sources on marine mammals since approximately 2006, and research on the effects of sonar and other active acoustic sources is advancing, our understanding of exactly how marine mammals in the Study Area will respond to sonar and other active acoustic sources is still limited. The Navy has submitted reports from more than 60 major exercises conducted in the HRC and SOCAL, and off the Atlantic Coast, that indicate no behavioral disturbance was observed. One cannot conclude from these results that marine mammals were not harassed from sonar and other active acoustic sources, as a portion of animals within the area of concern were not seen (especially those more cryptic, deep-diving species, such as beaked whales or *Kogia* spp.) and the full series of behaviors that would more accurately show an important change is not typically seen (i.e., only the surface behaviors are observed). Plus, some of the non-biologist lookouts might not be well-qualified to characterize behaviors. However, one can say that the animals that were observed did not respond in any of the obviously more severe ways, such as panic, aggression, or anti-predator response.

Diel Cycle

As noted previously, many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hr cycle). Behavioral reactions to noise exposure (when taking place in a biologically important context, such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007).

In the previous section, we discussed the fact that potential behavioral responses to sonar and other active acoustic sources that fall into the category of harassment could range in severity. By definition, for military readiness activities, takes by behavioral harassment involve the disturbance or likely disturbance of a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns (such as migration, surfacing, nursing, breeding, feeding, or sheltering) to a point where such behavioral patterns are abandoned or significantly altered. These reactions would, however, be more of a concern if they were expected to last over 24 hours or be repeated in subsequent days. However, vessels with hull-mounted active sonar are typically moving at speeds of 10–15 knots, which would make it unlikely that the same animal would remain in the immediate vicinity of the ship for the entire duration of the exercise. Animals may be exposed to sonar and other active acoustic sources for more than one day or on successive days. However, because neither the vessels nor the animals are stationary, significant long-term effects are not expected.

Most planned explosive exercises are of a short duration (1–6 hours). Although explosive exercises may sometimes be conducted in the same general areas repeatedly, because of their short duration and the fact that

they are in the open ocean and animals can easily move away, it is similarly unlikely that animals would be exposed for long, continuous amounts of time.

TTS

As mentioned previously, TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. The TTS sustained by an animal is primarily classified by three characteristics:

(1) Frequency—Available data (of mid-frequency hearing specialists exposed to mid- or high-frequency sounds; Southall *et al.,* 2007) suggest that most TTS occurs in the frequency range of the source up to one octave higher than the source (with the maximum TTS at ½ octave above). The more powerful MF sources used have center frequencies between 3.5 and 8 kHz and the other unidentified MF sources are, by definition, less than 10 kHz, which suggests that TTS induced by any of these MF sources would be in a frequency band somewhere between approximately 2 and 20 kHz. There are fewer hours of HF source use and the sounds would attenuate more quickly, plus they have lower source levels, but if an animal were to incur TTS from these sources, it would cover a higher frequency range (sources are between 10 and 100 kHz, which means that TTS could range up to 200 kHz; however, HF systems are typically used less frequently and for shorter time periods than surface ship and aircraft MF systems, so TTS from these sources is even less likely). TTS from explosives would be broadband. Vocalization data for each species was provided in the Navy's LOA application.

(2) Degree of the shift (i.e., how many dB is the sensitivity of the hearing reduced by)—Generally, both the degree of TTS and the duration of TTS will be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). The threshold for the onset of TTS was discussed previously in this document. An animal would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be difficult considering the lookouts and the nominal speed of an active sonar vessel (10–15 knots). In the TTS studies, some using exposures of almost an hour in duration or up to 217 SEL re 1 μPa^2sec, most of the TTS induced was 15 dB or less, though Finneran *et al.* (2007) induced 43 dB of TTS with a 64-sec exposure to a 20 kHz source. However, MFAS emits a 1-second ping 2 times/minute and incurring those levels of TTS is highly unlikely.

(3) Duration of TTS (recovery time)—In the TTS laboratory studies, some using exposures of almost an hour in duration or up to 217 SEL re 1 μPa^2sec, almost all individuals recovered within 1 day (or less, often in minutes), though in one study (Finneran *et al.,* 2007), recovery took 4 days.

Based on the range of degree and duration of TTS reportedly induced by exposures to non-pulse sounds of energy higher than that to which free-swimming marine mammals in the field are likely to be exposed during training exercises using sonar and other active acoustic sources in the Study Area, it is unlikely that marine mammals would ever sustain a TTS from MFAS that alters their sensitivity by more than 20 dB for more than a few days (and any incident of TTS would likely be far less severe due to the short duration of the majority of the exercises and the speed of a typical vessel), if that. Also, for the same reasons discussed in the Diel Cycle section, and because of the short distance within which animals would need to approach the sound source, it is unlikely that animals would be exposed to the levels necessary to induce TTS in subsequent time periods such that their recovery is impeded. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from MFAS (the source from which TTS would most likely be sustained because the higher source level make it more likely that an animal would be exposed to a higher received level) would not usually span the entire frequency range of one vocalization type, much less span all types of vocalizations. If impaired, marine mammals would implement behaviors to compensate (see Acoustic Masking or Communication Impairment Section), though these compensations may incur energetic costs.

Acoustic Masking or Communication Impairment

Masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which continues beyond the duration of the signal. Standard MFAS nominally pings every 50 seconds for hull-mounted sources. For the sources for which we know the pulse length, most are significantly shorter than hull-mounted active sonar, on the order of several microseconds to tens of microseconds. For hull-mounted active sonar, though some of the vocalizations that marine mammals make are less than one second long, there is only a 1 in 50 chance that they would occur exactly when the ping was received, and when vocalizations are longer than one second, only parts of them are masked. Alternately, when the pulses are only several microseconds long, the majority of most animals' vocalizations would not be masked. Masking effects from sonar and other active acoustic sources are expected to be minimal. If masking or communication impairment were to occur briefly, it would be in the frequency range of MFAS, which overlaps with some marine mammal vocalizations; however, it would likely not mask the entirety of any particular vocalization or communication series because the signal length, frequency, and duty cycle of the sonar signal does not perfectly mimic the characteristics of any marine mammal's vocalizations.

PTS, Injury, or Mortality

NMFS believes that many marine mammals would deliberately avoid exposing themselves to the received levels of sound necessary to induce injury by moving away from or at least modifying their path to avoid a close approach. Additionally, in the unlikely event that an animal approaches the sound source at a close distance, NMFS believes that the mitigation measures (i.e., shutdown/powerdown zones for sonar and other active acoustic sources) would typically ensure that animals would not be exposed to injurious levels of sound. As discussed previously, the Navy utilizes both aerial (when available) and passive acoustic monitoring (during all ASW exercises) in addition to Lookouts on vessels to detect marine mammals for mitigation implementation.

If a marine mammal is able to approach a surface vessel within the distance necessary to incur PTS, the likely speed of the vessel (nominal 10–15 knots) would make it very difficult for the animal to remain in range long enough to accumulate enough energy to result in more than a mild case of PTS. As mentioned previously and in relation to TTS, the likely consequences to the health of an individual that incurs PTS can range from mild to more serious dependent upon the degree of PTS and the frequency band it is in, and many animals are able to compensate for the shift, although it may include energetic costs.

Recovery from a threshold shift (i.e., partial hearing loss) can take a few minutes to a few days, depending on the severity of the initial shift. PTS would not fully recover. Threshold shifts do

not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. It is uncertain whether some permanent hearing loss over a part of a marine mammal's hearing range would have long-term consequences for that individual, although many mammals lose hearing ability as they age. Mitigation measures would further reduce the predicted impacts. Long-term consequences to populations would not be expected.

As discussed previously, marine mammals (especially beaked whales) could potentially respond to MFAS at a received level lower than the injury threshold in a manner that indirectly results in the animals stranding. The exact mechanisms of this potential response, behavioral or physiological, are not known. When naval exercises have been associated with strandings in the past, it has typically been when three or more vessels are operating simultaneously, in the presence of a strong surface duct, and in areas of constricted channels, semi-enclosed areas, and/or steep bathymetry. Based on the number of occurrences where strandings have been definitively associated with military active sonar versus the number of hours of active sonar training that have been conducted, we suggest that the probability is small that this will occur. Lastly, an active sonar shutdown protocol for strandings involving live animals milling in the water minimizes the chances that these types of events turn into mortalities.

Onset mortality and onset slight lung injury criteria use conservative thresholds to predict the onset of effect as discussed section "Take Criteria." The thresholds are based upon newborn calf masses, and therefore these effects are over-estimated by the acoustic model assuming most animals within the population are larger than a newborn calf. The threshold for onset mortality and onset slight lung injury is the impulse at which one percent of animals exposed would be expected to actually be injured or killed, with the likelihood of the effect increasing with proximity to the explosion. Considering these factors, these impacts would rarely be expected to actually occur. Nevertheless, it is possible for marine mammals to be injured or killed by an explosion. Small odontocetes are the marine mammal group most likely to be injured or killed by explosives (although mitigation measures are in place to prevent this, and only 3 deaths have been documented from explosives and these occurred prior to a modification in mitigation to improve protection during the use of time-delay firing devices). Most odontocete species have populations in the tens of thousands, so that even if a few individuals in the population were removed, long-term consequences for the population would not be expected.

While NMFS does not expect any mortalities from impulsive sources to occur, we propose to authorize takes by mortality of a limited number of small odontocetes from training and testing activities. Based on previous vessel strikes in the Study Area, NMFS also proposes to authorize takes by mortality of a limited number of marine mammals from vessel strikes. As described previously, although we have a good sense of how many marine mammals the Navy may strike over the course of five years (and it is much smaller than 10 large marine mammals and one large marine mammal as a result of training and testing, respectively), the species distribution is unpredicatable. Thus, we have analyzed the possibility that all the large whale takes requested in one year may be of the same species. However, if this happened to any given species in a given year—the number of takes authorized of that same species over the other 4 years of the rule is highly limited (for example, no more than the following number of ESA-listed marine mammals in any given year: three humpback whales, two fin whales, one sei whale, one blue whale, and one sperm whale from training activities). Over the last five years on the east coast, the Navy was involved in two ship strikes, with no confirmed marine mammal deaths as a result. The number of mortalities from vessel strikes are not expected to be an increase over the past decade, but are being addressed under this proposed incidental take authorization for the first time.

Species Specific Analysis

In the discussions below, the "acoustic analysis" refers to the Navy's model results and post-model analysis. The Navy performed a quantitative analysis to estimate the number of marine mammals that could be harassed by acoustic sources or explosives used during Navy training and testing activities. Inputs to the quantitative analysis included marine mammal density estimates; marine mammal depth occurrence distributions; oceanographic and environmental data; marine mammal hearing data; and criteria and thresholds for levels of potential effects. Marine mammal densities used in the model may overestimate actual densities when species data is limited and for species with seasonal migrations (e.g., North Atlantic right whales, humpbacks, blue whales, fin whales, sei whales). The quantitative analysis consists of computer modeled estimates and a post-model analysis to determine the number of potential mortalities and harassments. The model calculates sound energy propagation from sonars, other active acoustic sources, and explosives during naval activities; the sound or impulse received by animat dosimeters representing marine mammals distributed in the area around the modeled activity; and whether the sound or impulse received by a marine mammal exceeds the thresholds for effects. The model estimates are then further analyzed to consider animal avoidance and implementation of mitigation measures, resulting in final estimates of effects due to Navy training and testing. It is important to note that the Navy's take estimates represent the total number of takes and not the number of individuals taken, as a single individual may be taken multiple times over the course of a year.

Although this more complex computer modeling approach accounts for various environmental factors affecting acoustic propagation, the current software tools do not consider the likelihood that a marine mammal would attempt to avoid repeated exposures to a sound or avoid an area of intense activity where a training or testing event may be focused. Additionally, the software tools do not consider the implementation of mitigation (e.g., stopping sonar transmissions when a marine mammal is within a certain distance of a ship or range clearance prior to detonations). In both of these situations, naval activities are modeled as though an activity would occur regardless of proximity to marine mammals and without any horizontal movement by the animal away from the sound source or human activities (e.g., without accounting for likely animal avoidance). The initial model results overestimate the number of takes (as described previously), primarily by behavioral disturbance. The final step of the quantitative analysis of acoustic effects is to consider the implementation of mitigation and the possibility that marine mammals would avoid continued or repeated sound exposures. NMFS provided input to the Navy on this process and the Navy's qualitative analysis is described in detail in Chapter 6 of their LOA application (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*).

North Atlantic Right Whale

North Atlantic right whales may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. Exposures may occur in feeding grounds off the New England coast, on migration routes along the east coast, and on calving grounds in the southeast off the coast of Florida and Georgia; however, mitigation areas would be established in these areas with specific measures to further reduce impacts to North Atlantic right whales. Acoustic modeling predicts that North Atlantic right whales could be exposed to sound that may result in 60 TTS and 51 behavioral reactions per year from annually recurring training activities. The majority of these impacts are predicted within the JAX Range Complex where animals spend winter months calving. Annually recurring testing activities could expose North Atlantic right whales to sound that may result in 11 TTS and 66 behavioral reactions per year. These impacts are predicted in Rhode Island inland waters and within the Northeast Range Complexes. North Atlantic right whales may be exposed to sound or energy from explosions associated with training activities throughout the year. The acoustic analysis predicts one TTS exposure to a North Atlantic right whale annually from recurring training activities, but no impacts on North Atlantic right whales due to annually recurring testing activities or ship shock trials. Testing activities that use explosives would not occur in the North Atlantic right whale mitigation areas, although the sound and energy from explosions associated with testing activities may be detectable within the mitigation areas.

The Navy and NMFS do not anticipate that a North Atlantic right whale would be struck by a vessel during training or testing activities because of the extensive measures in place to reduce the risk of a vessel strike to the species. For example, the Navy would receive information about recent North Atlantic right whale sightings before transiting through or conducting training or testing activities in the mitigation areas. During transits, vessels would exercise extreme caution and proceed at the slowest speed that is consistent with safety, mission, training, and operations. In the southeast North Atlantic right whale mitigation area, vessels will reduce speed when the observe a North Atlantic right whale, when they are within 5 nm (9 km) of a sighting reported in the past 12 hours, or when operating at night or during periods of poor visibility. The Navy would also minimize to the maximum extent practicable north-south transits through the southeast North Atlantic right whale mitigation area. Similar measures to reduce the risk of ship strikes would be implemented in the northeast and mid-Atlantic mitigation areas.

Due to the importance of North Atlantic right whale critical habitat for feeding and reproductive activities, takes that occur in those areas may have more severe effects than takes that occur while whales are just transiting and not involved in feeding or reproductive behaviors. To address these potentially more severe effects, NMFS and the Navy have included mitigation measures to minimize impacts (both number and severity) in both the northeast and southeast designated right whale critical habitat as well as the migratory corridor which connects them. Additional mitigation measures pertaining to training and testing activities within the mitigation areas are described below.

In the southeast North Atlantic right whale mitigation area, no training activities using sonar or other active acoustic sources would occur with the exception of object detection/navigational sonar training and maintenance activities for surface ships and submarines while entering/exiting Mayport, Florida. Training activities involving helicopter dipping sonar would occur off of Mayport, Florida within the right whale mitigation area; however, the majority of active sonar activities would occur outside the southeast mitigation area. In the northeast North Atlantic right whale mitigation area, hull-mounted sonar would not be used. However, a limited number of torpedo exercises would be conducted in August and September when many North Atlantic right whales have migrated south out of the area. Of course, North Atlantic right whales can be found outside of designated mitigation areas and sound from nearby activities may be detectable within the mitigation areas. Acoustic modeling predictions consider these potential circumstances.

Training activities that use explosives, with the exception of training with explosive sonobuoys, are not conducted in the southeast North Atlantic right whale mitigation area. Training activities that use explosives would not occur in the northeast North Atlantic right whale mitigation area. Although, the sound and energy from explosions associated with training activities may be detectable within the mitigation areas.

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. Review of the photo-identification recapture database in July 2010 indicated that 396 individually recognized whales in the catalogue were known to be alive in 2007. This value is a minimum and does not include animals alive prior to 2007, but not recorded in the individual sightings database as seen during December 1, 2004 to July 6, 2010 (note that matching of photos taken during 2008–2010 was not complete at the time the data were received). It also does not include some calves known to be born during 2007, or any other individual whales seen during 2007, but not yet entered into the catalogue. In addition, this estimate has no associated coefficient of variation.

Acoustic analysis indicates that no North Atlantic right whales will be exposed to sound levels likely to result in Level A harassment. In addition, modeling predicts no potential for serious injury or mortality to North Atlantic right whales. Moreover, NMFS believes that Navy Lookouts would detect right whales and implement the appropriate mitigation measure before an animal could approach to within a distance necessary to result in injury. Any takes that do occur would likely be short term and at a lower received level and would likely not affect annual rates of recruitment or survival.

Humpback Whale

The acoustic analysis predicts that humpback whales could be exposed to sound associated with training activities that may result in 1 PTS, 1,128 TTS and 514 behavioral reactions per year. The majority of these impacts are predicted in the JAX, Navy Cherry Point, VACAPES, and Northeast Range Complexes. Further, the analysis predicts that humpback whales could be exposed to sound associated with testing activities that may result in 94 TTS and 100 behavioral reactions per year as a result of annually recurring testing activities. Humpback whales may be exposed to sound or energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that humpback whales could be exposed to sound or energy from explosions that may result in 1 TTS per year as a result of annually recurring training activities and 1 TTS to a humpback whale due to ship shock trials over a 5-year period. All predicted impacts would be to the Gulf of Maine stock because this is the only humpback whale stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or

other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even from a single individual, are unlikely to produce long-term consequences for that individual or the population. Furthermore, the implementation of mitigation measures and sightability of humpback whales (due to their large size) would further reduce the potential impacts.

Mysticetes exposed to the sound from explosions may react in a number of ways which may include alerting; startling; breaking off feeding dives and surfacing; diving or swimming away; or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations. Furthermore, the implementation of mitigation measures and sightability of humpback whales (due to their large size) would further reduce the potential impacts in addition to reducing the potential for injury.

The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year as a result of training activities, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than three humpback whales would be struck over a 5-year period based on the percentages that those species have been involved in vessel collisions. The Navy provided a detailed analysis of strike data in section 6.1.9 of its LOA application. Marine mammal mortalities were not previously analyzed by NMFS in the 2009 rulemakings for AFAST and the east coast range complexes. However, between 1995 and 2012, there have been 19 Navy vessel strikes in the Study Area. Eight of the strikes resulted in a confirmed death, but in 11 of the 19 strikes the fate of the animal was undetermined. The mortalities from vessel strike are not expected to be an increase over the past decade, but rather NMFS proposes to authorize these takes for the first time in the AFTT Study Area.

Of the 19 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the Navy estimates it could potentially take one marine mammal by injury or mortality over the course of the 5-year AFTT regulations. A number of the reported whale strikes were unidentified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species.

Important feeding areas for humpbacks are located in the Northeast. Stellwagen Bank National Marine Sanctuary contains some of this important area and the Navy does not plan to conduct any activities within Stellwagen Bank. The Navy has designated several planning awareness areas (PAAs) based on locations of high productivity that have been correlated with high concentrations of marine mammals, including important feeding areas in the Northeast, and would avoid conducting major training exercises involving active sonar in PAAs.

Sei Whale

The acoustic analysis predicts that sei whales could be exposed to sound associated with training activities that may result in 1 PTS, 6,604 TTS, and 3,582 behavioral reactions per year from annually recurring training activities. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent predicted in the GOMEX and Northeast Range Complexes and in areas outside of OPAREAS and range complexes. Sei whales could be exposed to sound associated with testing activities that may result in 439 TTS and 316 behavioral reactions per year as a result of annually recurring testing activities. Sei whales may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that one sei whale could be exposed annually to sound from explosions associated with training activities that may cause TTS and one sei whale could exhibit a behavioral reaction. Annually recurring testing activities involving explosives may result in 1 TTS for a sei whale per year and 7 TTS due to exposure to explosive sound and energy from ship shock trials over a 5-year period. All predicted impacts would be to the Nova Scotia stock because this is the only sei whale stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even from a single individual, are unlikely to produce long-term consequences for that individual or the population. Furthermore, the implementation of mitigation measures and sightability of sei whales (due to their large size) would further reduce the potential impacts.

Mysticetes exposed to the sound from explosions may react in a number of ways, which may include alerting; startling; breaking off feeding dives and surfacing; diving or swimming away; or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations. Furthermore, the implementation of mitigation measures and sightability of sei whales (due to their large size) would further reduce the potential impacts in addition to reducing the potential for injury.

The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year as a result of training activities, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than one sei whale would be struck over a 5-year period based on the percentages that those species have been involved in vessel collisions.

Of the 19 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the

Navy estimates it could potentially take one marine mammal by injury or mortality over the course of the 5-year AFTT regulations. A number of the reported whale strikes were unidentified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species.

No areas of specific importance for reproduction or feeding for sei whales have been identified in the AFTT Study Area. Sei whales in the North Atlantic belong to three stocks: Nova Scotia; Iceland-Denmark Strait; and Northeast Atlantic. The Nova Scotia stock occurs in the U.S. Atlantic waters. The best available abundance estimate for the Nova Scotia stock is 386 individuals.

Fin Whale

The acoustic analysis predicts that fin whales could be exposed to sound associated with training activities that may result in 1 PTS, 2,880 TTS and 1,608 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of impacts predicted in the GOMEX and Northeast Range Complexes. Fin whales could be exposed to sound associated with testing activities that may result in 263 TTS and 282 behavioral reactions per year as a result of annually recurring testing activities. The majority of these impacts are predicted within the Northeast Range Complexes with lesser impacts in the VACAPES, Navy Cherry Point, JAX, and GOMEX Range Complexes. Fin whales may be exposed to sound or energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts one TTS and one behavioral response for fin whales annually from training activities, 1 TTS to fin whales per year from annually recurring testing activities, and 6 TTS per 5-year period due to ship shock trials. All predicted impacts would be to the Western North Atlantic stock because this is the only fin whale stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even from a single individual, are unlikely to produce long-term consequences for that individual or the population. Furthermore, the implementation of mitigation measures and sightability of fin whales (due to their large size) would further reduce the potential impacts.

Mysticetes exposed to the sound from explosions may react in a number of ways, which may include alerting; startling; breaking off feeding dives and surfacing; diving or swimming away; or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations. Furthermore, the implementation of mitigation measures and sightability of fin whales (due to their large size) would further reduce the potential impacts in addition to reducing the potential for injury.

The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year as a result of training activities, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than two fin whales would be struck over a 5-year period based on the percentages that those species have been involved in vessel collisions.

Of the 19 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the Navy estimates it could potentially take one marine mammal by injury or mortality over the course of the 5-year AFTT regulations. A number of the reported whale strikes were unidentified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species.

New England waters are considered a major feeding ground for fin whales, and there is evidence the females continually return to this area (Waring *et al.,* 2010). The Navy has designated PAAs in the Northeast that include some of these important feeding areas and would avoid conducting major training exercises involving active sonar in PAAs. Fin whales in the North Atlantic belong to the western North Atlantic stock. The best abundance estimate for the western North Atlantic stock of fin whales is 3,985.

Blue Whale

Blue whales may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. The acoustic analysis predicts that blue whales could be exposed to sound associated with training activities that may result in 97 TTS and 50 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of impacts predicted in the GOMEX and Northeast Range Complexes. The acoustic analysis predicts that 10 TTS and 6 behavioral reactions may result from annual testing activities that use sonar and other active acoustic sources per year as a result of annually recurring testing activities. Blue whales may be exposed to sound or energy from explosions associated with training and testing activities throughout the year; however, the acoustic analysis predicts that no individuals would be impacted. All predicted impacts would be to the Western North Atlantic stock because this is the only blue whale stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even from a single individual, are unlikely to produce long-term consequences for that individual or the population. Furthermore, the implementation of mitigation measures and sightability of blue whales (due to their large size) would further reduce the potential impacts.

Mysticetes exposed to the sound from explosions may react in a number of ways, which may include alerting; startling; breaking off feeding dives and surfacing; diving or swimming away; or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations. Furthermore, the implementation of mitigation measures and sightability of blue whales (due to their large size) would further reduce the potential impacts in addition to reducing the potential for injury.

The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year as a result of training activities, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than one blue whale would be struck over a 5-year period based on the percentages that those species have been involved in vessel collisions.

Of the 19 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the Navy estimates it could potentially take one marine mammal by injury or mortality over the course of the 5-year AFTT regulations. A number of the reported whale strikes were unidentified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species.

No areas of specific importance for reproduction or feeding for blue whales have been identified in the AFTT Study Area. Blue whales in the western North Atlantic are classified as a single stock. The photo identification catalogue count of 440 recognizable individuals from the Gulf of St. Lawrence is considered a minimum population estimate for the western North Atlantic stock.

Minke Whale

The acoustic analysis predicts that minke whales could be exposed to sound associated with training activites that may result in 10 PTS, 40,866 TTS, and 19,497 behavioral reactions per year. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of effects predicted in the Northeast and GOMEX Range Complexes. The acoustic analysis predicts that minke whales could be exposed to sound that may result in 1 PTS, 3,571 TTS, and 3,100 behavioral reactions per year as a result of annually recurring testing activities. Minke whales may be exposed to sound or energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that minke whales could be exposed to sound annually from training activities that may result in 9 behavioral responses, 30 TTS, 4 PTS, 1 GI tract injury, and 1 slight lung injury (see Table 6–26 for predicted numbers of effects). As with mysticetes overall, effects are primarily predicted within the VACAPES Range Complex, followed by JAX, and Navy Cherry Point Range Complexes. Minke whales could be exposed to sound and energy from annual testing activities involving explosives that may result in 4 behavioral responses, 11 TTS, and 2 PTS, in addition to 41 TTS, 11 slight lung injury, and 3 mortalities due to exposure to explosive sound and energy from ship shock trials over a 5-year period. Based on conservativeness of the onset mortality criteria and impulse modeling and past observations of no marine mammal mortalities associated with ship shock trials, the predicted minke whale mortalities for CVN Ship Shock Trial are considered overestimates and highly unlikely to occur. All predicted effects on minke whales would be to the Canadian East Coast stock because this is the only stock present within the Study Area.

Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. A few behavioral reactions per year, even from a single individual, are unlikely to produce long-term consequences for that individual or the population. Furthermore, the implementation of mitigation measures and sightability of minke whales (due to their large size) would further reduce the potential impacts.

Mysticetes exposed to the sound from explosions may react in a number of ways, which may include alerting; startling; breaking off feeding dives and surfacing; diving or swimming away; or showing no response at all. Occasional behavioral reactions to intermittent explosions are unlikely to cause long-term consequences for individual mysticetes or populations. Furthermore, the implementation of mitigation measures and sightability of minke whales (due to their large size) would further reduce the potential impacts in addition to reducing the potential for injury.

Bryde's Whale

The acoustic analysis predicts that Bryde's whales could be exposed to sound associated with training activities that may result in 629 TTS and 326 behavioral reactions. The majority of these impacts are predicted in the VACAPES, Navy Cherry Point, and JAX Range Complexes, with a relatively small percent of effects predicted in the Northeast Range Complex. Bryde's whales could be exposed to sound that may result in 39 TTS and 21 behavioral reactions per year as a result of annually recurring testing activities. Bryde's whales may be exposed to sound or energy from explosions associated with training and testing activities throughout the year; however, the acoustic analysis predicts that no individuals would be impacted. All predicted effects on Bryde's whales would be to the Gulf of Mexico Oceanic stock because this is the only stock present within the Study Area.

Sperm Whale

Sperm whales may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. The acoustic analysis predicts that sperm whales could be exposed to sound associated with training activities that may result in 435 TTS and 14,311 behavioral reactions annually from annually recurring training activities; and a maximum of one behavioral reactions from each biennial training activity civilian port defense. Sperm whales could be exposed to sound from annually recurring testing activities that may result in 584 TTS and 1,101 behavioral reactions per year. Sperm whales may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts one TTS and one behavioral response for sperm whales

per year from explosions associated with training activities, one sperm whale behavioral response for per year due to annually recurring testing activities, and up to 20 TTS, 6 slight lung injuries, and 2 mortalities for sperm whales over a 5-year period as a result of ship shock trials in the VACAPES or JAX Range Complex. Based on conservativeness of the onset mortality criteria and impulse modeling and past observations of no marine mammal mortalities associated with ship shock trials, the predicted sperm whale mortalities for CVN ship shock trial are considered overestimates and highly unlikely to occur. Predicted effects on sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico Oceanic stock, whereas the majority of impacts predicted offshore of the east coast would impact the North Atlantic stock.

Research and observations show that if sperm whales are exposed to sonar or other active acoustic sources they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Sperm whales have shown resilience to acoustic and human disturbance, although they may react to sound sources and activities within a few kilometers. Sperm whales that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, avoid the area by swimming away or diving, or display aggressive behavior. Some (but not all) sperm whale vocalizations might overlap with the MFAS/HFAS TTS frequency range, which could potentially temporarily decrease an animal's sensitivity to the calls of conspecifics or returning echolocation signals. However, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to sonar and other active acoustic sources. The majority of Level B takes are expected to be in the form of mild responses. The implementation of mitigation measures and the large size of sperm whales (i.e., increased sightability) are expected to prevent any significant behavioral reactions. Therefore, long-term consequences for individuals or populations would not be expected.

The Navy estimates it may strike and take, by injury or mortality, an average of two marine mammals per year as a result of training activities, with a maximum of three in any given year. Of the ESA-listed species in the Study Area, the Navy anticipates no more than one sperm whale would be struck over a 5-year period based on the percentages that those species have been involved in vessel collisions.

Of the 19 reported Navy vessel strikes since 1995, only one strike was attributed to a testing event in 2001. Therefore, for testing events that will not occur on a training platform, the Navy estimates it could potentially take one marine mammal by injury or mortality over the course of the 5-year AFTT regulations. A number of the reported whale strikes were unidentified to species; therefore, the Navy cannot quantifiably predict that the proposed takes will be of any particular species.

The region of the Mississippi River Delta (Desoto Canyon) has been recognized for high densities of sperm whales and may represent an important calving and nursing or feeding area for these animals. Sperm whales typically exhibit a strong affinity for deep waters beyond the continental shelf, though in the area of the Mississippi Delta they also occur on the outer continental shelf break. However, there is a PAA designated immediately seaward of the continental shelf associated with the Mississippi Delta, in which the Navy plans to conduct no more than one major exercise and which they plan to take into consideration in the planning of unit-level exercises. Therefore, NMFS does not expect that impacts will be focuses, extensive, or severe in the sperm whale calving area.

Sperm whales within the Study Area belong to one of three stocks: North Atlantic; Gulf of Mexico Oceanic; or Puerto Rico and U.S. Virgin Islands. The best abundance estimate for sperm whales in the western North Atlantic is 4,804. The best abundance estimate for sperm whales in the northern Gulf of Mexico is 1,665.

Pygmy and Dwarf Sperm Whales

Pygmy and dwarf sperm whales may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. The acoustic analysis predicts that pygmy and dwarf sperm whales could be exposed to sound that may result in 13 PTS, 4,914 TTS, and 169 behavioral reactions from annually recurring training activities; and a maximum of 1 TTS from the biennial training activity civilian port defense. The majority of predicted impacts on these species are within the JAX and GOMEX Range Complexes. Pygmy and dwarf sperm whales could be exposed to sound that may result in 5 PTS, 1,061 TTS and 29 behavioral reactions per year from annually recurring activities. Pygmy and dwarf sperm whales may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that pygmy and dwarf sperm whales could be exposed to sound from annual training activities involving explosions that may result in 1 behavioral response, 5 TTS, and 2 PTS (see Table 6–26 in the LOA application for predicted numbers of effects). The majority of these exposures occur within the VACAPES and GOMEX Range Complexes. Pygmy or dwarf sperm whales could be exposed to energy or sound from underwater explosions that may result in 1 behavioral response, 2 TTS, and 1 PTS per year as a result of annually recurring testing activities. These impacts could happen anywhere throughout the Study Area where testing activities involving explosives occur. Additionally, the acoustic analysis predicts 6 TTS, 1 PTS, and 3 slight lung injury to a *Kogia* species over a 5-year period due to ship shock trials either in the VACAPES or JAX Range Complex. Predicted effects on pygmy and dwarf sperm whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks.

Research and observations on *Kogia* species are limited. However, these species tend to avoid human activity and presumably anthropogenic sounds. Pygmy and dwarf sperm whales may startle and leave the immediate area of the anti-submarine warfare training exercise. Significant behavioral reactions seem more likely than with most other odontocetes, however it is unlikely that animals would receive multiple exposures over a short time period allowing animals time to recover lost resources (e.g., food) or opportunities (e.g., mating). Therefore, long-term consequences for individual *Kogia* or their respective populations are not expected.

No areas of specific importance for reproduction or feeding for *Kogia* species have been identified in the AFTT Study Area. *Kogia* species are separated into two stocks within the Study Area: The Western North Atlantic and Gulf of Mexico Oceanic. The best estimate for both species in the U.S. Atlantic is 395 individuals. The best estimate for both species in the northern Gulf of Mexico is 453.

Beaked Whales

Beaked whales (six species total) may be exposed to sonar or other active acoustic stressors associated with training and testing activities

throughout the year. The acoustic analysis predicts that beaked whales could be exposed to sound that may result in 781 TTS and 135,573 behavioral reactions per year from annually recurring training activities; and a maximum of 8 behavioral reactions from each biennial training activity civilian port defense. Beaked whales could be exposed to sound that may result in 592 TTS and 32,695 behavioral reactions per year from annually recurring testing activities. The majority of these impacts happen within the Northeast Range Complexes, with lesser effects in the VACAPES, Navy Cherry Point, JAX, Key West and GOMEX Range Complexes. Beaked whales may be exposed to sound and energy from explosions associated with training and testing activities throughout the year; however, acoustic modeling predicts that no beaked whales would be impacted from annually recurring training and testing activities. The acoustic analysis predicts 7 TTS and 15 slight lung injuries to beaked whale species over a 5-year period due to ship shock trials. Predicted effects on beaked whales within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks.

The Navy designated several planning awareness areas based on locations of high productivity that have been correlated with high concentrations of marine mammals and areas with steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales. For activities involving active sonar, the Navy would avoid planning major exercises in the planning awareness areas where feasible. In addition, to the extent operationally feasible, the Navy would not conduct more than one of the four major training exercises or similar scale events per year in the Gulf of Mexico planning awareness area. The best abundance estimate for the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* species) in the northwest Atlantic is 3,513. The best abundance estimate available for Cuvier's beaked whales in the northern Gulf of Mexico is 65. The best abundance estimate available for Mesoplodon species is a combined estimate for Blainville's beaked whale and Gervais' beaked whale in the oceanic waters of the Gulf of Mexico is 57. The current abundance estimate for the northern bottlenose whale in the eastern North Atlantic is 40,000, but population estimates for this species along the eastern U.S. coast are unknown.

Research and observations show that if beaked whales are exposed to sonar or other active acoustic sources they may startle, break off feeding dives, and avoid the area of the sound source to levels of 157 dB (McCarthy *et al.,* 2011). However, in research done at the Navy's instrumented tracking range in the Bahamas, animals leave the immediate area of the anti-submarine warfare training exercise, but return within a few days after the event ends. At the Bahamas range, populations of beaked whales appear to be stable. The analysis also indicates that no exposures to sound levels likely to result in Level A harassment would occur. However, while the Navy's model did not quantitatively predict any mortalities of beaked whales, the Navy requests a limited number of takes by mortality given the sensitivities these species may have to anthropogenic activities. Almost 40 years of conducting similar exercises in the AFTT Study Area without observed incident indicates that injury or motality are not expected to occur as a result of Navy activities.

Some beaked whale vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz), which could potentially temporarily decrease an animal's sensitivity to the calls of conspecifics or returning echolocation signals. However, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to sonar and other active acoustic sources. No beaked whales are predicted to be exposed to sound levels associated with PTS or injury.

As discussed previously, scientific uncertainty exists regarding the potential contributing causes of beaked whale strandings and the exact behavioral or physiological mechanisms that can potentially lead to the ultimate physical effects (stranding and/or death) that have been documented in a few cases. Although NMFS does not expect injury or mortality of any of these species to occur as a result of the training exercises involving the use of sonar and other active acoustic sources, there remains the potential for the operation of sonar and other active acoustic sources to contribute to the mortality of beaked whales. Consequently, NMFS proposes to authorize mortality and we consider the 10 potential mortalities from across the seven species potentially effected over the course of 5 years in our negligible impact determination (NMFS only intends to authorize a total of 10 beaked whale mortality takes, but since they could be of any of the species, we consider the effects of 10 mortalities of any of the six species).

Dolphins and Small Whales

Delphinids (dolphins and small whales) may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. The acoustic analysis predicts that annually recurring training activities could expose 17 species of delphinids (Atlantic spotted dolphin, Atlantic white-sided dolphin, bottlenose dolphin, clymene dolphin, common dolphin, false killer whale, Fraser's dolphin, killer whale, melon-headed whale, pantropical spotted dolphin, pilot whale, pygmy killer whale, Risso's dolphin, rough-toothed dolphin, spinner dolphin, striped dolphin, and white-beaked dolphin) to sound that may result in 132,026 TTS and 1,542,713 behavioral reactions per year; and a maximum of 7 TTS and 592 behavioral reactions from each biennial training activity civilian port defense. The high take numbers are due in part to an increase in expended materials. However, many of these species generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. In addition, the majority of takes are anticipated to be by behavioral harassment in the form of mild responses. Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving. Annually recurring testing activities involving sonar and other active acoustic sources could expose delphinids to sound that may result in 63,784 TTS and 113,169 behavioral reactions per year. Delphinids may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that delphinids could be exposed to sound that may result in mortality, injury, temporary hearing loss and behavioral responses (see Table 6–26 in the LOA application for predicted numbers of effects). A total of 15 mortalities, 41 slight lung injuries, and 1 gastrointestinal tract injury, 13 PTS, 174 TTS, 91 behavioral responses are predicted per year for delphinids from explosions associated with training activities. The acoustic analysis of annually recurring testing activities predicts that delphinids could be exposed to sound that may result in 10 mortalities, 39 slight lung injuries, 1 PTS, 124 TTS, and 53 behavioral responses per year (see Table 6–27 in

the LOA application for predicted numbers of effects). These predicted impacts would occur primarily in the VACAPES Range Complex, as well as the Naval Surface Warfare Center, Panama City Division Testing Range, but a few impacts could occur throughout the Study Area. While the Navy does not anticipate delphinid mortalities from underwater detonations during mine neutralization activities involving time-delay diver placed charges, there is a possibility of a marine mammal approaching too close to an underwater detonation when there is insufficient time to delay or stop without jeopardizing human safety. During ship shock trials, the acoustic analysis predicts that delphinids could be exposed to sound that may result in 5,386 TTS, 7,743 slight lung injuries, and 527 mortalities over a 5-year period, which would take place in either the VACAPES or JAX Range Complex (Tables 6–25 and 6–26 in the LOA application). Based on conservativeness of the onset mortality criteria and impulse modeling, past observations of no marine mammal mortalities associated with ship shock trials, and implementation of mitigation, the mortality results predicted by the acoustic analysis are over-estimated are not expected to occur. Therefore, the Navy conservatively estimates that 10 small odontocetes mortalities could occur during the CVN Ship Shock Trial and 5 small odontocetes mortalities could occur due to each DDG or LCS Ship Shock Trial. The majority of these exposures would occur within the VACAPES and GOMEX Range Complexes. Bottlenose dolphins may be exposed to sound and energy from pile driving associated with training activities throughout the year. The acoustic analysis predicts that bottlenose dolphins could be exposed to sound that may result in up to 747 behavioral responses per year. These exposures occur within the VACAPES and Cherry Point Range Complexes. Most delphinid species are separated into two stocks within the Study Area: The Western North Atlantic and Gulf of Mexico. Predicted effects on delphinids within the Gulf of Mexico are presumed to primarily impact the Gulf of Mexico stocks, whereas the majority of effects predicted offshore of the east coast would impact the Western North Atlantic stocks. Bottlenose dolphins are divided into one Oceanic and many Coastal stocks along the east coast. The majority of exposures to bottlenose dolphins are likely to the Oceanic stock with the exception of nearshore and inport events that could expose animals in Coastal stocks.

Table 9 provides the abundance estimates for the different dolphin stocks. No areas of specific importance for reproduction or feeding for dolphins have been identified in the AFTT Study Area.

Harbor Porpoises

Harbor porpoises may be exposed to sonar or other active acoustic stressors associated with training and testing activities throughout the year. The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 62 PTS, 20,161 TTS, and 120,895 behavioral reactions from annually recurring training activities; and a maximum of 432 TTS and 725 behavioral reactions from the biennial training activity civilian port defense. Annual testing activities could expose harbor porpoises to level of sonar and other active acoustic source sound resulting in 99 PTS, 78,250 TTS, and 1,964,774 behavioral responses per year. The high take numbers are due in part to an increase in expended materials. In addition, the majority of takes are anticipated to be by behavioral harassment in the form of mild responses. Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving. Predicted impacts on these species are within the VACAPES and Northeast Range Complexes primarily within inland waters and along the Northeast U.S. Continental Shelf Large Marine Ecosystem. The behavioral response function is not used to estimate behavioral responses by harbor porpoises; rather, a single threshold is used. Because of this very low behavioral threshold (120 dB re 1 µPa) for harbor porpoises, animals at distances exceeding 200 km in some cases are predicted to have a behavioral reaction in this acoustic analysis. Although this species is known to be more sensitive to these sources at lower received levels, it is not known whether animals would actually react to sound sources at these ranges, regardless of the received sound level. Harbor porpoises may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 94 behavioral responses, 497 TTS, 177 PTS, 1 gastrointestinal tract injury, 21 slight lung injuries, and 2 mortalities annually; and 7 TTS and 1 PTS biannually for civilian port defense activities (see Table 6–26 and Table 6–28 in the LOA application for predicted numbers of effects). The acoustic analysis predicts that harbor porpoises could be exposed to sound that may result in 484 behavioral responses, 348 TTS, 110 PTS, 7 slight lung injuries, and 1 mortality per year due to annually recurring testing activities. The acoustic analysis predicts no impacts on harbor porpoises as a result of ship shock trials. Predicted impacts on this species are mostly in the VACAPES Range Complex, with a few impacts in the Northeast Range Complex, generally within the Northeast U.S. Continental Shelf Large Marine Ecosystem.

Research and observations of harbor porpoises show that this species is wary of human activity and will avoid anthropogenic sound sources in many situations at levels down to 120 dB. This level was determined by observing harbor porpoise reactions to acoustic deterrent and harassment devices used to drive away animals from around fishing nets and aquaculture facilities. Avoidance distances were on the order of a kilometer or more, but it is unknown if animals would react similarly if the sound source was located at a greater distance of tens or hundreds of kilometers. Since a large proportion of testing activities happen within harbor porpoise habitat in the northeast, predicted effects on this species are greater relative to other marine mammals. Nevertheless, it is not known whether or not animals would actually react to sound sources at these ranges, regardless of the received sound level. Harbor porpoises may startle and leave the immediate area of the testing event, but may return after the activity has ceased. Therefore, these animals could avoid more significant impacts, such as hearing loss, injury, or mortality. Significant behavioral reactions seem more likely than with most other odontocetes, especially at closer ranges (within a few kilometers). Since these species are typically found in nearshore and inshore habitats, resident animals that are present throughout the year near Navy ports of fixed ranges in the northeast could receive multiple exposures over a short period of time year round. Animals that do not exhibit a significant behavioral reaction would likely recover from any incurred costs, which reduce the likelihood of long-term consequences, such as reduced fitness, for the individual or population.

All harbor porpoises within the Study Area belong to the Gulf of Maine/Bay of Fundy Stock and therefore, all predicted impacts would be to this stock. No areas of specific importance for reproduction or feeding for harbor porpoises have

been identified in the AFTT Study Area. The best abundance estimate for the Gulf of Maine/Bay of Fundy stock is 89,054 individuals.

Pinnipeds

Predicted effects on pinnipeds from annual training activities from sonar and other active acoustic sources indicate that three species (gray, harbor, and hooded seals) could be exposed to sound that may result in 77 behavioral reactions per year from annually recurring training activities and a maximum of 94 behavioral reactions per event for the biennial training activity, civilian port defense. Predicted effects on pinnipeds from annual testing activities from sonar and other active acoustic sources indicate that exposure to sound may result in 73 PTS, 7,494 TTS, and 6,489 behavioral reactions per year. These predicted impacts would occur almost entirely within the Northeast Range Complexes. Pinnipeds may be exposed to sound and energy from explosions associated with training and testing activities throughout the year. The acoustic analysis predicts 2 TTS and 1 behavioral reaction per year from explosions associated with annually recurring training activities and 15 behavioral responses, 15 TTS, and 2 PTS per year from explosions associated with annually recurring testing activities. The model predicts no impacts to pinnipeds from exposure to explosive energy and sound associated with ship shock trials. The predicted impacts would occur in the Northeast Range Complexes within the Northeast U.S. Continental Shelf Large Marine Ecosystem.

Research and observations show that pinnipeds in the water are tolerant of anthropogenic noise and activity. If seals are exposed to sonar or other active acoustic sources and explosives they may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Significant behavioral reactions would not be expected in most cases and long-term consequences for individual seals or populations are unlikely. Overall, predicted effects are low and the implementation of mitigation measures would further reduce potential impacts. Therefore, occasional behavioral reactions to intermittent anthropogenic noise are unlikely to cause long-term consequences for individual animals or populations.

No areas of specific importance for reproduction or feeding for pinnipeds have been identified in the AFTT Study Area. The acoustic analysis predicts that no pinnipeds will be exposed to sound levels or explosive detonations likely to result in mortality. Best estimates for the hooded and harp seals are 592,100 and 6.9 million, respectively. The best estimate for the western north Atlantic stock of harbor seals is 99,340. There is no best estimate available for gray seal, but a survey of the Canadian population ranged between 208,720 and 223,220. The North Atlantic Marine Mammal Commission Scientific Committee derived a rough estimate of the abundance of ringed seals in the northern extreme of the AFTT Study Area of approximately 1.3 million. There are no estimates available for bearded seals in the western Atlantic, the best available global population is 450,000 to 500,000, half of which inhabit the Bering and Chukchi Seas.

Preliminary Determination

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat and dependent upon the implementation of the mitigation and monitoring measures, NMFS preliminarily finds that the total taking from Navy training and testing exercises in the AFTT Study Area will have a negligible impact on the affected species or stocks. NMFS has proposed regulations for these exercises that prescribe the means of effecting the least practicable adverse impact on marine mammals and their habitat and set forth requirements pertaining to the monitoring and reporting of that taking.

Subsistence Harvest of Marine Mammals

NMFS has preliminarily determined that the issuance of 5-year regulations and subsequent LOAs for Navy training and testing exercises in the AFTT Study Area would not have an unmitigable adverse impact on the availability of the affected species or stocks for subsistence use, since there are no such uses in the specified area.

ESA

There are six marine mammal species under NMFS jurisdiction included in the Navy's incidental take request that are listed as endangered under the ESA with confirmed or possible occurrence in the Study Area: blue whale, humpback whale, fin whale, sei whale, sperm whale, and North Atlantic right whale. The Navy will consult with NMFS pursuant to section 7 of the ESA, and NMFS will also consult internally on the issuance of LOAs under section 101(a)(5)(A) of the MMPA for AFTT activities. Consultation will be concluded prior to a determination on the issuance of the final rule and an LOA.

NMSA

Some Navy activities may potentially affect resources within National Marine Sanctuaries. The Navy will continue to analyze potential impacts to sanctuary resources and has provided the analysis in Navy's Draft Environmental Impact Statement/Overseas Environmental Impact Statement for AFTT to NOAA's Office of National Marine Sanctuaries. Navy will initiate consultation with NOAA's Office of National Marine Sanctuaries pursuant to the requirements of the National Marine Sanctuaries Act as warranted by ongoing analysis of the activities and their effects on sanctuary resources.

NEPA

NMFS has participated as a cooperating agency on the AFTT DEIS/OEIS, which was published on May 11, 2012. The AFTT DEIS/OEIS is posted on NMFS' Web site: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*. NMFS intends to adopt the Navy's final EIS/OEIS (FEIS/OEIS), if adequate and appropriate. Currently, we believe that the adoption of the Navy's FEIS/OEIS will allow NMFS to meet its responsibilities under NEPA for the issuance of regulations and LOAs for AFTT. If the Navy's FEIS/OEIS is deemed inadequate, NMFS would supplement the existing analysis to ensure that we comply with NEPA prior to the issuance of the final rule or LOA.

Classification

The Office of Management and Budget has determined that this proposed rule is not significant for purposes of Executive Order 12866.

Pursuant to the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The RFA requires federal agencies to prepare an analysis of a rule's impact on small entities whenever the agency is required to publish a notice of proposed rulemaking. However, a federal agency may certify, pursuant to 5 U.S.C. 605(b), that the action will not have a significant economic impact on a substantial number of small entities. The Navy is the sole entity that will be affected by this rulemaking, not a small governmental jurisdiction, small

organization, or small business, as defined by the RFA. Any requirements imposed by an LOA issued pursuant to these regulations, and any monitoring or reporting requirements imposed by these regulations, would be applicable only to the Navy. NMFS does not expect the issuance of these regulations or the associated LOAs to result in any impacts to small entities pursuant to the RFA. Because this action, if adopted, would directly affect the Navy and not a small entity, NMFS concludes the action would not result in a significant economic impact on a substantial number of small entities.

List of Subjects in 50 CFR Part 218

Exports, Fish, Imports, Incidental take, Indians, Labeling, Marine mammals, Navy, Penalties, Reporting and recordkeeping requirements, Seafood, Sonar, Transportation.

Dated: January 23, 2013.

Alan D. Risenhoover,

Director, Office of Sustainable Fisheries, performing the functions and duties of the Deputy Assistant Administrator for Regulatory Programs.

For reasons set forth in the preamble, 50 CFR part 218 is proposed to be amended as follows:

PART 218—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

■ 1. The authority citation for part 218 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*

■ 2. Subpart I is added to part 218 to read as follows:

Subpart I—Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Training and Testing (AFTT)

Sec.

218.80 Specified activity and specified geographical region.
218.81 Effective dates and definitions.
218.82 Permissible methods of taking.
218.83 Prohibitions.
218.84 Mitigation.
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Subpart I—Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Training and Testing (AFTT)

§ 218.80 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the U.S. Navy for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to the activities described in paragraph (c) of this section.

(b) The taking of marine mammals by the Navy is only authorized if it occurs within the AFTT Study Area, which is comprised of established operating and warning areas across the North Atlantic Ocean and the Gulf of Mexico (see Figure 1–1 in the Navy's application). In addition, the Study Area also includes U.S. Navy pierside locations where sonar maintenance and testing occurs within the Study Area, and areas on the high seas that are not part of the range complexes, where training and testing may occur during vessel transit.

(c) The taking of marine mammals by the Navy is only authorized if it occurs incidental to the following activities within the designated amounts of use identified in paragraphs (c)(5) through (c)(11) of this section:

(1) Training events:

(i) Amphibious Warfare:

(A) Fire Support Exercise (FIREX) at Sea—up to 50 per year.

(B) Elevated Causeway System (ELCAS)—up to 1 event per year.

(ii) Anti-Surface Warfare:

(A) Gunnery Exercise (GUNEX) (Surface-to-Surface) Ship—Medium-caliber—up to 827 events per year.

(B) GUNEX (Surface-to-Surface) Ship—Large-caliber—up to 294 events per year.

(C) GUNEX (Surface-to-Surface) Boat—Medium-caliber—up to 434 events per year.

(D) Missile Exercise (MISSILEX) (Surface-to-Surface)—up to 20 events per year.

(E) GUNEX (Air-to-Surface)—up to 715 events per year.

(F) MISSILEX (Air-to-Surface) Rocket—up to 210 events per year.

(G) MISSILEX (Air-to-Surface)—up to 248 events per year.

(H) Bombing Exercise (BOMBEX) (Air-to-Surface)—up to 930 events per year.

(I) Sinking Exercise (SINKEX)—up to 1 event per year.

(J) Maritime Security Operations (MSO)—Anti-swimmer Grenades—up to 12 events per year.

(iii) Anti-Submarine Warfare:

(A) Tracking Exercise/Torpedo Exercise (TRACKEX/TORPEX)-Submarine—up to 102 events per year.

(B) TRACKEX/TORPEX-Surface– up to 764 events per year.

(C) TRACKEX/TORPEX-Helicopter—up to 432 events per year.

(D) TRACKEX/TORPEX-Maritime Patrol Aircraft—up to 752 events per year.

(E) TRACKEX-Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys—up to 160 events per year.

(iv) Major Training Events:

(A) Anti-Submarine Warfare Tactical Development Exercise—up to 4 events in per year.

(B) Composite Training Unit Exercise—up to 5 events per year.

(C) Joint Task Force Exercise/ Sustainment Exercise—up to 4 events per year.

(D) Integrated Anti-Submarine Warfare Course—up to 5 events per year.

(E) Group Sail—up to 20 events per year.

(v) Mine Warfare:

(A) Mine Countermeasures Exercise-MCM Sonar-Ship—up to 116 events per year.

(B) Mine Countermeasures—Mine Detection—up to 2,538 events per year.

(C) Mine Neutralization-Explosive Ordnance Disposal (EOD)—up to 618 events per year.

(D) Mine Neutralization—Remotely Operated Vehicle—up to 508 events per year.

(E) Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises—up to 8 events per year.

(F) Civilian Port Defense—up to 1 event every other year.

(vi) Other Training Activities:

(A) Submarine Navigation—up to 284 events per year.

(B) Submarine Navigation Under Ice Certification—up to 24 events per year.

(C) Surface Ship Object Detection—up to 144 events per year.

(D) Surface Ship Sonar Maintenance—up to 824 events per year.

(D) Submarine Sonar Maintenance—up to 220 events per year.

(2) Naval Air Systems Command Testing Events:

(i) Anti-Surface Warfare (ASUW):

(A) Air-to-Surface Missile Test—up to 239 events per year.

(B) Air-to-Surface Gunnery Test—up to 165 events per year.

(C) Rocket Test—up to 332 events per year.

(ii) Anti-Submarine Warfare (ASW):

(A) Anti-Submarine Warfare Torpedo Test—up to 242 events per year.

(B) Kilo Dip—up to 43 events per year.

(C) Sonobuoy Lot Acceptance Test—up to 39 events per year.

(D) Anti-Submarine Warfare Tracking Test—Helicopter—up to 428 events per year.

(E) Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft—up to 75 events per year.

(iii) Mine Warfare (MIW):

(A) Airborne Towed Minehunting Sonar System Test—up to155 events per year.
(B) Airborne Mine Neutralization System Test—up to 165 events per year.
(C) Airborne Projectile-based Mine Clearance System—up to 237 events per year.
(D) Airborne Towed Minesweeping Test—up to 72 events per year.
(3) Naval Sea Systems Command Testing Events:
(i) New Ship Construction:
(A) Surface Combatant Sea Trials—Pierside Sonar Testing—up to 12 events per year.
(B) Surface Combatant Sea Trials—ASW Testing—up to 10 events per year.
(C) Submarine Sea Trials—Pierside Sonar Testing—up to 6 events per year.
(D) Submarine Sea Trials—ASW Testing—up to 12 events per year.
(D) Mission Package Testing—ASW—up to 24 events per year.
(E) Mission Package Testing—Mine Countermeasures—up to 8 events per year.
(ii) Life Cycle Activities:
(A) Surface Ship Sonar Testing/Maintenance—up to 16 events per year.
(B) Submarine Sonar Testing/Maintenance—up to 28 events per year.
(C) Combat System Ship Qualification Trial (CSSQT)—In-Port Maintenance Period—up to 12 events per year.
(D) Combat System Ship Qualification (CSSQT)—Undersea Warfare (USW)—up to 9 events per year.
(iii) NAVSEA Range Activities:
(A) Unmanned Underwater Vehicles Demonstration—up to 3 events per 5 year period.
(B) Mine Detection and Classification Testing—up to 81 events per year.
(C) Stationary Source Testing—up to 11 events per year.
(D) Special Warfare Testing—up to 110 events per year.
(E) Unmanned Underwater Vehicle Testing—up to 211 events per year.
(F) Torpedo Testing (non-explosive)—up to 30 events per year.
(G) Towed Equipment Testing—up to 33 events per year.
(H) Semi-Stationary Equipment Testing—up to 154 events per year.
(I) Pierside Integrated Swimmer Defense Testing—up to 6 events per year.
(J) Signature Analysis Activities—up to 18 events per year.
(K) Mine Testing—up to 33 events per year.
(L) Surface Testing—up to 33 events per year.
(M) Mine Countermeasure/Neutralization Testing—up to 15 events per year.
(N) Ordnance Testing—up to 37 events per year.
(iv) Additional Activities Outside of NAVSEA Ranges:
(A) Torpedo (non-explosive) Testing—up to 26 events per year.
(B) Torpedo (explosive) Testing—up to 4 events per year.
(C) Countermeasure Testing—up to 3 events per year.
(D) Pierside Sonar Testing—up to 23 events per year.
(E) At-sea Sonar Testing—up to 15 events per year.
(F) Mine Detection and Classification Testing—up to 66 events per year.
(G) Mine Countermeasure/Neutralization Testing—up to 28 events per year.
(H) Pierside Integrated Swimmer Defense Testing—up to 3 events per year.
(I) Unmanned Vehicle Deployment and Payload Testing—up to 111 events per year.
(J) Special Warfare Testing—up to 4 events per year.
(K) Aircraft Carrier Sea Trials—Gun Testing—Medium Caliber—up to 410 events per year.
(L) Surface Warfare Mission Package—Gun Testing—Medium Caliber—up to 5 events per year.
(M) Surface Warfare Mission Package—Gun Testing—Large Caliber—up to 5 events per year.
(N) Surface Warfare Mission Package—Missile/Rocket Testing—up to 15 events per year.
(O) Mine Countermeasure Mission Package Testing—up to 8 events per year.
(P) Aircraft Carrier Full Ship Shock Trial—1 event per 5 year period
(Q) DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial—1 event per 5 year period.
(R) Littoral Combat Ship Full Ship Shock Trial—up to 2 events per 5 year period.
(S) At-sea Explosives Testing—up to 4 events per year.
(4) Active Acoustic Sources Used During Annual Training:
(i) Mid-frequency (MF) Source Classes:
(A) MF1—up to 9,844 hours per year.
(B) MF1K—up to 163 hours per year.
(C) MF2—up to 3,150 hours per year.
(D) MF2K—up to 61 hours per year.
(E) MF3—up to 2,058 hours per year.
(F) MF4—up to 927 hours per year.
(G) MF5—up to 14,556 sonobuoys per year.
(H) MF11—up to 800 hours per year.
(I) MF12—up to 687 hours per year.
(ii) High-frequency (HF) and Very High-frequency (VHF) Source Classes:
(A) HF1—up to 1,676 hours per year.
(B) HF4—up to 8,464 hours per year.
(iii) Anti-Submarine Warfare (ASW) Source Classes:
(A) ASW1—up to 128 hours per year.
(B) ASW2—up to 2,620 sonobuoys per year.
(C) ASW3—up to 13,586 hours per year.
(D) ASW4—up to 1,365 devices per year.
(iv) Torpedoes (TORP) Source Classes:
(A) TORP1—up to 54 torpedoes per year.
(B) TORP2—up to 80 torpedoes year.
(5) Active Acoustic Sources Used During Annual Testing:
(i) LF:
(A) LF4—up to 254 hours per year.
(B) LF5—up to 370 hours per year.
(ii) MF:
(A) MF1—up to 220 hours per year.
(B) MF1K—up to 19 hours per year.
(C) MF2—up to 36 hours per year.
(D) MF3—up to 434 hours per year.
(E) MF4—up to 776 hours per year.
(F) MF5—up to 4,184 sonobuoys per year.
(G) MF6—up to 303 items per year.
(H) MF8—up to 90 hours per year.
(I) MF9—up to 13,034 hours per year.
(J) MF10—up to 1,067 hours per year.
(K) MF12—up to 144 hours per year.
(iii) HF and VHF:
(A) HF1—up to 1,243 hours per year.
(B) HF3—up to 384 hours per year.
(C) HF4—up to 5,572 hours per year.
(D) HF5—up to 1,206 hours per year.
(E) HF6—up to 1,974 hours per year.
(F) HF7—up to 366 hours per year.
(iv) ASW:
(A) ASW1—up to 96 hours per year.
(B) ASW2—up to 2,743 sonobuoys per year.
(C) ASW2—up to 274 hours per year.
(D) ASW3—up to 948 hours per year.
(E) ASW4—up to 483 devices per year.
(v) TORP:
(A) TORP1—up to 581 torpedoes per year.
(B) TORP2—up to 521 torpedoes per year.
(vi) Acoustic Modems (M):
(A) M3—up to 461 hours per year.
(B) [Reserved]
(vii) Swimmer Detection Sonar (SD):
(A) SD1 and SD2—up to 230 hours per year.
(B) [Reserved]
(viii) Forward Looking Sonar (FLS):
(A) FLS2 and FLS3—up to 365 hours per year.
(B) [Reserved]
(ix) Synthetic Aperture Sonar (SAS):
(A) SAS1—up to 6 hours per year.
(B) SAS2—up to 3,424 hours per year.
(6) Explosive Sources Used During Annual Training:
(i) Explosive Classes:
(A) E1 (0.1 to 0.25 lb NEW)—up to 124,552 detonations per year.
(B) E2 (1.26 to 0.5 lb NEW)—up to 856 detonations per year.

(C) E3 (0.6 to 2.5 lb NEW)—up to 3,132 detonations per year.
(D) E4 (>2.5 to 5 lb NEW)—up to 2,190 detonations per year.
(E) E5 (>5 to 10 lb NEW)—up to 14,370 detonations per year.
(F) E6 (>10 to 20 lb NEW)—up to 500 detonations per year.
(G) E7 (>20 to 60 lb NEW)—up to 322 detonations per year.
(H) E8 (>60 to 100 lb NEW)—up to 77 detonations per year.
(I) E9 (>100 to 250 lb NEW)—up to 2 detonations per year.
(J) E10 (>250 to 500 lb NEW)—up to 8 detonations per year.
(K) E11 (>500 to 650 lb NEW)—up to 1 detonations per year.
(L) E12 (>650 to 1,000 lb NEW)—up to 133 detonations per year.
(ii) [Reserved]
(7) Explosive Sources Used During Annual Testing:
(i) Explosive Classes:
(A) E1 (0.1 to 0.25 lb NEW)—up to 25,501 detonations per year.
(B) E2 (0.26 to 0.5 lb NEW)—up to 0 detonations per year.
(C) E3 (0.6 to 2.5 lb NEW)—up to 2,912 detonations per year.
(D) E4 (>2.5 to 5 lb NEW)—up to 1,432 detonations per year.
(E) E5 (>5 to 10 lb NEW)—up to 495 detonations per year.
(F) E6 (>10 to 20 lb NEW)—up to 54 detonations per year.
(G) E7 >20 to 60 lb NEW)—up to 0 detonations per year.
(H) E8 (>60 to 100 lb NEW)—up to 11 detonations per year.
(I) E9 (>100 to 250 lb NEW)—up to 0 detonations per year.
(J) E10 (>250 to 500 lb NEW)—up to 10 detonations per year.
(K) E11 (>500 to 650 lb NEW)—up to 27 detonations per year.
(L) E12 (>650 to 1,000 lb NEW)—up to 0 detonations per year.
(M) E13 (>1,000 to 1,740 lb NEW)—up to 0 detonations per year.
(N) E14(>1,714 to 3,625 lb NEW)—up to 4 detonations per year.
(ii) [Reserved]
(8) Active Acoustic Source Used During Non-Annual Training
(i) HF4—up to 192 hours
(ii) [Reserved]
(9) Active Acoustic Sources Used During Non-Annual Testing
(i) LF5—up to 240 hours
(ii) MF9—up to 480 hours
(iii) HF5—up to 240 hours
(iv) HF6—up to 720 hours
(v) HF7—up to 240 hours
(vi) FLS2 and FLS3—up to 240 hours
(vii) SAS2—up to 720 hours
(10) Explosive Sources Used During Non-Annual Training
(i) E2(0.26 to 0.5 lbs NEW)—up to 2
(ii) E4 (2.6 to 5 lbs NEW)—up to 2
(11) Explosive Sources Used During Non-Annual Training
(i) E1 (0.1 to 0.25 lbs NEW)—up to 600
(ii) E16 (7,251 to 14,500 lbs NEW)—up to 12
(iii) E17 (14,501 to 58,000 lbs NEW)—up to 4

§ 218.81 Effective dates and definitions.

(a) Regulations are effective January 25, 2013 through January 25, 2018.
(b) The following definitions are utilized in these regulations:
(1) *Uncommon Stranding Event (USE)*—A stranding event that takes place during a major training exercise (MTE) and involves any one of the following:
(i) Two or more individuals of any cetacean species (not including mother/calf pairs), unless of species of concern listed in paragraph (b)(1)(ii) of this section found dead or live on shore within a 2-day period and occurring within 30 miles of one another.
(ii) A single individual or mother/calf pair of any of the following marine mammals of concern: beaked whale of any species, *Kogia* spp., Risso's dolphin, melon-headed whale, pilot whale, North Atlantic right whale, humpback whale, sperm whale, blue whale, fin whale, or sei whale.
(iii) A group of two or more cetaceans of any species exhibiting indicators of distress.
(2) *Shutdown*—The cessation of MFAS/HFAS operation or detonation of explosives within 14 nautical miles of any live, in the water, animal involved in a USE.

§ 218.82 Permissible methods of taking.

(a) Under Letters of Authorization (LOAs) issued pursuant to § 218.87, the Holder of the Letter of Authorization may incidentally, but not intentionally, take marine mammals within the area described in § 218.80, provided the activity is in compliance with all terms, conditions, and requirements of these regulations and the appropriate LOA.
(b) The activities identified in § 218.80(c) must be conducted in a manner that minimizes, to the greatest extent practicable, any adverse impacts on marine mammals and their habitat.
(c) The incidental take of marine mammals under the activities identified in § 218.80(c) is limited to the following species, by the identified method of take and the indicated number of times:
(1) Level B Harassment for all Training Activities:
(i) Mysticetes:
(A) Blue whale (*Balaenoptera musculus*)—735 (an average of 147 per year)
(B) Bryde's whale (*Balaenoptera edeni*)—4,775 (an average of 955 per year)
(C) Fin whale (*Balaenoptera physalus*)—22,450 (an average of 4,490 per year)
(D) North Atlantic right whale (*Eubalaena glacialis*)—560 (an average of 112 per year)
(E) Humpback whale (*Megaptera novaeangliae*)—8,215 (an average of 1,643 per year)
(F) Minke whale (*Balaenoptera acutorostrata*)—302,010 (an average of 60,402 per year)
(G) Sei whale (*Balaenoptera borealis*)—50,940 (an average of 10,188 per year)
(ii) Odontocetes:
(A) Atlantic spotted dolphin (*Stenella frontalis*)—887,550 (an average of 177,570 per year)
(B) Atlantic white-sided dolphin (Lagenorhynchus acutus)—156,100 (an average of 31,228)
(C) Blainville's beaked whale (*Mesoplodon densirostris*)—140,893 (28,179 per year)
(D) Bottlenose dolphin (*Tursiops truncatus*)—1,422,938 (284,728 per year)
(E) Clymene dolphin (Stenella clymene)—97,938 (19,588 per year)
(F) Common dolphin (Delphinus spp.)—2,325,022 (465,014 per year)
(G) Cuvier's beaked whale (*Ziphius cavirostris*)—174,473 (34,895 per year)
(H) False killer whale (*Pseudorca crassidens*)—3,565 (an average of 713 per year)
(I) Fraser's dolphin (*Lagenodelphis hosei*)—11,025 (2,205 per year)
(J) Gervais' beaked whale (Mesoplodon europaeus)—141,271 (28,255 per year)
(K) Harbor porpoise (*Phocoena phocoena*)—711,727 (142,811 per year)
(L) Killer whale (*Orcinus orca*)—70,273 (14,055 per year)
(M) *Kogia* spp.—25,448 (5,090 per year)
(N) Melon-headed whale (*Peponocephala electra*)—104,380 (20,876 per year)
(O) Northern bottlenose whale (Hyperoodon ampullatus)—91,786 (18,358 per year)
(P) Pantropical spotted dolphin (*Stenella attenuata*)—354,834 (70,968 per year)
(Q) Pilot whale (*Globicephala spp.*)—506,240 (101,252 per year)
(R) Pygmy killer whale (*Feresa attenuata*)—7,435 (1,487 per year)
(S) Risso's dolphin (*Grampus griseus*)—1,192,618 (238,528 per year)
(T) Rough-toothed dolphin (*Steno bredanensis*)—5,293 (1,059 per year)

(U) Sowerby's beaked whale (*Mesoplodon bidens*)—49,818 (9,964 per year)
(V) Sperm whale (*Physeter macrocephalus*)—73,743 (14,749 per year)
(W) Spinner dolphin (*Stenella longirostris*)—102,068 (20,414 per year)
(X) Striped dolphin (*Stenella coerulealba*)—1,121,511 (224,305 per year)
(Y) True's beaked whale (*Mesoplodon mirus*)—83,553 (16,711 per year)
(Z) White-beaked dolphin (Lagenorhynchus albirostris)—8,027 (1,613 per year)
(iii) Pinnipeds:
(A) Gray seal (*Halichoerus grypus*)—316 (82 per year)
(B) Harbor seal (*Phoca vitulina*)—329 (83 per year)
(C) Harp seal (*Pagophilus groenlanica*)—12 (4 per year)
(D) Hooded seal (*Cystophora cristata*)—25 (5 per year)
(2) Level A Harassment for all Training Activities:
(i) Mysticetes:
(A) Minke whale (*Balaenoptera acutorostrata*)—80 (16 per year)
(B) Fin whale (*Balaenoptera physalus*)—5 (1 per year)
(C) Humpback whale (*Megaptera novaeangliae*)—5 (1 per year)
(D) Sei whale (*Balaenoptera borealis*)—5 (1 per year)
(ii) Odontocetes:
(A) Atlantic spotted dolphin (*Stenella frontalis*)—60 (12 per year)
(B) Atlantic white-sided dolphin (Lagenorhynchus acutus)—15 (3 per year)
(C) Bottlenose dolphin (*Tursiops truncatus*)—40 (8 per year)
(D) Clymene dolphin (Stenella clymene)—5 (1 per year)
(E) Common dolphin (Delphinus spp.)—85 (17 per year)
(F) Harbor porpoise (*Phocoena phocoena*)—1,308 (262 per year)
(G) *Kogia* spp.—75 (15 per year)
(H) Pantropical spotted dolphin (*Stenella attenuata*)—5 (1 per year)
(I) Pilot whale (*Globicephala spp.*)—15 (3 per year)
(J) Risso's dolphin (*Grampus griseus*)—15 (3 per year)
(K) Striped dolphin (*Stenella coerulealba*)—35 (7 per year)
(3) Mortality for all Training Activities:
(i) No more than 85 mortalities (17 per year) applicable to any small odontocete species from an impulse source.
(ii) No more than 10 beaked whale mortalities (2 per year).
(iii) No more than 10 large whale mortalities (no more than 3 in any given year) from vessel strike.
(4) Level B Harassment for all Testing Activities:
(i) Mysticetes:
(A) Blue whale (*Balaenoptera musculus*)—82 (18 per year)
(B) Bryde's whale (*Balaenoptera edeni*)—304 (64 per year)
(C) Fin whale (*Balaenoptera physalus*)—2,784 (599 per year)
(D) North Atlantic right whale (*Eubalaena glacialis*)—395 (87 per year)
(E) Humpback whale (*Megaptera novaeangliae*)—976 (200 per year)
(F) Minke whale (*Balaenoptera acutorostrata*)—34,505 (7,756 per year)
(G) Sei whale (*Balaenoptera borealis*)—3,821 (796 per year)
(ii) Odontocetes:
(A) Atlantic spotted dolphin (*Stenella frontalis*)—104,647 (24,429 per year)
(B) Atlantic white-sided dolphin (Lagenorhynchus acutus)—50,133 (10,330 per year)
(C) Blainville's beaked whale (*Mesoplodon densirostris*)—23,561 (4,753 per year)
(D) Bottlenose dolphin (*Tursiops truncatus*)—146,863 (33,708 per year)
(E) Clymene dolphin (Stenella clymene)—10,169 (2,173 per year)
(F) Common dolphin (Delphinus spp.)—235,493 (52,546 per year)
(G) Cuvier's beaked whale (*Ziphius cavirostris*)—30,472 (6,144 per year)
(H) False killer whale (*Pseudorca crassidens*)—497 (an average of 109 per year)
(I) Fraser's dolphin (*Lagenodelphis hosei*)—791 (171 per year)
(J) Gervais' beaked whale (Mesoplodon europaeus)—23,388 (4,764 per year)
(K) Harbor porpoise (*Phocoena phocoena*)—10,358,300 (2,182,872 per year)
(L) Killer whale (*Orcinus orca*)—7,173 (1,540 per year)
(M) *Kogia* spp.—5,536 (1,163 per year)
(N) Melon-headed whale (*Peponocephala electra*)—6,950 (1,512 per year)
(O) Northern bottlenose whale (Hyperoodon ampullatus)—60,409 (12,096 per year)
(P) Pantropical spotted dolphin (*Stenella attenuata*)—38,385 (7,985 per year)
(Q) Pilot whale (*Globicephala spp.*)—74,614 (15,701 per year)
(R) Pygmy killer whale (*Feresa attenuata*)—603 (135 per year)
(S) Risso's dolphin (*Grampus griseus*)—113,682 (24,356 per year)
(T) Rough-toothed dolphin (*Steno bredanensis*)—618 (138 per year)
(U) Sowerby's beaked whale (*Mesoplodon bidens*)—13,338 (2,698 per year)
(V) Sperm whale (*Physeter macrocephalus*)—8,533 (1,786 per year)
(W) Spinner dolphin (*Stenella longirostris*)—13,208 (2,862 per year)
(X) Striped dolphin (*Stenella coerulealba*)—97,852 (21,738 per year)
(Y) True's beaked whale (*Mesoplodon mirus*)—15,569 (3,133 per year)
(Z) White-beaked dolphin (Lagenorhynchus albirostris)—8,370 (1,818 per year)
(iii) Pinnipeds:
(A) Bearded seal (*Erignathus barbatus*)—161 (33 per year)
(B) Gray seal (*Halichoerus grypus*)—14,149 (3,293 per year)
(C) Harbor seal (*Phoca vitulina*)—38,860 (8,668 per year)
(D) Harp seal (*Pagophilus groenlanica*)—16,277 (3,997 per year)
(E) Hooded seal (*Cystophora cristata*)—1,447 (295 per year)
(F) Ringed seal (*Pusa hispida*)—1,795 (359 per year)
(5) Level A Harassment for all Testing Activities:
(i) Mysticetes:
(A) Minke whale (*Balaenoptera acutorostrata*)—28 (15 per year)
(B) [Reserved]
(ii) Odontocetes:
(A) Atlantic spotted dolphin (*Stenella frontalis*)—1,964 (1,854 per year)
(B) Atlantic white-sided dolphin (Lagenorhynchus acutus)—166 (147 per year)
(C) Bottlenose dolphin (*Tursiops truncatus*)—190 (149 per year)
(D) Clymene dolphin (Stenella clymene)—87 (80 per year)
(E) Common dolphin (Delphinus spp.)—2,369 (2,203 per year)
(F) Harbor porpoise (*Phocoena phocoena*)—1,080 (216 per year)
(G) Killer whale (Orcinus orca)—2 (2 per year)
(H) *Kogia* spp.—36 (12 per year)
(I) Melon-headed whale (*Peponocephala electra*)—30 (28 per year)
(J) Pantropical spotted dolphin (*Stenella attenuata*)—92 (71 per year)
(K) Pilot whale (*Globicephala spp.*)—163 (153 per year)
(L) Pygmy killer whale (*Feresa attenuata*)—3 (3 per year)
(M) Risso's dolphin (*Grampus griseus*)—89 (70 per year)
(N) Spinner dolphin (*Stenella longirostris*)—34 (28 per year)
(O) Striped dolphin (*Stenella coerulealba*)—2,751 (2,599 per year)
(P) White-beaked dolphin (Lagenorhynchus albirostris)—3 (3 per year)
(iii) Pinnipeds:
(A) Gray seal (*Halichoerus grypus*)—46 (14 per year)
(B) Harbor seal (*Phoca vitulina*)—330 (78 per year)
(C) Harp seal (*Pagophilus groenlanica*)—30 (14 per year)

(6) Mortality for all Testing Activities:

(i) No more than 55 mortalities (11 per year) applicable to any small odontocete species from an impulse source.

(ii) No more than 1 large whale mortalities (no more than 1 in any given year) from vessel strike.

(iii) Nor more than 25 mortalities (no more than 20 in any given year) applicable to any small odontocete species from Ship Shock trials.

§ 218.83 Prohibitions.

Notwithstanding takings contemplated in § 218.82 and authorized by an LOA issued under § 216.106 of this chapter and § 218.87, no person in connection with the activities described in § 218.80 may:

(a) Take any marine mammal not specified in § 218.82(c);

(b) Take any marine mammal specified in § 218.82(c) other than by incidental take as specified in § 218.82(c);

(c) Take a marine mammal specified in § 218.82(c) if such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(d) Violate, or fail to comply with, the terms, conditions, and requirements of these regulations or an LOA issued under § 216.106 of this chapter and § 218.87.

§ 218.84 Mitigation.

(a) When conducting training and testing activities, as identified in § 218.80, the mitigation measures contained in the LOA issued under § 216.106 of this chapter and § 218.87 must be implemented. These mitigation measures include, but are not limited to:

(1) Lookouts—The following are protective measures concerning the use of lookouts.

(i) Lookouts positioned on surface ships will be dedicated solely to diligent observation of the air and surface of the water. Their observation objectives will include, but are not limited to, detecting the presence of biological resources and recreational or fishing boats, observing buffer zones, and monitoring for vessel and personnel safety concerns.

(ii) Lookouts positioned in aircraft or on boats will, to the maximum extent practicable and consistent with aircraft and boat safety and training and testing requirements, comply with the observation objectives described above in paragraph (a)(1)(i) of this section.

(iii) Lookout measures for non-impulsive sound:

(A) With the exception of vessels less than 65 ft (20 m) in length and the Littoral Combat Ship (and similar vessels which are minimally manned), ships using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea will have two Lookouts at the forward position of the vessel. For the purposes of this rule, low-frequency active sonar does not include surface towed array surveillance system low-frequency active sonar.

(B) While using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea, vessels less than 65 ft (20 m) in length and the Littoral Combat Ship (and similar vessels which are minimally manned) will have one Lookout at the forward position of the vessel due to space and manning restrictions.

(C) Ships conducting active sonar activities while moored or at anchor (including pierside testing or maintenance) will maintain one Lookout.

(D) Ships or aircraft conducting non-hull-mounted mid-frequency active sonar, such as helicopter dipping sonar systems, will maintain one Lookout.

(E) Surface ships or aircraft conducting high-frequency or non-hull-mounted mid-frequency active sonar activities associated with anti-submarine warfare and mine warfare activities at sea will have one Lookout.

(iv) Lookout measures for explosives and impulsive sound:

(A) Aircraft conducting activities with IEER sonobuoys and explosive sonobuoys with 0.6 to 2.5 lbs net explosive weight will have one Lookout.

(B) Surface vessels conducting anti-swimmer grenade activities will have one Lookout.

(C) During general mine countermeasure and neutralization activities using up to a 500-lb net explosive weight detonation (bin E10 and below), vessels greater than 200 ft will have two Lookouts, while vessels less than 200 ft will have one Lookout.

(D) General mine countermeasure and neutralization activities using a 501 to 650-lb net explosive weight detonation (bin E11), will have two Lookouts. One Lookout will be positioned in an aircraft and one in a support vessel.

(E) Mine neutralization activities involving diver-placed charges using up to 100-lb net explosive weight detonation (E8) conducted with a positive control device will have a total of two Lookouts. One Lookout will be positioned in each of the two support vessels. When aircraft are used, the pilot or member of the aircrew will serve as an additional Lookout. All divers placing the charges on mines will support the Lookouts while performing their regular duties. The divers placing the charges on mines will report all marine mammal sightings to their dive support vessel.

(F) When mine neutralization activities using diver-placed charges with up to a 20-lb net explosive weight detonation (bin E6) are conducted with a time-delay firing device, four Lookouts will be used. Two Lookouts will be positioned in each of two small rigid hull inflatable boats. When aircraft are used, the pilot or member of the aircrew will serve as an additional Lookout. The divers placing the charges on mines will report all marine mammal sightings to their dive support vessel.

(G) Surface vessels conducting line charge testing will have one Lookout

(H) Surface vessels or aircraft conducting small- and medium-caliber gunnery exercises will have one Lookout.

(I) Surface vessels or aircraft conducting large-caliber gunnery exercises will have one Lookout.

(J) Surface vessels or aircraft conducting missile exercises against surface targets will have one Lookout.

(K) Aircraft conducting bombing exercises will have one Lookout.

(L) During explosive torpedo testing, one Lookout will be used and positioned in an aircraft.

(M) During sinking exercises, two Lookouts will be used. One Lookout will be positioned in an aircraft and one on a surface vessel.

(N) Prior to commencement, during, and after ship shock trials using up to 10,000 lb HBX charges, the Navy will have Lookouts or trained marine species observers positioned either in an aircraft or on multiple surface vessels. If vessels are the only available platform, a sufficient number will be used to provide visual observation of the mitigation zone comparable to that achieved by aerial surveys.

(O) Prior to commencement and after ship shock trials using up to 40,000 lb HBX charges, the Navy will have a minimum of two Lookouts or trained marine species observers positioned in an aircraft. During ship shock trials using up to 40,000 lb HBX charges, the Navy will have a total of four Lookouts or trained marine species observers. Two Lookouts will be positioned in an aircraft and two Lookouts will be positioned on a surface vessel.

(P) Each surface vessel supporting at-sea explosive testing will have at least one lookout.

(Q) During pile driving, one lookout will be used and positioned on the platform that will maximize the potential for marine mammal sightings

(e.g., the shore, an elevated causeway, or on a ship).

(R) Surface vessels conducting explosive and non-explosive large-caliber gunnery exercises will have one lookout. This may be the same lookout used during large-caliber gunnery exercises with a surface target.

(v) Lookout measures for physical strike and disturbance:

(A) While underway, surface ships will have at least one lookout.

(B) During activities using towed in-water devices, one lookout will be used.

(C) Activities involving non-explosive practice munitions (e.g., small-, medium-, and large-caliber gunnery exercises) using a surface target will have one lookout.

(D) During activities involving non-explosive bombing exercises, one lookout will be used.

(2) *Mitigation Zones*—The following are protective measures concerning the implementation of mitigation zones.

(i) Mitigation zones will be measured as the radius from a source and represent a distance to be monitored.

(ii) Visual detections of marine mammals within a mitigation zone will be communicated immediately to a watch station for information dissemination and appropriate action.

(iii) Mitigation zones for non-impulsive sound:

(A) When marine mammals are visually detected, the Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmission levels are limited to at least 6 dB below normal operating levels if any detected marine mammals are within 1,000 yd (914 m) of the sonar dome (the bow).

(B) The Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmissions are limited to at least 10 dB below the equipment's normal operating level if any detected marine mammals are within 500 yd (457 m) of the sonar dome.

(B) The Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmissions are ceased if any visually detected marine mammals are within 200 yd (183 m) of the sonar dome. Transmissions will not resume until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yd beyond the location of the last detection.

(C) When marine mammals are visually detected, the Navy shall ensure that high-frequency and non-hull-mounted mid-frequency active sonar transmission levels are ceased if any visually detected marine mammals are within 200 yd (183 m) of the source. Transmissions will not resume until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yd beyond the location of the last detection.

(D) Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the Officer of the Deck concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.

(E) Prior to start up or restart of active sonar, operators shall check that the mitigation zone radius around the sound source is clear of marine mammals.

(iv) Mitigation zones for explosive and impulsive sound:

(A) A mitigation zone with a radius of 600 yd (549 m) shall be established for IEER sonobuoys (bin E4).

(B) A mitigation zone with a radius of 350 yd (320 m) shall be established for explosive sonobuoys using 0.6 to 2.5 lb net explosive weight (bin E3).

(C) A mitigation zone with a radius of 200 yd (183 m) shall be established for anti-swimmer grenades (bin E2).

(D) A mitigation zone ranging from 350 yd (320 m) to 850 yd (777 m), dependent on charge size, shall be established for mine countermeasure and neutralization activities using diver placed positive control firing devices. Mitigation zone distances are specified for charge size in Table 11–2 of the Navy's application.

(E) A mitigation zone with a radius of 1,000 yd (915 m) shall be established for mine neutralization diver placed mines using time-delay firing devices (bin E6).

(F) A mitigation zone with a radius of 900 yd (823 m) shall be established for ordnance testing (line charge testing) (bin E4).

(G) A mitigation zone with a radius of 200 yd (183 m) shall be established for small- and medium-caliber gunnery exercises with a surface target (bin E2).

(H) A mitigation zone with a radius of 600 yd (549 m) shall be established for large-caliber gunnery exercises with a surface target (bin E5).

(I) A mitigation zone with a radius of 900 yd (823 m) shall be established for missile exercises with up to 250 lb net explosive weight and a surface target (bin E9).

(J) A mitigation zone with a radius of 2,000 yd (1.8 km) shall be established for missile exercises with 251 to 500 lb net explosive weight and a surface target (E10).

(K) A mitigation zone with a radius of 2,500 yd (2.3 km) shall be established for bombing exercises (bin E12).

(L) A mitigation zone with a radius of 2,100 yd (1.9 km) shall be established for torpedo (explosive) testing (bin E11).

(M) A mitigation zone with a radius of 2.5 nautical miles shall be established for sinking exercises (bin E12).

(N) A mitigation zone with a radius of 1,600 yd (1.4 km) shall be established for at-sea explosive testing (bin E5).

(O) A mitigation zone with a radius of 60 yd (55 m) shall be established for elevated causeway system pile driving.

(P) A mitigation zone with a radius of 3.5 nautical miles shall be established for a shock trial.

(v) Mitigation zones for vessels and in-water devices:

(A) A mitigation zone of 500 yd (457 m) for observed whales and 200 yd (183 m) for all other marine mammals (except bow riding dolphins) shall be established for all vessel movement, providing it is safe to do so.

(B) A mitigation zone of 250 yd (229 m) shall be established for all towed in-water devices, providing it is safe to do so.

(vi) Mitigation zones for non-explosive practice munitions:

(A) A mitigation zone of 200 yd (183 m) shall be established for small, medium, and large caliber gunnery exercises using a surface target.

(B) A mitigation zone of 1,000 yd (914 m) shall be established for bombing exercises.

(3) *Protective Measures Specific to North Atlantic Right Whales.*

(i) North Atlantic Right Whale Calving Habitat off the Southeast United States.

(A) The Southeast Right Whale Mitigation Area is defined by a 5 nm (9.3 km) buffer around the coastal waters between 31–15 N. lat. and 30–15 N. lat. extending from the coast out 15 nm (27.8 km), and the coastal waters between 30–15 N. lat. to 28–00 N. lat. from the coast out to 5 nm (9.3 km).

(B) Between November 15 and April 15, the following activities are prohibited within the Southeast Right Whale Mitigation Area:

(*1*) High-frequency and non-hull mounted mid-frequency active sonar (except helicopter dipping)

(*2*) Missile activities (explosive and non-explosive)

(*3*) Bombing exercises (explosive and non-explosive)

(*4*) Underwater detonations

(*5*) Improved extended echo ranging sonobuoy exercises

(*6*) Torpedo exercises (explosive)

(*7*) Small-, medium-, and large-caliber gunnery exercises

(C) Prior to transiting or training in the Southeast Right Whale Mitigation Area, ships shall contact Fleet Area Control and Surveillance Facility, Jacksonville, to obtain the latest whale sightings and other information needed to make informed decisions regarding safe speed and path of intended movement. Submarines shall contact Commander, Submarine Force United States Atlantic Fleet for similar information.

(D) The following specific mitigation measures apply to activities occurring within the Southeast Right Whale Mitigation Area:

(*1*) When transiting within the Southeast Right Whale Mitigation Area, vessels shall exercise extreme caution and proceed at a slow safe speed. The speed shall be the slowest safe speed that is consistent with mission, training, and operations.

(*2*) Speed reductions (adjustments) are required when a North Atlantic right whale is sighted by a vessel, when the vessel is within 9 km (5 nm) of a sighting reported within the past 12 hours, or when operating at night or during periods of poor visibility.

(*3*) Vessels shall avoid head-on approaches to North Atlantic right whales(s) and shall maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when a change of course would create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in their ability to maneuver.

(*4*) Vessels shall minimize to the extent practicable north-south transits through the Southeast Right Whale Mitigation Area. If transit in a north-south direction is required during training or testing activities, the Navy shall implement the measures described above.

(*5*) Ship, surfaced subs, and aircraft shall report any North Atlantic right whale sightings to Fleet Area Control and Surveillance Facility, Jacksonville, by the most convenient and fastest means. The sighting report shall include the time, latitude/longitude, direction of movement and number and description of whale (i.e., adult/calf)

(ii) North Atlantic Right Whale Foraging Habitat off the Northeast United States.

(A) The Northeast Right Whale Mitigation Area consists of two areas: the Great South Channel and Cape Cod Bay. The Great South Channel is defined by the following coordinates: 41-40 N. Lat., 69-45 W. Long.; 41-00 N. Lat., 69-05 W. Long.; 41-38 N. Lat., 68-13 W. Long.; and 42-10 N. Lat., 68-31 W. Long. Cape Cod Bay is defined by the following coordinates: 42-04.8 N. Lat., 70-10 W. Long.; 42-10 N. Lat., 70-15 W. Long.; 42-12 N. Lat., 70-30 W. Long.; 41-46.8 N. Lat., 70-30 W. Long.; and on the south and east by the interior shoreline of Cape Cod.

(B) Year-round, the following activities are prohibited within the Northeast Right Whale Mitigation Area:

(*1*) Improved extended echo ranging sonobuoy exercises in or within 5.6 km (3 nm) of the mitigation area.

(*2*) Bombing exercises (explosive and non-explosive)

(*3*) Underwater detonations

(*4*) Torpedo exercises (explosive)

(C) Prior to transiting or training in the Northeast Right Whale Mitigation Area, ships and submarines shall contact the Northeast Right Whale Sighting Advisory System to obtain the latest whale sightings and other information needed to make informed decisions regarding safe speed and path of intended movement.

(D) The following specific mitigation measures apply to activities occurring within the Northeast Right Whale Mitigation Area:

(*1*) When transiting within the Northeast Right Whale Mitigation Area, vessels shall exercise extreme caution and proceed at a slow safe speed. The speed shall be the slowest safe speed that is consistent with mission, training, and operations.

(*2*) Speed reductions (adjustments) are required when a North Atlantic right whale is sighted by a vessel, when the vessel is within 9 km (5 nm) of a sighting reported within the past week, or when operating at night or during periods of poor visibility.

(*3*) When conducting TORPEXs, the following additional speed restrictions shall be required: during transit, surface vessels and submarines shall maintain a speed of no more than 19 km/hour (10 knots); during torpedo firing exercises, vessel speeds should, where feasible, not exceed 10 knots; when a submarine is used as a target, vessel speeds should, where feasible, not exceed 18 knots; when surface vessels are used as targets, vessels may exceed 18 knots for a short period of time (e.g., 10–15 minutes).

(*4*) Vessels shall avoid head-on approaches to North Atlantic right whales(s) and shall maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when a change of course would create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in their ability to maneuver.

(*5*) Non-explosive torpedo testing shall be conducted during daylight hours only in Beaufort sea states of 3 or less to increase the probability of marine mammal detection.

(*6*) Non-explosive torpedo testing activities shall not commence if concentrations of floating vegetation (*Sargassum* or kelp patties) are observed in the vicinity.

(*7*) Non-explosive torpedo testing activities shall cease if a marine mammal is visually detected within the immediate vicinity of the activity. The tests may recommence when any one of the following conditions are met: the animal is observed exiting the immediate vicinity of the activity; the animal is thought to have exited the immediate vicinity based on its course and speed; or the immediate vicinity of the activity has been clear from any additional sightings for a period of 30 minutes.

(iii) North Atlantic Right Whale Mid-Atlantic Migration Corridor

(A) The Mid-Atlantic Right Whale Mitigation Area consists of the following areas:

(*1*) Block Island Sound: the area bounded by 40-51-53.7 N. Lat., 70-36-44.9 W. Long.; and 41-20-14.1 N. Lat., 70-49-44.1 W. Long.

(*2*) New York and New Jersey: 37 km (20 nm) seaward of the line between 40-29-42.2 N. Lat., 73-55-57.6 W. Long.

(*3*) Delaware Bay: 38-52-27.4 N. Lat., 75-01-32.1 W. Long.

(*4*) Chesapeake Bay: 37-00-36.9 N. Lat., 75-57-50.5 W. Long.

(*5*) Morehead City, North Carolina: 34-41-32 N. Lat., 76-40-08.3 W. Long.

(*6*) Wilmington, North Carolina, through South Carolina, and to Brunswick, Georgia: within a continuous area 37 km (20 nm) from shore and west back to shore bounded by 34-10-30 N. Lat., 77-49-12 W. Long.; 33-56-42 N. Lat., 77-31-30 W. Long.; 33-36-30 N. Lat., 77-47-06 W. Long.; 33-28-24 N. Lat., 78-32-30 W. Long.; 32-59-06 N. Lat., 78-50-18 W. Long.; 31-50 N. Lat., 80-33-12 W. Long.; 31-27 N. Lat., 80-51-36 W. Long.

(B) Between November 1 and April 30, when transiting within the Mid-Atlantic Right Whale Mitigation Area, vessels shall exercise extreme caution and proceed at a slow safe speed. The speed shall be the slowest safe speed that is consistent with mission, training, and operations.

(iv) Planning Awareness Areas.

(A) The Navy shall avoid planning exercises involving the use of active sonar in the specified planning

awareness areas (PAAs—see Figure 11-1 in the Navy's LOA application) where feasible. Should national security require the conduct of more than five major exercises (C2X, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year, the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.

(4) *Stranding Response Plan.*

(i) The Navy shall abide by the current Stranding Response Plan for Major Navy Training Exercises in the Study Area, to include the following measures:

(A) Shutdown Procedures—When an Uncommon Stranding Event (USE—defined in § 218.71(b)(1)) occurs during a Major Training Exercise (MTE) in the AFTT Study Area, the Navy shall implement the procedures described below.

(*1*) The Navy shall implement a shutdown (as defined § 218.81(b)(2)) when advised by a NMFS Office of Protected Resources Headquarters Senior Official designated in the AFTT Study Area Stranding Communication Protocol that a USE involving live animals has been identified and that at least one live animal is located in the water. NMFS and the Navy will maintain a dialogue, as needed, regarding the identification of the USE and the potential need to implement shutdown procedures.

(*2*) Any shutdown in a given area shall remain in effect in that area until NMFS advises the Navy that the subject(s) of the USE at that area die or are euthanized, or that all live animals involved in the USE at that area have left the area (either of their own volition or herded).

(*3*) If the Navy finds an injured or dead animal floating at sea during an MTE, the Navy shall notify NMFS immediately or as soon as operational security considerations allow. The Navy shall provide NMFS with species or description of the animal(s), the condition of the animal(s), including carcass condition if the animal(s) is/are dead, location, time of first discovery, observed behavior (if alive), and photo or video (if available). Based on the information provided, NFMS will determine if, and advise the Navy whether a modified shutdown is appropriate on a case-by-case basis.

(*4*) In the event, following a USE, that qualified individuals are attempting to herd animals back out to the open ocean and animals are not willing to leave, or animals are seen repeatedly heading for the open ocean but turning back to shore, NMFS and the Navy shall coordinate (including an investigation of other potential anthropogenic stressors in the area) to determine if the proximity of mid-frequency active sonar training activities or explosive detonations, though farther than 14 nautical miles from the distressed animal(s), is likely contributing to the animals' refusal to return to the open water. If so, NMFS and the Navy will further coordinate to determine what measures are necessary to improve the probability that the animals will return to open water and implement those measures as appropriate.

(B) Within 72 hours of NMFS notifying the Navy of the presence of a USE, the Navy shall provide available information to NMFS (per the AFTT Study Area Communication Protocol) regarding the location, number and types of acoustic/explosive sources, direction and speed of units using mid-frequency active sonar, and marine mammal sightings information associated with training activities occurring within 80 nautical miles (148 km) and 72 hours prior to the USE event. Information not initially available regarding the 80-nautical miles (148-km), 72-hour period prior to the event will be provided as soon as it becomes available. The Navy will provide NMFS investigative teams with additional relevant unclassified information as requested, if available.

(ii) [Reserved]

(b) [Reserved]

§ 218.85 Requirements for monitoring and reporting.

(a) As outlined in the AFTT Study Area Stranding Communication Plan, the Holder of the Authorization must notify NMFS immediately (or as soon as clearance procedures allow) if the specified activity identified in § 218.80 is thought to have resulted in the mortality or injury of any marine mammals, or in any take of marine mammals not identified in § 218.81.

(b) The Holder of the LOA must conduct all monitoring and required reporting under the LOA, including abiding by the AFTT Monitoring Plan.

(c) General Notification of Injured or Dead Marine Mammals—Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, an Navy training or testing activity utilizing mid- or high-frequency active sonar, or underwater explosive detonations. The Navy shall provide NMFS with species identification or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The Navy shall consult the Stranding Response Plan to obtain more specific reporting requirements for specific circumstances.

(d) Annual AFTT Monitoring Plan Report—The Navy shall submit an annual report describing the implementation and results of the AFTT Monitoring Plan, described in this section. Data collection methods will be standardized across range complexes and study areas to allow for comparison in different geographic locations. Although additional information will be gathered, the protected species observers collecting marine mammal data pursuant to the AFTT Monitoring Plan shall, at a minimum, provide the same marine mammal observation data required in this section. The AFTT Monitoring Plan may be provided to NMFS within a larger report that includes the required Monitoring Plan reports from multiple range complexes and study areas.

(e) Annual AFTT Exercise Report—The Navy shall submit an annual AFTT Exercise Report. This report shall contain information identified in paragraphs (e)(1) through (5) of this section.

(1) MFAS/HFAS Major Training Exercises—This section shall contain the following information for Major Training Exercises conducted in the AFTT Study Area:

(i) Exercise Information (for each MTE):

(A) Exercise designator.

(B) Date that exercise began and ended.

(C) Location.

(D) Number and types of active sources used in the exercise.

(E) Number and types of passive acoustic sources used in exercise.

(F) Number and types of vessels, aircraft, etc., participating in exercise.

(G) Total hours of observation by watchstanders.

(H) Total hours of all active sonar source operation.

(I) Total hours of each active sonar source bin.

(J) Wave height (high, low, and average during exercise).

(ii) Individual marine mammal sighting info (for each sighting in each MTE).

(A) Location of sighting.

(B) Species (if not possible, indication of whale/dolphin/pinniped).

(C) Number of individuals.

(D) Calves observed (y/n).

(E) Initial Detection Sensor.
(F) Indication of specific type of platform observation made from (including, for example, what type of surface vessel, i.e., FFG, DDG, or CG).
(G) Length of time observers maintained visual contact with marine mammal.
(H) Wave height (in feet).
(I) Visibility.
(J) Sonar source in use (y/n).
(K) Indication of whether animal is <200 yd, 200 to 500 yd, 500 to 1,000 yd, 1,000 to 2,000 yd, or >2,000 yd from sonar source in paragraph (e)(1)(ii)(J) of this section.
(L) Mitigation Implementation—Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.
(M) If source in use (see paragraph (e)(1)(ii)(J) of this section) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel).
(N) Observed behavior—Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/speed, floating on surface and not swimming, etc.).
(iii) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing animals to mid-frequency active sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.
(2) ASW Summary—This section shall include the following information as summarized from both MTEs and non-major training exercises (i.e., unit-level exercises, such as TRACKEXs):
(i) Total annual hours of each sonar source bin.
(ii) Cumulative Impact Report—To the extent practicable, the Navy, in coordination with NMFS, shall develop and implement a method of annually reporting non-major training exercises utilizing hull-mounted sonar. The report shall present an annual (and seasonal, where practicable) depiction of non-major training exercises geographically across the AFTT Study Area. The Navy shall include (in the AFTT annual report) a brief annual progress update on the status of development until an agreed-upon (with NMFS) method has been developed and implemented.
(3) SINKEXs—This section shall include the following information for each SINKEX completed that year:
(i) Exercise information (gathered for each SINKEX):
(A) Location.
(B) Date and time exercise began and ended.
(C) Total hours of observation by watchstanders before, during, and after exercise.
(D) Total number and types of explosive source bins detonated.
(E) Number and types of passive acoustic sources used in exercise.
(F) Total hours of passive acoustic search time.
(G) Number and types of vessels, aircraft, etc., participating in exercise.
(H) Wave height in feet (high, low, and average during exercise).
(I) Narrative description of sensors and platforms utilized for marine mammal detection and timeline illustrating how marine mammal detection was conducted.
(ii) Individual marine mammal observation (by Navy lookouts) information (gathered for each marine mammal sighting):
(A) Location of sighting.
(B) Species (if not possible, indicate whale, dolphin, or pinniped).
(C) Number of individuals.
(D) Whether calves were observed.
(E) Initial detection sensor.
(F) Length of time observers maintained visual contact with marine mammal.
(G) Wave height.
(H) Visibility.
(I) Whether sighting was before, during, or after detonations/exercise, and how many minutes before or after.
(J) Distance of marine mammal from actual detonations (or target spot if not yet detonated).
(K) Observed behavior—Watchstanders will report, in plain language and without trying to categorize in any way, the observed behavior of the animal(s) (such as animal closing to bow ride, paralleling course/speed, floating on surface and not swimming etc.), including speed and direction.
(L) Resulting mitigation implementation—Indicate whether explosive detonations were delayed, ceased, modified, or not modified due to marine mammal presence and for how long.
(M) If observation occurs while explosives are detonating in the water, indicate munition type in use at time of marine mammal detection.
(4) IEER Summary—This section shall include an annual summary of the following IEER information:
(i) Total number of IEER events conducted in the AFTT Study Area.
(ii) Total expended/detonated rounds (buoys).
(iii) Total number of self-scuttled IEER rounds.
(5) Explosives Summary—To the extent practicable, the Navy will provide the information described below for all of their explosive exercises. Until the Navy is able to report in full the information below, they will provide an annual update on the Navy's explosive tracking methods, including improvements from the previous year.
(i) Total annual number of each type of explosive exercises (of those identified as part of the "specified activity" in this subpart) conducted in the AFTT Study Area.
(ii) Total annual expended/detonated rounds (missiles, bombs, etc.) for each explosive source bin.
(f) Sonar Exercise Notification—The Navy shall submit to the NMFS Office of Protected Resources (specific contact information to be provided in LOA) either an electronic (preferably) or verbal report within fifteen calendar days after the completion of any major exercise (COMPTUEX, JTFEX, SEASWITI or similar scale event) indicating:
(1) Location of the exercise.
(2) Beginning and end dates of the exercise.
(3) Type of exercise (e.g., COMPTUEX, JTFEX, SEASWITI or similar scale event).
(g) AFTT Study Area 5-yr Comprehensive Report—The Navy shall submit to NMFS a draft report that analyzes and summarizes all of the multi-year marine mammal information gathered during ASW and explosive exercises for which annual reports are required (Annual AFTT Exercise Reports and AFTT Monitoring Plan reports). This report will be submitted at the end of the fourth year of the rule (November 2018), covering activities that have occurred through June 1, 2018.
(h) Comprehensive National ASW Report—By June 2019, the Navy shall submit a draft Comprehensive National Report that analyzes, compares, and summarizes the active sonar data gathered (through January 1, 2019) from the watchstanders in accordance with the Monitoring Plans for HSTT, AFTT, MITT, and NWTT.
(i) The Navy shall respond to NMFS' comments and requests for additional information or clarification on the AFTT Comprehensive Report, the draft National ASW report, the Annual AFTT Exercise Report, or the Annual AFTT Monitoring Plan report (or the multi-Range Complex Annual Monitoring Plan Report, if that is how the Navy chooses to submit the information) if submitted within 3 months of receipt. These

reports will be considered final after the Navy has addressed NMFS' comments or provided the requested information, or three months after the submittal of the draft if NMFS does not provide comment.

§ 218.86 Applications for Letters of Authorization.

To incidentally take marine mammals pursuant to the regulations in this subpart, the U.S. citizen (as defined by § 216.106 of this chapter) conducting the activity identified in § 218.80(c) (the U.S. Navy) must apply for and obtain either an initial LOA in accordance with § 218.87 or a renewal under § 218.88.

§ 218.87 Letters of Authorization.

(a) An LOA, unless suspended or revoked, will be valid for a period of time not to exceed the period of validity of this subpart.

(b) Each LOA will set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact on the species, its habitat, and on the availability of the species for subsistence uses (i.e., mitigation); and

(3) Requirements for mitigation, monitoring and reporting.

(c) Issuance and renewal of the LOA will be based on a determination that the total number of marine mammals taken by the activity as a whole will have no more than a negligible impact on the affected species or stock of marine mammal(s).

§ 218.88 Renewal of Letters of Authorization.

(a) A Letter of Authorization issued under § 216.106 of this chapter and § 218.87 for the activity identified in § 218.80(c) will be renewed based upon:

(1) Notification to NMFS that the activity described in the application submitted under this sectionwill be undertaken and that there will not be a substantial modification to the described work, mitigation, or monitoring undertaken during the upcoming period of validity;

(2) Timely receipt (by the dates indicated in this subpart) of the monitoring reports required under § 218.85(c) through (j); and

(3) A determination by the NMFS that the mitigation, monitoring, and reporting measures required under § 218.84 and the LOA issued under § 216.106 of this chapter and § 218.87, were undertaken and will be undertaken during the upcoming period of validity of a renewed Letter of Authorization.

(b) If a request for a renewal of an LOA issued under this § 216.106 of this chapter and § 218.87 indicates that a substantial modification, as determined by NMFS, to the described work, mitigation or monitoring undertaken during the upcoming season will occur, NMFS will provide the public a period of 30 days for review and comment on the request. Review and comment on renewals of LOAs are restricted to:

(1) New cited information and data indicating that the determinations made in this document are in need of reconsideration; and

(2) Proposed changes to the mitigation and monitoring requirements contained in these regulations or in the current LOA.

(c) A notice of issuance or denial of an LOA renewal will be published in the **Federal Register**.

(d) NMFS, in response to new information and in consultation with the Navy, may modify the mitigation or monitoring measures in subsequent LOAs if doing so creates a reasonable likelihood of more effectively accomplishing the goals of mitigation and monitoring. Below are some of the possible sources of new data that could contribute to the decision to modify the mitigation or monitoring measures:

(1) Results from the Navy's monitoring from the previous year (either from the AFTT Study Area or other locations).

(2) Compiled results of Navy-funded research and development (R&D) studies (presented pursuant to the ICMP (§ 218.85(d)).

(3) Results from specific stranding investigations (either from the AFTT Study Area or other locations, and involving coincident mid- or high-frequency active sonar or explosives training or not involving coincident use).

(4) Results from the Long Term Prospective Study.

(5) Results from general marine mammal and sound research (funded by the Navy (or otherwise).

§ 218.89 Modifications to Letters of Authorization.

(a) Except as provided in paragraph (b) of this section, no substantive modification (including withdrawal or suspension) to the LOA by NMFS, issued pursuant to § 216.106 of this chapter and § 218.87 and subject to the provisions of this subpart shall be made until after notification and an opportunity for public comment has been provided. For purposes of this paragraph, a renewal of an LOA under § 218.88, without modification (except for the period of validity), is not considered a substantive modification.

(b) If the Assistant Administrator determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 218.82(c), an LOA issued pursuant to § 216.106 of this chapter and § 218.87 may be substantively modified without prior notification and an opportunity for public comment. Notification will be published in the **Federal Register** within 30 days subsequent to the action.

[FR Doc. 2013–01817 Filed 1–25–13; 11:15 am]

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APPENDIX C

AGENCY CORRESPONDENCE

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APPENDIX C AGENCY CORRESPONDENCE

Appendix C contains the correspondence between the Navy and federal or state agencies with respect to cooperating agency status (Section C.1), Coastal Zone Management Act (Section C.2), Endangered Species Act (Section C.3), Magnuson-Stevens Fishery Conservation and Management Act (Section C.4), Marine Mammal Protection Act (Section C.5), the National Historic Preservation Act (Section C.6), and Executive Order (EO) 13175, *Consultation and Coordination with Indian Tribal Governments* (Section C.7).

C.1 COOPERATING AGENCY STATUS

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser N456D/10U158199
21 July 2010

Mr. Eric C. Schwaab
Assistant Administrator
National Marine Fisheries Service
1315 East West Highway
Silver Spring, MD 20910

Dear Mr. Schwaab: Eric

In accordance with the National Environmental Policy Act (NEPA), the Department of the Navy (Navy) is initiating the preparation of an Environmental Impact Statement (EIS)/Overseas EIS (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (RDT&E) activities conducted within the Atlantic Fleet Training and Testing (AFTT) study area. The AFTT study area includes the Western North Atlantic Ocean along the East Coast of North America, the Chesapeake Bay, and the Gulf of Mexico (including the area where the Undersea Warfare Training Range will be operated). Also included are select Navy pier-side locations and channels. The AFTT study area does not include the Arctic.

The AFTT EIS/OEIS will consolidate five previous EIS/OEISs that cover most of the AFTT study area into a single EIS/OEIS analyses: the Atlantic Fleet Active Sonar Training (AFAST), the Virginia Capes (VACAPES) Range Complex, the Navy Cherry Point Range Complex, the Jacksonville Range Complex and the Naval Surface Warfare Center Panama City Range Complex. In addition, Navy is currently finalizing the Gulf of Mexico (GOMEX) Range Complex EIS/OEIS that is expected to be complete in late 2010.

An important aspect of the AFTT EIS/OEIS will be the anaylsis of the acoustic effects to marine species protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The AFTT EIS/OEIS is also intended to serve as a basis for the renewal of current regulatory permits and authorizations, the earliest expiring in January 2014; address current training and testing not covered under the existing permits and authorizations; and obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements.

To complete the analysis required by the permitting and consultation processes, the Navy and the National Marine Fisheries Services (NMFS) will need to work together. Therefore, in accordance with the Council on Environmental Quality's (CEQ) NEPA guidelines

(specifically, 40 CFR Part 1501) and CEQ's 2002 guidance on cooperating agencies, Navy requests NMFS serve as a cooperating agency for the development of the AFTT EIS/OEIS.

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that will include, but not be limited to, the following:

- Gathering all necessary background information and preparing all necessary permit applications associated with the proposed action.
- Working with NMFS personnel to determine the method of estimating potential effects to protected marine species, including threatened and endangered species.
- Determining the scope of the EIS/OEIS, including the alternatives evaluated.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising meetings held in support of the NEPA process and compiling any comments received.
- Maintaining an administrative record and responding to any Freedom of Information Act requests relating to the EIS/OEIS.

Navy respectfully requests that NMFS, in its role as a cooperating agency, provide support as follows:

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the EIS/OEIS process) and on working drafts of the EIS/OEIS documents. The Navy requests that comments on draft EIS/OEIS documents (Version 2) be provided within 30 working days.
- Responding to Navy requests for information, in particular related to review of the acoustic effects analysis and evaluation of the effectiveness of protection and mitigation measures.
- Coordinating, to the maximum extent practicable, any public comment periods required in the MMPA permitting process with the Navy's NEPA public comment periods.
- Participating, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS, including public hearings/meetings.

2

- Adhering to the overall schedule as set forth by the Navy.
- Providing a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the AFTT EIS/OEIS. NMFS assistance will be invaluable in this endeavor.

The point of contact for this action is Ms. Dawn Schroeder, (703) 602-4769, email: Dawn.Schroeder@navy.mil.

John Quinn

JOHN P. QUINN
Deputy Director, Energy and Environmental Readiness Division (OPNAV N45)

Copy to:
ASN (EI&E)
DASN (E)
OAGC (EI&E)
Commander, U.S. Fleet Forces Command (N73, N77)
Commander, U.S. Pacific Fleet (N01CE, N7)
Commander, Navy Installations Command (N45)
Commander, Navy Region Southeast (N45)
Commander, Navy Region MIDLANT (N45)

Eric – Thanks in advance for your help as we cooperate to achieve both our missions.

John

3

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

THE DIRECTOR

Mr. John P. Quinn
Deputy Director, Energy and
Environmental Readiness Division
Department of the Navy
2000 Navy Pentagon
Washington, DC 20350-2000

AUG 27 2010

Dear Mr. Quinn: John

Thank you for your letter requesting that NOAA's National Marine Fisheries Service (NMFS) participate as a cooperating agency in the preparation of an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate potential environmental effects of military readiness training and research, development, testing, and evaluation (RDT&E) activities conducted within the Atlantic Fleet Training and Testing (AFTT) study area. We support the Navy's decision to prepare an EIS/OEIS on these activities and agree to be a cooperating agency, due, in part, to our responsibilities under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) and section 7 of the Endangered Species Act.

In response to your letter, NMFS staff will, to the extent possible,

- Provide timely review and comments, within 30 working days, after the Agency Information Meeting and on working drafts of the EIS/OEIS documents;
- Respond to Navy requests for information, in particular those related to the acoustic effects analysis and the evaluation of the effectiveness of protection and mitigation measures, in a timely manner;
- Coordinate, when logistically feasible, any public comment periods required by the MMPA with the Navy's NEPA public comment periods;
- Participate in meetings, as necessary, hosted by the Navy to discuss issues related to the EIS/OEIS, including public hearings on the draft EIS/OEIS, and;
- Adhere to the overall schedule as agreed upon by NMFS and the Navy.

If you need any additional information, please contact Ms. Jolie Harrison, NMFS Office of Protected Resources, at (301) 713-2289.

Sincerely,

Eric C. Schwaab

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

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C.2 COASTAL ZONE MANAGEMENT ACT

Under the CZMA, states/territories have 60 days to respond to federal consistency reviews or their concurrence is assumed. Consistency determinations were submitted to 18 states and 2 territories adjacent to the Study Area. Letters indicating concurrence were received from 16 states/territories as of 14 March 2013. Concurrence was assumed for the four remaining states/territories (Rhode Island, South Carolina, Texas, and the U.S. Virgin Islands).

C.2.1 ALABAMA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1079
December 12, 2012

Mr. Scott Brown, Program Chief
Coastal Programs Office
Department of Environmental Management
4171 Commanders Drive
Mobile, AL 36615

Dear Mr. Brown:

In accordance with the Coastal Zone Management Act (16 United States Code §1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Alabama's Coastal Area Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be fully consistent with Alabama's Coastal Area Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

LANCE R. LEFLEUR
DIRECTOR

ROBERT J. BENTLEY
GOVERNOR

Alabama Department of Environmental Management
adem.alabama.gov
1400 Coliseum Blvd. 36110-2400 ■ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ■ FAX (334) 271-7950

February 13, 2013

J.W. MURPHY, DEPUTY CHIEF OF STAFF
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK VA 23551-2487

RE: State of Alabama Coastal Consistency Determination
Atlantic Fleet Training and Testing
ADEM Tracking Number: 2013-071-NAVY

Dear Mr. Murphy:

Reference is made to the December 12, 2012, request for the State of Alabama's coastal consistency determination regarding the referenced proposal. A coastal consistency determination was requested pursuant to 15 CFR § 930, et seq. and Section 307 of the Coastal Zone Management Act of 1972, as amended.

Based upon review of the information submitted with the request for a coastal zone management consistency determination, the activity should not result in significant negative impacts to Alabama's coastal resources pursuant to ADEM Administrative Code Rule 335-8-2-.01 (2(b&c)). Furthermore, the proposal appears to be in the national interest and as such would be considered a use of regional benefit under the administrative code. Therefore, the ADEM concurs with the Department of the Navy's statement of coastal consistency.

If you have any questions, please contact Allen Phelps of the ADEM Coastal/Facility Section office in Mobile at 251/432-6533.

Sincerely,

Steven O. Jenkins, Chief
Field Operations Division

SOJ/cap File: CZCERT/

e-copy: Chris Denson, ADCNR-MRD
Richard J. Nissen, Navy

Birmingham Branch
110 Vulcan Road
Birmingham, AL 35209-4702
(205) 942-6168
(205) 941-1603 (FAX)

Decatur Branch
2715 Sandlin Road, S. W.
Decatur, AL 35603-1333
(256) 353-1713
(256) 340-9359 (FAX)

Mobile Branch
2204 Perimeter Road
Mobile, AL 36615-1131
(251) 450-3400
(251) 479-2593 (FAX)

Mobile-Coastal
4171 Commanders Drive
Mobile, AL 36615-1421
(251) 432-6533
(251) 432-6598 (FAX)

C.2.2 CONNECTICUT

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1080
December 12, 2012

Mr. David Blatt
Office of Long Island Sound Programs
Department of Environmental Protection
79 Elm Street, 3rd Floor
Hartford, CT 06106-5127

Dear Mr. Blatt:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Connecticut's Coastal Management Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with Connecticut's Coastal Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

Connecticut Department
of
ENERGY &
ENVIRONMENTAL
PROTECTION

February 26, 2013

Richard J. Nissen
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue Suite 250
Norfolk, VA 23551-2487

RE: Federal Consistency Determination for Proposed Activities in the Atlantic Fleet Training and Testing Study Area for Connecticut

Dear Mr.Nissen:

This Office has reviewed your request for federal consistency concurrence to conduct training and testing activities in Connecticut as shown in materials received by this Office on December 18, 2012 pursuant to section 307(c)(1) of the Coastal Zone Management Act of 1972, as amended, and Subpart C of 15 Code of Federal Regulations (CFR), Part 930. Based on a review of the proposed activities as described in the above-referenced plans and the application received by this Office, we concur with your determination that the activities as proposed are consistent with Connecticut's federally approved Coastal Management Program and will be conducted in a manner consistent with that program.

Please be advised that any subsequent modifications to the proposed activity, regardless of their magnitude or impact, constitute a new application for the purposes of federal consistency certification. Accordingly, all such modifications must be submitted to this Office for a coastal consistency concurrence pursuant to 15 CFR 930.50.

Thank you for providing a consistency determination and supporting information for our review. Should you have any questions regarding this consistency determination or any other coastal management matter, please contact Kristal Kallenberg in the Office of Long Island Sound Programs at (860) 424-3760 or Kristal.Kallenberg@ct.gov.

Yours truly,

Betsey C. Wingfield, Chief
Bureau of Water Protection and Land Reuse

BCW/kk

cc: J.W. Murphy, Deputy Chief of Staff for Fleet Installations, Dept. of the Navy

79 Elm Street • Hartford, CT 06106-5127
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C.2.3 DELAWARE

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1081
December 12, 2012

Ms. Sarah Cooksey
Delaware Coastal Programs
5 East Reed Street
Dover, DE 19901
Phone: (302) 739-9283 / Fax: (302) 739-2048

Dear Ms. Cooksey:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456 (c)) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Delaware's Coastal Management Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be consistent to the maximum extent practicable with Delaware's Coastal Management Program. The Navy is unable to be fully consistent with the program, because doing so would limit the Navy's ability to fulfill its mission as mandated by federal law (Title 10 U.S.C. § 5062), which charges the Chief of Naval Operations with the responsibility for ensuring the readiness of the nation's naval forces.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENTAL CONTROL

DELAWARE COASTAL MANAGEMENT PROGRAM

89 KINGS HIGHWAY
DOVER, DELAWARE 19901

Phone: (302) 739- 9283
Fax: (302) 739-2048

February 8, 2013

J.W. Murphy
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue Suite 250
Norfolk, VA 23551-2487

Re: United States Navy's Atlantic Fleet Training and Testing DEIS/Overseas EIS
Delaware Coastal Management Federal Consistency Certification (FC# 2013.0033)

Dear Mr. Murphy,

The Delaware Coastal Management Program (DCMP) received your consistency determination for the Draft Environmental Impact Statement (EIS) and Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing on December 14, 2012. The Draft EIS identified the area as seaward of the mean high tide line east to the 45 degree west longitude line, covering approximately 2.6 million square nautical miles. Based upon our review and pursuant to National Oceanic & Atmospheric Administration regulations (15 CFR 930), the DCMP concurs with your consistency certification for the above referenced project.

While the DCMP concurs with this determination, please be advised of the following comments pertaining to the air quality analysis provided in the DEIS and we ask that Final EIS address these concerns:

- The emissions estimates for the criteria pollutants are summarized by the testing range complexes, and it is not clear what portions of the Virginia Capes and Northeast Range Complex emissions are attributable to Delaware. We suspect that the emissions estimates provided in these reports account for the operations in the entire testing range complexes. If so, it is not clear how to assign emissions to the outer continental shelf within Delaware's borders. Emissions inventories maintained by the Delaware Department of Natural Resources and Environmental Control include emissions from sources within 25 miles of state waters; so these emissions would represent an increase in the state emissions inventory. As the emissions estimates for the proposed operations attributable to Delaware are not provided, it is unknown if these emissions will be subjected to the Prevention of Significant Deterioration (PSD) thresholds.

- No air quality modeling was conducted to assess whether the emissions would have significant impact on Delaware's air quality. However, the documents state that the natural mixing would substantially disperse the pollutants before they reach the shore and the distances travelled are large, and therefore, the impacts are insignificant. The proposed operations could produce emissions as close as 3 nautical miles of the shore. The conclusions of no impact should be supported by atmospheric modeling results not general assumptions.

Delaware's good nature depends on you!

- Hazardous Air Pollutant (HAP) emissions resulting from the proposed operations are not estimated. The documents state that there will be no health effects from the resulting HAP emissions; the HAPs emitted are minute; the emissions are released in a remote area, and HAPs would be diluted through mixing. These conclusions should be based on some numeric analysis which we could not find in the available documents.

If you have any questions, please contact me or Tricia Arndt of my staff at (302) 739-9283.

Sincerely,

Sarah W. Cooksey, Administrator

SWC/tka

cc: Collin P. O'Mara, DNREC
File: 2013.0033

C.2.4 FLORIDA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1077
December 12, 2012

Ms. Kelly Samek
Florida Coastal Management Program
Department of Environmental Protection
3900 Commonwealth Boulevard
Douglas Building, Mail Station 47
Tallahassee, FL 32399-3000

Dear Ms. Samek:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy has reviewed Florida's Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be consistent to the maximum extent practicable with Florida's Coastal Management Program. The Navy cannot be fully consistent with the program because doing so would limit the Navy's ability to fulfill its mission as mandated by federal law (Title 10 U.S.C. § 5062), which charges the Chief of Naval Operations with the responsibility for ensuring the readiness of the nation's naval forces.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MARJORY STONEMAN DOUGLAS BUILDING
3900 COMMONWEALTH BOULEVARD
TALLAHASSEE, FLORIDA 32399-3000

RICK SCOTT
GOVERNOR

JENNIFER CARROLL
LT. GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

February 22, 2013

Mr. Richard Jene Nissen
U.S. Fleet Forces Command
Department of the Navy
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

RE: U.S. Department of the Navy – Consistency Determination – Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for Navy Atlantic Fleet Training and Testing in the North Atlantic Ocean and Gulf of Mexico. SAI # FL201212216455C (Reference Prior SAI # FL201205166230)

Dear Mr. Nissen:

The Florida State Clearinghouse has coordinated a review of the Department of the Navy's Consistency Determination for the Atlantic Fleet Training and Testing (AFTT) project under the following authorities: Presidential Executive Order 12372; § 403.061(42), *Florida Statutes*; the Coastal Zone Management Act (CZMA), 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

The Florida Department of Environmental Protection's (DEP) Outer Continental Shelf Program staff recommends the following as the Navy proceeds with development of the final EIS/OEIS and implementation of activities described therein:

- Site-specific information collected and analyzed in the *JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Jacksonville, Florida – Final Cruise Report* (December 31, 2010) should be used in habitat descriptions in the final EIS/OEIS.
- In July 2009, the State of Florida conditionally concurred with the Navy's determination that the planning, design and construction phase of the Navy's Undersea Warfare Training Range (USWTR) project – located offshore Jacksonville, Florida – was consistent with the Florida Coastal Management Program. The state's concurrence was conditioned upon the Navy conducting a benthic habitat study of the area to determine the location and types of sensitive resources and working with the state to determine the areas that should be avoided during planning, designing and constructing the sonar grid for USWTR. The DEP appreciates the Navy's efforts to date to comply with the state's conditions by having a benthic habitat survey conducted and results reported in the *JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Jacksonville, Florida – Final Cruise Report* (December 31, 2010).

Florida State Clearinghouse

- The state would appreciate the opportunity to review the video and still photography collected during the study, and the opportunity to work cooperatively with the Navy to determine the best location for cable routes and sonar nodes in relation to benthic resources.
- The DEP continues to recommend that all bottom-disturbing activities avoid the North Florida Marine Protected Area offshore Jacksonville and all hard/live-bottom habitats.
- The DEP Beaches, Mining and Environmental Resource Permit Support Program requests that sand borrow areas be avoided during exercises involving expendable munitions testing and training. The DEP offers its assistance to the Navy in identifying sand borrow areas, as plans are developed.

For additional information and assistance, please contact Ms. Debby Tucker at (850) 245-2181 or Debby.Tucker@dep.state.fl.us.

Florida Fish and Wildlife Conservation Commission (FWC) notes that the Navy recognizes the "growing issues of ship strikes on marine mammals, including right whales," and the FWC reiterates the importance of the project area's proximity to habitat vital to right whale calving. Although the indefinite timeframe and potential cumulative impacts of the proposed activities may affect right whale habitat quality and increase the risk of watercraft-related injury or mortality, the draft EIS/OEIS also references the early warning system (EWS) aerial surveys, which are critically important for right whale ship-strike mitigation. The FWC commends the Navy's support of the EWS surveys and recognizes the role that the Fleet Area Control and Surveillance Facility in Jacksonville plays in the dissemination of right whale sightings. The FWC notes the possibility that more frequent and extensive airspace restrictions could further limit the mitigation effectiveness of EWS surveys. Therefore, the FWC continues to recommend that the Navy work closely with the National Marine Fisheries Service to develop adaptive management approaches to support effective mitigation for marine mammals.

The FWC finds the draft EIS/OEIS consistent with its authorities under Florida's Coastal Zone Management Program. As additional project information becomes available, the FWC may have additional comments regarding appropriate conservation measures. Please refer to the enclosed FWC letters and contact Ms. Mary Duncan at Mary.Duncan@MyFWC.com or (850) 922-4330 for further information.

Based on the information contained in the AFTT Consistency Determination, the draft EIS/OEIS and the comments provided by our reviewing agencies, the state has determined that the proposed activities are consistent to the maximum extent practicable with the enforceable policies of the Florida Coastal Management Program (FCMP). Pursuant to 15 C.F.R. 930.45(a), federal and state agencies will cooperate on monitoring the approved activities to ensure the Navy continues to undertake them in a manner consistent with the FCMP to the maximum extent practicable. The state's continued concurrence will be based on the activities' continued compliance with FCMP authorities, as well as the adequate resolution of issues identified during this and any subsequent reviews.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Ms. Lauren P. Milligan at Lauren.Milligan@dep.state.fl.us or (850) 245-2170.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm
Enclosure

cc: Debby Tucker, DEP, OIP
Roxane Dow, DEP, BMESP
Scott Sanders, FWC
Lesley Dobbins, Department of the Navy

Florida State Clearinghouse

C.2.5 GEORGIA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1082
December 12, 2012

Ms. Kelie Moore
Coastal Zone Management Program
Department of Natural Resources
One Conservation Way, Suite 300
Brunswick, GA 31520-8687

Dear Ms. Moore:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess potential environmental impacts in the Study Area (Study Area). The proposed activities evaluated in the Draft EIS/OEIS are associated with Navy training and testing activities and associated range capabilities enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Georgia's Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy determined that the Proposed Action in the Study Area will be consistent to the maximum extent practicable with the Georgia Coastal Management Program. The Navy is unable to be fully consistent with the program, because doing so would limit the Navy's ability to fulfill its mission as mandated by federal law (Title 10 U.S.C. § 5062), which charges the Chief of Naval Operations with the responsibility for ensuring the readiness of the nation's naval forces.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/029
February 08, 2013

Mr. A. G. Woodward
Director
Coastal Resources Division
Department of Natural Resources
One Conservation Way
Brunswick, GA 31520-8687

Dear Mr. Woodward:

The United States Navy (Navy) is in receipt of your letter, dated January 2, 2013, requesting additional information on the Navy's Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area. The proposed activities and their potential environmental impacts are analyzed in the Navy's AFTT Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS), which was provided to your office along with our consistency determination letter.

Your letter of January 2, 2013 requested information on five issues: North Atlantic right whale (NARW) abundance and distribution; active sonar; ordnance detonation; vessel strikes; and the Undersea Warfare Training Range (USWTR). You will find each of these areas addressed in the documentation provided with the Navy letter of December 12, 2012. This information has also been highlighted in the attachment to this letter. In addition, we have provided links to the National Marine Fisheries Service (NMFS) Office of Protected Resources website, which is the repository for Navy monitoring reports, as well as the Navy's monitoring website. The Navy believes this information will allow you to make an informed decision.

Your letter also references Georgia Coastal Management Plan enforceable policy (Official Code of Georgia Annotated 27-3-130) regarding the protection of marine wildlife and their habitat. As we have discussed in previous correspondence with your agency, such policies are preempted by the Marine Mammal Protection Act (MMPA) insofar as these policies relate to the taking of marine mammals and are not explicitly authorized under Section 6 of the Endangered Species Act. Georgia Department of Natural Resources (GaDNR) has an opportunity to submit comments to NMFS as part of the AFTT MMPA rulemaking process. NMFS published the AFTT Proposed Rule in the Federal Register on January 31, 2013, and the public comment period runs through March 11, 2013.

5090
Ser N46/029
February 08, 2013

Finally, your January 2, 2013 letter indicated that additional information must be provided to GaDNR before the 60-day review will begin. All information required by 15 CFR §930.39(a) was submitted with the Navy's consistency determination. Moreover, your letter of January 2, 2013 did not meet the 14-day notification period. Therefore, the 60-day review period began on December 17, 2012, the date the GaDNR received the consistency determination and accompanying information. However, as described in §930.41(b), an extension of the review period may be requested.

We appreciate your assistance in this federal consistency process. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: Information for the United States Navy's Federal Consistency Determination for Proposed Activities in the Atlantic Fleet Training and Testing Study Area

2

INFORMATION FOR THE UNITED STATES NAVY'S FEDERAL CONSISTENCY DETERMINATION FOR PROPOSED ACTIVITIES IN THE ATLANTIC FLEET TRAINING AND TESTING STUDY AREA

The United States Navy (Navy) submitted a coastal consistency determination for activities analyzed in the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS) to the Georgia Coastal Management Program by letter dated December 12, 2012. This document highlights information already provided to the Georgia Department of Natural Resources (GaDNR) regarding North Atlantic right whale (NARW) abundance and distribution, active sonar, ordnance detonation, vessel strikes, and the Undersea Warfare Training Range (USWTR). Each of these issues is addressed below.

1) NARW Abundance and Distribution - Sections 3.0.2.2.2.1 and 3.0.2.2.2.2 of the AFTT DEIS/OEIS discuss the ongoing monitoring efforts and the annual reports, which are submitted to the National Marine Fisheries Service (NMFS) per the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS and Jacksonville EIS/OEIS Final Rules and Letters of Authorization. These reports are also posted to the NMFS Office of Protected Resources web site at http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications. The reports have been and will continue to be made available to the public. Information on NARW surveys can also be found in Section 3.4.2.5.3 of the AFTT DEIS/OEIS. Additionally, we have launched a web site for Navy monitoring efforts, including the monitoring reports at http://www.navymarinespeciesmonitoring.us/. As detailed in the reports, there have been no sightings of NARW in the USWTR area.

   The mitigation measures for NARW have been developed in cooperation with NMFS. In compliance with the Endangered Species Act and Marine Mammal Protection Act, all activities conducted by the Navy in NARW critical habitat have been coordinated with NMFS and are addressed in the proposed Final Rule published by NMFS on January 31, 2013.

2) Active Sonar - The level of active sonar occurring in the NARW critical habitat from 15 November to 15 April is provided in Section 5.3.3.1.1.1 of the AFTT DEIS/OEIS. In summary, active sonar in the mitigation area (designated critical habitat plus a 5 nm buffer) is proposed only for navigation training and helicopter dipping sonar testing or maintenance. This is consistent with our current permits issued by NMFS, which have been in place since January 2009. The intensive acoustic modeling effort and analysis of the findings undertaken for the AFTT DEIS/OEIS satisfies the federal regulatory requirements under the Marine Mammal Protection Act permit program and the Coastal Zone Management Act.

   The extent to which active sonar propagates into critical habitat has been studied and the effects analyzed through modeling. The acoustic propagation models are based on the best available science. The models have been validated for worldwide use and there is nothing specific to the waters off the coasts of Georgia or Florida that would alter the modeling results for acoustic propagation. Information regarding the models used by the Navy was provided to GaDNR in August 2009. Further empirical testing to demonstrate what has already been conducted, modeled and analyzed in varying water conditions is unnecessary.

   Tables 3.4-10, 3.4-11, and 3.4-12 of the AFTT DEIS/OEIS address the maximum sound levels of sonar adjacent to the critical habitat. These tables show the range to permanent threshold shift is less than 80 meters for hull mounted sonar systems (the highest source level) and less than 6300 meters for temporary threshold shift. Mitigations currently in place are designed to

Enclosure

INFORMATION FOR THE UNITED STATES NAVY'S FEDERAL CONSISTENCY DETERMINATION FOR PROPOSED ACTIVITIES IN THE ATLANTIC FLEET TRAINING AND TESTING STUDY AREA

prevent permanent threshold shift exposures. The proposed mitigations are the same as the approved mitigations we currently operate under as described in the AFAST EIS/OEIS and associated NMFS permits. The remaining exposures are temporary level B exposures. These conclusions are fully consistent with the AFAST EIS/OEIS analysis.

There is no evidence that sonar increases ambient noise levels. Sonar is not a continuous sound over extended periods of time; it is intermittent with events lasting on the order of hours. The energy from sonar attenuates to below ambient levels relatively quickly. Ambient noise levels are affected by low frequency sounds (on the order of <300 Hz) that are persistent over days and weeks. These types of sources are not part of the proposed action.

The information on current and forecast levels can be obtained through Section 2.8, Tables 2.8-1, 2.8-1, 2.8-3 and Table 3.0-9 in the AFTT DEIS/OEIS.

3) Ordnance Detonation - As stated in Section 5.3.3.1.1.1 of the AFTT DEIS/OEIS, explosive detonation is not proposed to occur in the NARW critical habitat from 15 November - 15 April. The Navy is consulting with NMFS regarding ordnance detonations outside the critical habitat.

4) Vessel Strikes - Section 3.0.5.3.3.1 of the AFTT DEIS/OEIS analyzes ship traffic and Section 3.4.3.3 of the AFTT DEIS/OEIS has a complete analysis regarding ship strikes. The proposed action does not include an increase in vessel traffic of 190%. At the end of Section 3.4.3.3, it clearly states that while the number of events may increase, the number of ships and/or transits does not. The Navy's ship inventory and fuel budget are static and are not expected to increase during the duration of the proposed action.

5) USWTR - The USWTR EIS/OEIS is a supporting document to the AFTT DEIS/OEIS. The level and types of activities identified in the USWTR EIS/OEIS were reanalyzed in the AFTT DEIS/OEIS at the same levels. As stated in the USWTR EIS/OEIS, the AFTT DEIS/OEIS, and as discussed above, the level of ship traffic is not expected to change through 2019. A specific number of transits cannot be identified in advance as training and testing schedules are predicated on deployment requirements, which are predicated on the geo-political climate. Additionally, specific ship schedules are classified, therefore the DEIS/OEIS explains to the reader that while the number of training events may be increasing, the amount of ship traffic does not, meaning that the activity level will not appreciably change from current levels.

   Information on sound propagation into the critical habitat from activities occurring on USWTR can be found in Table 3.4-12 of the AFTT DEIS/OEIS. This table shows the maximum range hull-mounted sonar (highest source level) can propagate. From this, the maximum (and low probability) sound level that could reach the critical habitat is less than a dolphin whistle, and far less than a pleasure craft. Activities occurring on USWTR will not result in sound effects to the GA coastal zone or coastal resources. Ambient sound is addressed above.

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

March 11, 2013

J.W. Murphy, Deputy Chief of Staff
Navy Fleet Installations and Environmental Readiness
U.S. Fleet Forces Command
1562 Mitscher Avenue, Ste. 250
Norfolk, Virginia 23551-2487

RE: **Conditional** Federal Consistency Determination Concurrence: AFTT Study Area Activities DEIS/DOES

Dear Mr. Murphy:

Staff of Georgia's Coastal Management Program (GCMP) and Georgia Department of Natural Resources' Wildlife Resources Division (GaDNR/WRD) has reviewed the supplemental information requested in our February 11, 2013 letter regarding monitoring and progress reports. Our primary concerns have been and continue to be 1) the accuracy with which the Navy is able to predict interactions with North Atlantic right whales (NARW) resulting from operation of the Undersea Warfare Training Range (USWTR) portion of the Atlantic Fleet Testing and Training (AFTT) proposal and 2) the effectiveness of proposed AFTT vessel mitigation measures to reduce risk of NARW vessel collisions.

Our confidence level that operation of the USWTR will be conducted in a manner that minimizes or eliminates NARW impacts remains low due to close proximity of the USWTR to the NARW calving habitat and uncertainty surrounding 1) sonar propagation distance, 2) NARW abundance in the USWTR area and 3) levels of vessel, active sonar and ordnance detonation activities that will occur during the NARW calving season (November 15-April 15). Georgia's July 20, 2009 Phased Consistency Determination specifically **objected** to USWTR operation until these three issues were better defined.

Regarding sonar propagation distance, the GCMP previously requested that the Navy conduct an in-situ sonar validation study to assess the accuracy of the Navy's Acoustic Effects Model and projected take estimates. This request was denied. As a result, the extent to which active sonar noise may propagate from the USWTR and into the adjacent NARW calving habitat will not be determinable until after the USWTR becomes operational. Likewise, the distribution and abundance of NARW in the USWTR area remains uncertain because 1) a Navy-funded passive acoustic monitoring study has not been completed and 2) Navy-funded aerial and vessel surveys have been conducted at an insufficient level of effort during the NARW calving season to assess NARW presence or absence. Lastly, the Navy has failed to quantify levels of vessel, active sonar and ordnance detonation activities that will occur in the USWTR during the NARW calving season, and how these levels differ from the status quo. As such, we are unable to evaluate the extent to which the USWTR will concentrate training and testing activities in close proximity to the NARW calving habitat.

Our confidence level that proposed AFTT vessel mitigation measures will eliminate the potential of NARW vessel collisions remains low because 1) mitigation measures rely primarily on visual detection methods, rather than speed reduction and 2) the NARW calving Mitigation Area does not adequately encompass the area inhabited by NARW. Visual detection methods, while prudent, cannot be relied

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upon to reliably detect NARW. NARW are often below the surface of the water and undetectable by visual means. The probability of detecting NARW is further reduced in rough seas, inclement weather and at night. A combination of visual detection and vessel speed reductions would be a more effective way to mitigate vessel strike risk. Studies indicate that probability of whale mortality and serious injury are reduced at vessel speeds of 10 knots or less (Laist et al. 2001, Pace and Silber 2007, Vanderlaan and Taggart 2007). The Navy has stated that vessels will reduce their speed while operating in the calving habitat Mitigation Area, but the actual speed that vessels will travel is unclear. The proposed calving habitat Mitigation Area, which includes waters within 15 nmi of shore between Kings Bay, GA and Mayport, FL, plus a 5 nmi buffer, does not adequately encompass the area actually utilized by NARW during the calving season. NARW inhabit all Southeast U.S. waters within 30 nmi of the South Carolina, Georgia and northeast Florida coast during November 15 to April 15.

The proposed action has incorporated adaptive management, as directed by Executive Order 13547, in only the most general sense. We recommend that the Navy develop a concrete Adaptive Management Plan outlining USWTR-specific monitoring needs, specific trigger levels, and alternate mitigation actions. Such a plan will position the Navy to respond rapidly in the event that direct or cumulative environmental effects are observed that are greater or different than predicted. This approach would increase our confidence that the proposed action can be conducted in a manner that will minimize reasonably foreseeable impacts to Georgia's coastal resources.

Appropriate Adaptive Management Plan elements include:

- USWTR-Specific Monitoring Needs:
  - Passive acoustic monitoring of the USWTR, NARW calving habitat and intervening ocean waters should be conducted to assess ambient and operational noise levels. Monitoring should commence at least one year prior to USWTR operation and continue for at least five years post-operation. Monitoring should be conducted in cooperation with the National Marine Fisheries Services (NMFS) and independent researchers with expertise in acoustics and marine mammal biology. Calibrated acoustic monitoring devices should be deployed at sufficient spatial and temporal resolution to assess whether training and testing activities in the USWTR are increasing ambient noise levels within the NARW calving habitat. Monitoring should continue beyond five years if 1) vessel activities, active sonar and/or ordnance detonation levels increase beyond predicted levels or 2) effects on NARW calving habitat are exceed predicted levels
  - Annual activity reports should be provided that quantify vessel activity, active sonar and ordnance detonation levels from November 15 to April 15 within 1) the USWTR area, 2) NARW critical habitat offshore of a) Georgia and b) northeast Florida, and 3) ocean waters within 30 nmi of the a) Georgia and b) northeast Florida coast.
- Specific Trigger Levels and Alternate Mitigation Actions:
  - In the event that NMFS expands NARW Critical Habitat, AFTT NARW Mitigation Area boundaries will be redrawn to reflect expanded NARW Critical Habitat, plus 5 mile buffers.
  - In the event that a NARW is killed or seriously injured by a Navy vessel 60 ft or greater in length operating within 30 nmi of the Southeast U.S. coast, the Navy will implement 10 kt vessel speed restrictions in this area from November 15 to April 15.
  - In the event that a NARW is killed or severely injured in the USWTR area by a vessel strike, active sonar or ordnance detonation, USWTR training and testing activities will cease during November 15 to April 15 pending re-initiation of an ESA Section 7 consultation with NMFS.
- Trigger Levels and Alternate Mitigation Actions to be Developed:
  - The Navy will coordinate with the NMFS Ocean Acoustics Program to establish maximum

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and cumulative thresholds for active sonar and ordnance detonation sound pressure levels detected within the NARW calving habitat Mitigation Area.

- In the event that these thresholds are exceeded, training and testing activities will cease in the USWTR area during November 15 to April 15 pending re-initiation of an ESA Section 7 consultation with NMFS.

The Georgia Coastal Management Program **concurs** that that the Atlantic Fleet Testing and Training Study Area Activities comply with the Program to the maximum extent practicable with the **condition** that an Undersea Warfare Training Range Adaptive Management Plan is developed and implemented prior to USWTR operation. That plan must include monitoring needs, identify triggers, and list alternate mitigation actions.

If the proposed project is not modified to include an Adaptive Management Plan prior to USWTR operation all parties shall treat this conditional concurrence letter as an objection letter pursuant to 15 CFR §930.43. The Navy must notify us immediately if these conditions are not acceptable [15 CFR §930.4(a)(2)].

In the event actual impacts are higher than or different from predicted impacts, a Supplemental Federal Consistency Determination must be submitted in accordance with 15 CFR §930.36 that includes adequate public notice and public participation to specifically address reasonably foreseeable coastal effects on NARW and NARW calving habitat from Navy vessel activities and USWTR testing and training activities.

If you have any technical questions regarding this action, please contact Jason Lee or Clay George at the number below. If you have any questions regarding the federal consistency process, please contact Brad Gane or Kelie Moore at the number below.

Sincerely,

A.G. "Spud" Woodward
Director

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DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/059
March 25, 2013

Mr. A. G. Woodward
Director, Coastal Resources Division
Department of Natural Resources
One Conservation Way
Brunswick, GA 31520-8687

Dear Mr. Woodward:

The United States Navy (Navy) is in receipt of your letter dated March 11, 2013. The Georgia Coastal Management Program concurred that activities proposed in the Atlantic Fleet Training and Testing (AFTT) Study Area comply with the Coastal Management Program to the maximum extent practicable with the condition that an Undersea Warfare Training Range (USWTR) Adaptive Management Plan be developed and implemented prior to USWTR operation.

However, your response does not identify how the proposed activity is inconsistent with a specific enforceable policy that the condition (the adaptive management plan) is designed to satisfy, as required by 15 CFR 930.43(a). The Navy is consistent to the maximum extent practicable with each of Georgia's enforceable Coastal Zone Management Act (CZMA) policies that are not preempted by National Marine Fisheries Service (NMFS) regulations under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Therefore, we ask that you reconsider your conditional concurrence and invite you to participate in the NMFS rulemaking process to address your concerns under MMPA.

The following information is provided to address your primary concerns:

Monitoring. The Navy currently conducts North Atlantic right whale (NARW) monitoring in the USWTR area through an established monitoring program that has been developed with and reviewed by recognized scientific experts. The monitoring program includes passive acoustic monitoring (PAM) devices deployed 365 days per year that collect data on vocalizing marine species to aid in the determination of presence and potential for reactions to anthropogenic activities. These high-frequency acoustic recording package (HARP) devices have been in place since 2009 as an element of the Atlantic Fleet Active Sonar Training (AFAST) monitoring plan and will continue in the AFTT monitoring plan.

Additionally, visual surveys of the USWTR area are and will remain an element of the Navy's monitoring plan. The Navy conducts visual surveys of the area between USWTR and the NARW critical habitat beginning five nautical miles (nm) seaward of where the current NMFS critical habitat surveys occur. NMFS agreed to Navy's survey boundary starting five nm seaward of the NMFS critical habitat survey boundary to deconflict

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airspace for safety of flight reasons. Visual surveys were developed to complement PAM in determining species presence throughout all seasons and this effort has resulted in considerable data for the area, including the first recording of a NARW birth. Developed with leading scientific experts, the overall monitoring plan is sufficient to meet NMFS and Navy monitoring goals. The visual surveys will continue throughout the AFTT permit period as a required monitoring measure. The Navy is currently in consultation with NMFS to address potential impacts on marine mammals and endangered species in the AFTT Study Area. Mitigation and monitoring for marine mammals will be finalized during this public process. However, the Navy is not recommending an expansion of the PAM effort into either the NARW critical habitat or the area between critical habitat and USWTR. An expansion would be beyond the scope of monitoring required under our current permits from NMFS as very little Navy activity occurs in this area. These monitoring and mitigation requirements remain a matter under NMFS purview.

Annual reports. The Navy has and will continue to provide unclassified annual exercise and monitoring reports that certify our permit compliance. The Navy also provides classified reports to NMFS that detail specific information about the level of activity and this information must remain classified. The unclassified reports are publicly available on the NMFS Office of Protected Resources web site and are also available on the Navy monitoring web site; links to both sites were provided to Georgia Department of Natural Resources (GaDNR) staff during our CZMA consistency determination discussions.

Critical Habitat Expansion. In the event the NARW critical habitat is expanded, the Navy will work with NMFS under the ESA to determine the appropriate changes (if any) to be made to the AFTT mitigation zone. NMFS is the regulating body responsible for enforcing the ESA for ocean-based species; the Navy fully complies with NMFS requirements set through a consultation process.

Speed restrictions. As discussed in the AFTT Draft Environmental Impact Statement and pursuant to 50 C.F.R. § 224.105 (2012), U.S. Navy vessels are exempt from the 10-knot NARW critical habitat speed restriction. In coordination with NMFS, Navy provides specific guidance to our ships during NARW calving season through the enclosed annual message directing specific alertness for NARW presence.

Restrict activities November-April. Navy training and testing is directly tied to meeting operational requirements. GaDNR's request to restrict Navy training to seven months of the year would significantly impact the Navy's ability to generate ready forces to effectively respond to crises and operational deployments. The Navy is currently in consultation with NMFS on the development of a biological opinion for AFTT.

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March 25, 2013

Sound thresholds. Sound impact criteria were developed in coordination with NMFS. Under MMPA and ESA, NMFS evaluates the effects to the species and authorizes the level of activity that Navy can conduct under the permit. The levels of activity authorized by NMFS are based upon the best available information and science. Because NMFS is designated as the regulating body responsible for enforcing the MMPA and ESA for ocean-based species, Georgia's policies regulating these same species are preempted by NMFS regulations under the MMPA and ESA.

Sound budget. The Navy is fully integrated with the NMFS Ocean Acoustics Program. Any modifications resulting from this program will be considered during consultation with NMFS and by NMFS during their rulemaking determination. Direction from the NMFS Ocean Acoustics Program will be part of the AFTT adaptive management process.

We invite your continued participation in the NMFS rulemaking process associated with Navy AFTT applications and to continue to monitor current and future Navy reports to NMFS on Navy compliance. It is the Navy's intent to fully disclose unclassified information from the monitoring reports. The Navy's contribution to a better understanding of NARW, other endangered species, and all marine mammals is important not only for the recovery of those species but also for the Navy's ability to effectively train. As a concerned steward of the ocean environment, the Navy appreciates your efforts to protect the NARW and other endangered species. We are available to answer questions and look forward to continuing the dialogue with you on these issues.

Because Georgia has no enforceable policies covering marine mammals that are not preempted by NMFS regulations under the MMPA and ESA, the Navy asks that you reconsider your conditional concurrence for the USWTR and find concurrence with all aspects of the AFTT Consistency Determination.

We appreciate your assistance. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: North Atlantic Right Whale Calving Season Message

3

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/100
July 3, 2013

Mr. A. G. Woodward
Director, Coastal Resources Division
Department of Natural Resources
One Conservation Way
Brunswick, GA 31520-8687

Dear Mr. Woodward:

The United States Navy (Navy) is in receipt of your letter dated March 11, 2013 in which the Georgia Coastal Management Program concurred that activities proposed in the Atlantic Fleet Training and Testing (AFTT) Study Area comply with the Coastal Management Program to the maximum extent practicable with the condition that an Undersea Warfare Training Range (USWTR) Adaptive Management Plan be developed and implemented prior to USWTR operation. During a phone call on April 10, 2013, Navy and Georgia staffs further discussed Georgia's request for a USWTR adaptive management plan.

Georgia suggested that the Navy is not consistent with Official Code of Georgia (O.C.G.A.) 27-3-130 (Endangered Wildlife Act) which prohibits the capture, killing or selling of any endangered species listed by Georgia Ecological Services. Georgia's concern is that the Navy's proposed USWTR actions could kill a Georgia listed species, specifically the North Atlantic right whale. The Navy has reviewed O.C.G.A. 27-3-130 and has determined that the Navy is consistent to the maximum extent practicable with the enforceable policies of the statute. The Navy's proposed action, described in the consistency determination submitted to Georgia on December 12, 2012, does not propose to capture, kill or sell the North Atlantic right whale.

Georgia requested that the Navy, as a condition to full Coastal Zone Management Act (CZMA) concurrence, agree to consult with Georgia in the event that a North Atlantic right whale is killed as a result of Navy activities on the USWTR.

The Navy supports transparent discussions with the State of Georgia on Navy activities and North Atlantic right whale protections. With this in mind, the Navy agrees to make available to Georgia unclassified monitoring and activity reports associated with USWTR; make available to Georgia copies of the annual North Atlantic right whale calving season and migration message; and should there be an unanticipated ship strike of a North Atlantic right whale associated with USWTR activities, the Navy will open a dialogue with the State of Georgia. Because the take of marine mammals is preemptively regulated

5090
Ser N46/100
July 3, 2013

by the Marine Mammal Protection Act, should a right whale be struck, the Navy would be required to consult with National Marine Fisheries Service (NMFS) Office of Protected Resources. Should that consultation result in changes to Navy activities so that their effects on any land or water use or natural resource of the Georgia coastal zone are substantially different than the effects anticipated now, the Navy would enter into CZMA consultations with the State of Georgia on the new activities. Based upon this clarification of the process Navy will follow in the event of an unanticipated strike of a North Atlantic right whale, the Navy asks that Georgia provide concurrence with Navy's December 12, 2012 consistency determination.

We invite you to continue participating in the NMFS rulemaking process associated with Navy AFTT applications and to continue to monitor current and future Navy reports to NMFS on Navy compliance. It is the Navy's intent to fully disclose unclassified scientifically-based information from monitoring reports. The Navy's contribution to a better understanding of North Atlantic right whales, other endangered species, and all marine mammals is important not only for the recovery of those species but also for the Navy's ability to effectively train. As a concerned steward of the ocean environment, the Navy appreciates your efforts to protect the North Atlantic right whale and other endangered species. We are available to answer questions and look forward to continuing the dialogue with you on these issues.

We appreciate your assistance. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

2

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

July 19, 2013

Mr. J.W. Murphy
Navy Fleet Installations & Environmental Readiness
1562 Mitscher Avenue, Ste. 250
Norfolk, Virginia 23551-2487

RE: CZMA Consistency Determination Concurrence: AFTT Study Area Activities DEIS/DOIES

Dear Mr. Murphy:

Staff of Georgia's Coastal Management Program (GCMP) and Georgia Department of Natural Resources' Wildlife Resources Division (GaDNR/WRD) has reviewed your July 3, 2013 letter providing clarification on the Navy's intent to adopt an adaptive management plan as requested in our March 11, 2013 letter. We appreciate the Navy's effort to quantify and mitigate environmental impacts of proposed Atlantic Fleet Testing and Training (AFTT) activities as described in the December 12, 2012 Draft Environmental Impact Statement/Draft Overseas Environmental Impact Statement (DEIS/DOEIS) and accompanying Coastal Zone Management Act (CZMA) Federal Consistency Determination. We also appreciate the Navy's continued discussions with GCMP regarding potential impacts of AFTT activities on endangered North Atlantic right whales (NARW).

The Navy has agreed to open a dialogue with GCMP should there be an unanticipated ship strike of NARW associated with the Under Sea Warfare Training Range (USWTR), as well as make available unclassified USWTR monitoring and activity reports and copies of the annual NARW calving season and migration message. These adaptive management measures position the Navy to rapidly, transparently, and effectively address direct and cumulative negative impacts to NARW. Other AFTT activities found to contribute to the unforeseen death or serious injury of NARW, or that negatively affect NARW survival, distribution or habitat suitability would also trigger reinitiating discussions with GCMP through the Supplemental Federal Consistency Determination process described in 15 SFR §930.36.

The Georgia Coastal Management Program **concurs** that the Atlantic Fleet Testing and Training Study Area Activities comply with the Program to the maximum extent practicable and has been designed to comply with the Program's enforceable policies. Please feel free to contact Kelie Moore or me if we can be of further assistance.

Sincerely,

A.G. "Spud" Woodward
Director

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912.264.7218 | FAX 912.262.3143 | WWW.COASTALGADNR.ORG

C.2.6 LOUISIANA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1083
December 12, 2012

Mr. Keith Lovell
Department of Natural Resources
PO Box 44487
617 North 3rd St., Suite 1048
Baton Rouge, LA 70808-4487

Dear Mr. Lovell:

In accordance with the Coastal Zone Management Act 16 (United States Code § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy has prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Louisiana's Coastal Management Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with Louisiana's Coastal Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

BOBBY JINDAL
GOVERNOR

STEPHEN CHUSTZ
INTERIM SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL MANAGEMENT

February 6, 2013

J. W. Murphy
Deputy Chief of Staff
Department of the Navy
U. S. Fleet Forces Command
1562 Mitscher Avenue Suite 250
Norfolk, VA 23551-2487

RE: **C20120375,** Coastal Zone Consistency
Department of the Navy
Direct Federal Action
Draft EIS/OEIS to conduct Navy training and testing activities off the coast of Louisiana,
Gulf of Mexico, Offshore Louisiana

Dear Commander Murphy:

The above referenced project has been reviewed for consistency with the Louisiana Coastal Resources Program in accordance with Section 307 (c) of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in this application, is consistent with the LCRP provided that if, during the implementation of project actions the Navy consistency determination for the Louisiana Coastal Zone changes, the Navy will re-initiate consultation under CZMA, as agreed in email from Jene Nissen on January 24, 2013. If you have any questions concerning this determination please contact Brian Marcks of the Consistency Section at (225) 342-7939 or 1-800-267-4019.

Sincerely,

Keith Lovell
Acting Administrator
Interagency Affairs/Field Services Division

KOL/JDH/bgm
cc: Richard Nissen, Dept. of the Navy
David Butler, LDWF
Brian Cameron, BOEM 5412
Martin Mayer, COE-NOD

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C.2.7 MAINE

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1086
December 12, 2012

Ms. Kathleen Leyden
Maine Coastal Program
Bureau of Geology, Natural Areas,
and Coastal Resources
Department of Conservation
22 State House Station
Augusta, ME 04333

Dear Ms. Leyden:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Maine's Coastal Program and analyzed potential impacts on coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with Maine's Coastal Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
DIVISION OF GEOLOGY, NATURAL AREAS, AND COASTAL RESOURCES
93 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0093

PAUL R. LEPAGE
GOVERNOR

WALTER E. WHITCOMB
COMMISSIONER

March 11, 2013

J.W. Murphy
Deputy Chief of Staff
For Fleet Installations and Environmental Readiness
Department of the Navy
Commander
U.S. Fleet Forces Command
1562 Mitschier Avenue Suite 250
Norfolk, VA 23551-2487

RE: CZMA Consistency Determination for Atlantic Fleet Training and Testing activities

Dear Mr. Murphy:

I am writing to provide the State of Maine's ("State") response to the Department of the Navy's ("Navy") determination pursuant to Section 307 of the Coastal Zone Management Act (16 U.S.C. §1456(c)) ("CZMA") and its implementing regulations (15 C.F.R. Part 930, Subpart C) ("consistency rules") that its proposed Atlantic Fleet Training and Testing ("AFTT") activities, as detailed in its consistency determination and accompanying information, "will be fully consistent with the enforceable policies of the Maine Coastal Program."[1] As explained below, the State concurs with the Navy's determination that its proposed AFTT activities are consistent with applicable enforceable policies of its coastal program. In addition, the State urges the Navy to avoid, minimize, and mitigate to the maximum extent practicable the potential for adverse effects on coastal uses and resources in accordance with the recommendations of the Maine Department of Marine Resources ("DMR").

Proposed action subject to consistency review

The Navy describes the AFTT activities as military readiness-related "training and testing activities, which may include the use of active sound navigation and ranging (sonar) and explosives, primarily within existing range complexes and testing ranges along the U.S. Atlantic coast; in the Gulf of Mexico; and at Navy pierside locations, in port transit channels, and in the lower Chesapeake Bay."[2]

Based on review of the Navy's proposal by the state agencies that administer the core laws that provide the enforceable policies of the Maine Coastal Program, the State finds that the Navy has provided adequate information for purposes of review of the proposed action for consistency with the enforceable policies of its

[1] Department of the Navy, Consistency Determination for Maine, dated December 12, 2012 ("consistency determination"), p. 13. The Navy provided its Draft Environmental Impact Statement/Overseas Environmental Impact Statement ("DEIS") assessing AFTT activities as information in support of its consistency determination.
[2] *Id.*, at 2.

MAINE COASTAL PROGRAM
KATHLEEN LEYDEN, DIRECTOR

17 ELKINS LANE – WILLIAMS PAVILLION
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www.maine.gov/acf/gnc

coastal program. Issues and concerns regarding the lack of specific information on the location and timing of the Navy's proposed activities are addressed below.

In accordance with the CZMA and consistency rules, the Navy's proposed action and the State's review of it concern AFTT activities that have potential to affect uses and resources in Maine's coastal zone. These activities are outlined in Table 3 of the Navy's consistency determination, with reference to Appendix A of the DEIS where these activities are further detailed.[3] These activities may be divided into two general categories - training and testing - and include a wide range of at-sea gunnery, missile, and torpedo-related exercises, testing and training employing various active and passive sonar technologies, ship and submarine maintenance and repair, anti-submarine training and testing, surface warfare testing, and biological and chemical simulant testing.

In addition to at-sea activities, the Navy's proposed activities include pier-side testing of active sonar at the Bath Iron Works ("BIW") facility in Bath, Maine, and the Portsmouth Naval Shipyard ("PNSY") in Kittery, Maine. None of the activities in the Navy's proposed action would be conducted on land in Maine.

With the exception of the above-noted pier-side testing, the Navy's consistency determination does not specify precisely where activities included in the proposed action would occur. "To maintain flexibility for training and testing in the Study Area, the Navy identified the locations of the majority of proposed activities only to the range complex or testing range level and not to specific areas within OPAREAs [operating areas]."[4] The Boston OPAREA lies off Maine's coast, for the most part seaward of the State's coastal waters, and includes a portion of the Gulf of Maine as well as coastal waters off Massachusetts and southern New England.

In consultation with state agencies, the Navy provided some additional clarification regarding the nature and location of its proposed activities. While it stated that "most AFTT activities don't have specific locations, but can happen anywhere in the study area", the Navy indicated that "training activities, especially, tend to be located relatively close to homeports to limit time away from home;" that an activity listed as occurring "outside" the coastal zone, will always occur outside the coastal zone; and that "most ship and submarine activities will occur outside of 3 miles from shore (outside Maine's coastal zone)."[5] Gunnery, torpedo, and missile-related activities involving explosives would occur outside Maine's coastal zone; maritime security operations involving anti-swimmer grenades and anti-submarine tracking involving explosive sonobuoys may occur in the coastal zone.[6] In addition, the Navy clarified that there are no activities included in its proposed action that entail seafloor or near seafloor explosions in Maine coastal waters.[7]

Federal consistency review process

The Maine Coastal Program ("MCP")[8] received the Navy's consistency determination and accompanying materials on December 17, 2012. The Navy agreed to extend the period for consistency review until March 11, 2013. The MCP provided a copy of the Navy's consistency determination and accompanying materials to and requested review of that determination by the Department of Environmental Protection

[3] The activities that the Navy has identified as having potential coastal effects include activities both within Maine's designated coastal zone, i.e., inside the three-mile limit, as well as activities that may occur outside the coastal zone. Maine's designated coastal zone includes the land area of all municipalities or unorganized places on water subject to tidal influence seaward to the three-mile limit of state ownership.
[4] Consistency determination at 7
[5] Navy summary of Maine/Navy Coastal Consistency Determination telecom, 23 January 2013, p. 3
[6] *See* Consistency determination, Table 3
[7] Above-referenced Navy summary of telecom, p. 7
[8] The Maine Coastal Program is within the Maine Department of Agriculture, Conservation and Forestry, Bureau of Geology, Natural Areas and Coastal Resources and is the "state agency" responsible for administration of Maine's federally-approved coastal zone management program.

("DEP"), the Land Use Planning Commission ("LUPC"), the Department of Marine Resources ("DMR"), and the Department of Inland Fisheries and Wildlife ("DIFW"), the state natural resources agencies that administer the core laws that provide the enforceable policies and participate in implementation of the State's networked coastal program. These agencies' findings, conclusions, and recommendations regarding the proposed action's consistency with the enforceable policies of the State's coastal program provide the basis for the State's response to the Navy's consistency determination. On January 27, 2013, the MCP published notice of opportunity to comment on the Navy's consistency determination in the *Kennebec Journal* and *Portland Press Herald;* the notice was published in the *Bangor Daily News* on January 29, 2013.

Summary of public comments

Over 400 public comments on the Navy's consistency determination were received. In summary, these comments expressed concerns about the adverse effects of the Navy's proposed activities on coastal resources, particularly the Northern right whale and other endangered species, marine mammals, commercial fisheries, and other wildlife; questioned the efficacy of the Navy's proposed mitigation measures; urged the State to hold the Navy to the highest standards in assessing potential impacts on endangered species; and generally asserted that the Navy's plans are inconsistent with Maine's coastal program. In addition, the State received comments from the Natural Resources Defense Council ("NRDC") and Citizens Opposed to Active Sonar Threats ("COAST").

In summary, NRDC commented that the Navy's analysis indicates that significant harm to multiple marine mammal and other species would result from AFTT activities; that the Navy's estimate of the number of potential AFTT-related "takes" of marine mammals from 2014-19 reflects a 95% increase over its "take" estimate for comparable Atlantic Fleet testing and training exercises from 2009-14; that the National Marine Fisheries Service's ("NMFS") estimates of "takes" to marine mammals that may result from AFTT activities exceeds the Navy's own estimate[9]; that potential for adverse effects on the Northern right whale is of particular concern due to that endangered species' greatly diminished population; that the Navy has not provided information needed for consistency review, including regarding the scope or geographic location of AFTT activities; that the Navy's proposed mitigation measures fail to protect the Northern right whale and other marine mammals, and that additional time and area restrictions and closures are needed to adequately protect the Northern right whale and other vulnerable species.

In summary, COAST commented that, in light of the potential adverse effects, including those on the Northern right whale and other species listed under the Maine Endangered Species Act ("MESA"), which the Navy has acknowledged in its consistency determination, the Navy's proposed AFTT activities are inconsistent with the enforceable policies of the Maine Coastal Program, in particular the Maine Endangered Species Act and Coastal Management Policies Act. COAST stated that the Navy's methodologies for assessing potential impacts are flawed and underestimate adverse impacts; that the Navy's proposed mitigation measures are inadequate; and that additional mitigation measures, such as seasonal and area restrictions on training and testing, could eliminate or significantly reduce potential adverse impacts. COAST's comments included a copy of comments previously submitted to the Navy by a number of organizations, including COAST, concerning the Navy's AFTT DEIS. As summarized by COAST, "these comments challenge the notion that the Navy undertook a rigorous investigation into the environmental impacts that will result from its activities, and explain why some of these impacts have been greatly underestimated, and how a number of common sense mitigation measures, if put into place, could greatly reduce impacts."

[9] As noted in its consistency determination, the Navy is in the process of seeking authorization from NMFS for AFTT-related "takes" of marine mammals under the Marine Mammal Protection Act.

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Coastal effects

As detailed in the Navy's consistency determination and emphasized in the many public comments received, the Navy's proposed action may affect Maine's coastal uses and resources. The Navy's consistency determination and DEIS identify the potential for effects on the Northern right whale and other marine mammals and various bird, fish, and other species that are part of the ecology of Maine's coastal zone and help support its natural resources-based economy. Given the Navy's acknowledgement of the potential for such effects and based on state agencies' review of its consistency determination, the State has determined that impacts on Maine's coastal zone and uses are a reasonably foreseeable potential consequence of the Navy's proposed action.

Standard of review

The CZMA requires that federal agency activities affecting coastal uses or resources be "carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs."[10] The consistency rules define "consistent to the maximum extent practicable" to mean ". . . fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency."[11]

In its consistency determination, as noted above, the Navy has determined that its proposed action "will be fully consistent with the enforceable policies of the Maine Coastal Program" rather than "consistent to the maximum extent practicable."[12] Accordingly, the State's response to the Navy's consistency determination is based on whether it concurs with the Navy's determination that it is fully consistent with the State's enforceable policies.

Enforceable policies

Under the authority provided to a coastal state by the CZMA, an effect on the State's coastal uses or resources, regardless of its nature or magnitude, is not in and of itself a sufficient basis for an objection to a federal agency's consistency determination or for a state-imposed requirement that a federal agency take or refrain from certain actions. The federal rules governing the consistency review process require that a state objection to a federal agency's consistency determination must cite and be based directly on a specific enforceable policy of its program.[13] State statutes and rules that are not included in Maine's Coastal Program cannot be used as a basis for finding and objecting to an activity as inconsistent. Likewise, if an activity or effect is not addressed by one of the State's enforceable policies, the federal action is presumed to be consistent with the Maine Coastal Program.

The consistency rules define "enforceable policy" as -

> "State policies which are legally binding, through constitutional provisions, laws, regulations, land use plans, ordinances, or judicial or administrative decisions, by which a State exerts control over private and public land and water uses and natural resources in the coastal zone . . . ."

which have been approved by OCRM for incorporation into the State's coastal program.[14] This rule further specifies that an "enforceable policy" "shall contain standards of sufficient specificity to guide

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[10] 16 U.S.C. §1456(c)(1)(A).
[11] 15 C.F.R. § 930.32(a)(1)
[12] Consistency determination at 13
[13] *See* 15 C.F.R. §§930.43(a) and 930.63(b)
[14] 15 C.F.R. § 930.11(h)

4

public and private uses."[15] (In addition, the federal consistency rules provide that "federal agencies should give consideration to management program provisions which are in the nature of recommendations" and do not meet the definition of an "enforceable policy."[16])

The enforceable policies of the Maine Coastal Program are provided by generally applicable state environmental and natural resources statutes (commonly referred to as the program's "core laws") and their implementing rules. Since the core laws are administered by various state agencies and municipalities, the MCP coordinates the consistency review process and serves as a single point of contact to receive and to provide the State's response to a federal agency's consistency determination. Maine's consistency review process uses the same standards and, to the extent practicable and applicable, the same procedures used in processing license and permit applications under the core laws.

In its consistency determination, the Navy provides its analysis of which of Maine's enforceable policies are applicable to its proposed action and which are not applicable.[17] The Navy concludes that, with exception of several provisions in the Coastal Management Policies Act,[18] there are no enforceable policies that apply to activities under its proposed action.

As discussed below, the State finds that specific enforceable policies regarding water quality and state-listed endangered species, which the Navy addresses in part under its discussion of the Coastal Management Policies Act, and land use regulation are applicable to review of activities under the proposed action.

The Coastal Management Policies Act ("CMPA") does not itself contain "enforceable policies" but articulates general state coastal management policy that is implemented through enforceable polices in other state core laws and their implementing rules.[19] The CMPA's general policy provisions are not themselves legally binding standards by which the State exerts control over private and public land and water uses and natural resources in its coastal zone and are not enforceable policies. As noted above, generally applicable state environmental and natural resources licensing and permitting laws provide the enforceable policy standards for Maine's coastal program. Accordingly, the CMPA's provisions themselves are not used as a basis for concurrence with or objection to the Navy's consistency determination.

Findings and conclusions regarding enforceable policies applicable for review

Water Quality

Activities included in the Navy's proposed action include chemical and biological simulant testing. Based on its review of the Navy's consistency determination and DEIS, DEP determined that chemical/biological simulant testing may occur within the coastal zone, may involve discharge of up to 200 gallons of triethyl phosphate, and may have water quality impacts. The Navy's DEIS notes that triethyl phosphate has a half-life of 5-10 years, is a common component of pesticides and is known to negatively affect marine organisms. Based on the information provided in the consistency determination, DEP found that such a discharge in Maine waters would require a license from DEP under 38 M.R.S. §413(1) as it would be considered a discharge of pollutants under 38 M.R.S. §§361-A(1) and (4-A). DEP encouraged the Navy to conduct this aspect of its testing outside of Maine's coastal zone. DEP notes that, as an authorized state under the Clean Water Act's National Pollutant Discharge Elimination System ("NPDES") Program, any permit issued

[15] *Id.*
[16] 15 C.F.R. §§930.39(c)
[17] *See* Consistency determination, pp. 8 -13.
[18] *See* 38 M.R.S. §1801
[19] In its consistency determination, the Navy discusses several provisions of the CMPA as "enforceable policies."

5

by the State for this type of discharge in Maine's coastal zone would also be consistent with any applicable NPDES requirements.

The Navy subsequently submitted additional information clarifying that these tests will not be conducted in or near Maine waters and will typically take place well south of the State. The Navy has proposed that if its plans change, and such an activity is later planned for waters in or near Maine, it will "re-initiate CZMA discussions and reach consensus before an event would occur." Based on DEP's review, the State finds that such supplemental consultation, which may be required under the consistency rules, would be appropriate and would likely result in determination by DEP that a discharge license under 38 M.R.S. §413(1) is required. Accordingly, the State concurs with the Navy's determination that its proposed action is consistent with 38 M.R.S. §413(1), with the understanding that prior to initiation of chemical/biological simulant testing as described in the DEIS or comparable activity that may result in a discharge of a pollutant into Maine's coastal waters, the Navy will consult with the State and obtain any license required by DEP pursuant to 38 M.R.S. §413(1) that is not preempted by Section 312 of the Clean Water Act or other applicable federal law.

Land use regulation

As discussed above, the Navy does not specify precisely where in Maine's coastal zone certain AFTT activities may occur. Maine's Land Use Planning Commission ("LUPC") is responsible for planning and management of the unorganized areas of the State which include some submerged lands areas in Maine's coastal zone. Accordingly, it is foreseeable that certain AFTT-related activities could occur in coastal waters within the LUPC's jurisdiction.

As noted above, the Navy has clarified that no AFTT activities would occur on land in Maine and that no activities included in its proposed action would entail seafloor or near seafloor explosions in Maine coastal waters. Based on its review of the Navy's consistency determination and related additional information provided, the LUPC has determined that the AFTT navigation, training, and testing-related activities that could occur in its jurisdiction are allowable under its potentially applicable submerged lands-related zoning and that further review of the Navy's proposed action by the LUPC is not required.

State-listed endangered species

Marine species. The Maine Endangered Species Act ("MESA") has two distinct lists of threatened or endangered species. DMR has management authority regarding marine mammals and other listed marine species; DIFW has such authority for other listed species, including various seabirds. By definition, the marine-listed species for which DMR has management authority under the MESA are also listed under the federal Endangered Species Act ("ESA").[20] In the case of marine mammals, these MESA-listed marine species are also covered by the federal Marine Mammal Protection Act ("MMPA").

The authority provided to state agencies by MESA over marine and non-marine species differs. Notably, MESA's provision regarding take or harassment of state-listed species does not apply to marine species subject to management by DMR, which include the Northern right whale and other marine mammals. There is no enforceable policy in MESA that directly addresses taking, harassment or other adverse effects on marine mammals or other state-listed marine species.[21] Therefore, as concerns state-listed marine species, MESA does not provide a basis for state concurrence with or objection to the Navy's consistency determination. For these marine-listed species, MESA is focused on efforts to assist and facilitate compliance with requirements of the federal ESA.[22]

[20] 12 M.R.S. §§6972, 6973(1)
[21] 12 M.R.S. §6971
[22] 12 M.R.S. §6972

The Navy is obligated to obtain express authorization from the NMFS and the United States Fish and Wildlife Service ("USFWS") for potential adverse effects on the Northern right whale, other marine mammals, and species (including the Northern right whale) listed under the federal ESA. As the Navy notes in its consistency determination, it is in the process of consulting with NMFS and USFWS and seeking the requisite authorizations under the ESA and MMPA. Consequently, the full scope and nature of mitigation measures that the Navy will be required to employ pursuant to the MMPA and ESA to avoid, minimize, and mitigate potential adverse effects on the Northern right whale and other listed marine species has not been finally determined.

As noted above, the consistency rules direct the Navy to consider management program provisions which are in the nature of recommendations and do not meet the definition of an "enforceable policy." In enacting MESA, the Maine Legislature found that "various species of fish or wildlife have been and are in danger of being rendered extinct within the State of Maine, and that these species are of esthetic, ecological, educational, historical, recreational and scientific value to the people of the State" and declared that "it is the policy of the State to conserve, by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend."

In keeping with MESA's general statement of state policy and the general policies expressed in the CMPA, the State requests that the Navy avoid, minimize, and mitigate to the fullest extent practicable the potential for adverse effects on marine, estuarine, and diadromous species, including the federally-listed threatened and endangered marine species listed in the MESA. To that end, the State urges the Navy to adapt its proposed action to implement to the maximum extent practicable the mitigation measures recommended by DMR in its attached letter dated March 4, 2013.

Non-marine species

In its consistency determination, the Navy states that "the inland species portion of the [MESA] statute is not applicable since the proposed activities will not impact inland species."[23] In its DEIS, the Navy explains that its AFTT activities have potential to affect but are not likely to adversely affect several avian species listed by the MESA as threatened or endangered, including the roseate tern and piping plover.

As noted above, DIFW administers MESA's provisions regarding non-marine listed species. DIFW reviewed the Navy's proposed activities at the BIW and PNSY locations for each of the non-marine MESA-listed species that frequents the coastal zone and is subject to its management authority. DIFW determined that these proposed activities will not result in a "take" of any such species and DIFW has not recommended additional management measures under the MESA.

DIFW suggests that if AFTT exercises were to occur within three miles of a DIFW-identified seabird nesting island during breeding season or within other DIFW-mapped "significant wildlife habitat" or mapped rare, threatened, or endangered species habitat additional consultation with DIFW and additional information would be beneficial to determine the need, if any, for additional management measures under the MESA. DIFW indicates that it is its understanding that the potential for such exercises to occur in proximity to most "significant wildlife habitat" (tidal waterfowl and wading bird habitat and shorebird habitat) is very low since these areas are tidal or near shore, and is likewise highly unlikely regarding state-listed species habitat. Addressing DIFW's comment, the Navy reiterated its determination that consultation under MESA is not required and stated that no actions are proposed to be conducted in these areas that could potentially result in a "may affect" determination. In the event that the Navy changes its plans to include such actions in the above-

[23] Consistency determination at 10

noted areas identified by DIFW, supplemental CZMA consultation would be appropriate to assess potential effects and additional measures, if any, needed to avoid, minimize, or mitigate them.

Based on its review of the Navy's consistency determination and related additional information provided, DIFW has determined that the AFTT navigation, training, and testing-related activities that could occur in the coastal zone are unlikely to adversely affect MESA-listed species subject to DIFW's management authority and that further consultation or provision for additional management measures under the MESA is not required at this time.

* * *

While, for the foregoing reasons, the State concurs that the Navy's proposed AFTT activities are consistent with applicable enforceable policies of its coastal program, the Navy's own analysis indicates these activities' potential for adverse effects on the Northern right whale and other coastal resources and uses. Accordingly, mindful and respectful of the Navy's mission to ensure the readiness of our nation's armed forces, the State reiterates its request that the Navy implement the Department of Marine Resources' attached recommendations to the maximum extent practicable.

Thank you for your consideration and cooperation during the review process. Please let me know if you have questions or need additional information.

Sincerely,

Kathleen Leyden
Director, Maine Coastal Program

cc:\ with attachment

Walter Whitcomb, Commissioner, DACF
Patrick Keliher, Commissioner, DMR

8

STATE OF MAINE
DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

PAUL R. LEPAGE
GOVERNOR

PATRICK C. KELIHER
COMMISSIONER

March 4, 2013

Ms. Kathleen Leyden
Director Maine Coastal Program
Bureau of Geology, Natural Areas, and Coastal Resources
Department of Agriculture, Conservation, and Forestry
93 State House Station
Augusta, Maine 04333

RE: The United States Navy's Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area

Dear Ms. Leyden:

The Maine Department of Marine Resources (DMR) recognizes the importance of Navy AFTT in ensuring military preparedness and addressing national security concerns. We do, however, wish to express concerns related to potential adverse impacts from the Navy's proposed activities in the Gulf of Maine and waters proximate to the Gulf of Maine including the Piscataqua and Kennebec Rivers, and to offer some suggestions for mitigating those potential impacts. Our comments are aimed at helping to ensure that the Navy avoid, minimize, and mitigate to the fullest extent practicable the potential for adverse effects on marine, estuarine and diadromous species including federally listed threatened and endangered species.

Activity Summary

It is DMR's understanding that the U.S. Navy is proposing ongoing training and testing activities within the Study Area that covers the waters of the United States East Coast and Gulf of Mexico including the Gulf of Maine outside of the state's coastal waters (beyond 3 nautical miles) and within the state's coastal waters (from Mean Low Water to 3 nautical miles). Training and testing outside of the state's coastal waters include a broad range of activities such as sonar and radar testing, acoustic counter measures, weapon systems development and testing (including anti-submarine, mine, sonobouy and torpedo training and testing), ship sea trials, ordnance and munitions testing and practice, and ship shock trials. Within the state's coastal waters activities would include pierside testing of ship sonar and other ship systems at Bath Iron Works (BIW) and at the Portsmouth Naval Shipyard (PNSY).

The Navy is seeking concurrence with its Federal Consistency Determination that these activities are consistent with Maine's coastal management program.

OFFICES AT 2 BEECH ST., BAKER BUILDING, HALLOWELL, MAINE
http://www.Maine.gov/dmr
PHONE: (207) 624-6550 FAX: (207) 624-6024

Resources of Concern

The Gulf of Maine's natural resources aside from their intrinsic value are of inestimable value to the people of Maine, those that visit, and those from Maine and outside of the state that utilize those resources to provide income. These proposed activities both inside and outside of Maine's territorial limits have the potential for direct adverse impacts to marine mammals, fish, sea turtles and innumerable other marine and estuarine organisms and their habitat and food sources. Of particular concern are marine mammals including the federally listed endangered North Atlantic right whale (*Eubalaena glacialis*), and diadromous fish including the federally listed endangered Atlantic salmon (*Salmo salar*) and shortnose sturgeon (*Acipenser brevirostrum*), and threatened Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) that utilize the Kennebec River in the proximity of Bath Iron Works. Both sturgeon species utilize the Piscataqua River in the proximity of the Portsmouth Naval Shipyard as well. DMR also is concerned about potential adverse impacts to eight other diadromous species that occur in these waters. These include Atlantic tomcod (*Microgadus tomcod*) and sea lamprey (*Petromyzon marinus*); three species that are being considered for listing under the federal Endangered Species Act (ESA), the alewife (*Alosa psuedoharengus*), blueback herring (*Alosa aestivalis*) and American eel (*Anguilla rostrata*); and three species that support important recreational fisheries, American shad, (*Alosa sapidissima*), striped bass (*Morone saxatilis*), and rainbow smelt (*Osmerus mordax*).

The Navy's proposed activities in the AFTT Study Area have the potential for an unprecedented number of takes, including behavioral impacts, harassment, injury, and mortality to many marine mammal, sea turtle, and diadromous fish species that are included on Maine's marine threatened and endangered species list. These species, including the North Atlantic right whale, are considered among the natural resources that make up the ecology of Maine's coastal zone. The precarious population status of the endangered right whale necessitates close scrutiny of activities with potential for adverse effects on the species and has prompted management measures, such as gear restrictions, to protect the species that have attendant economic effects on Maine's commercial fishing industry. In this instance, to the extent that the proposed action has some potential adverse effects on the right whale, DMR has determined that correlative effects on Maine's coastal zone and uses are a reasonable foreseeable potential consequence of the Navy's program in the AFTT Study Area.

The Maine Endangered Species Act (MESA) gives DMR state-level management authority regarding the North Atlantic right whale and other species listed on the State's marine threatened and endangered species list. These marine listed species are also protected under the ESA and in the case of marine mammals, the federal Marine Mammal Protection Act (MMPA) as well. To date, DMR has focused on working with Maine's fishing industry to facilitate its compliance with deferral ESA and MMPA-based management measures regarding whale species, particularly the right whale.

Recommendations

We urge the Navy to adapt its proposed action to fully implement mitigation measures to protect marine mammals and other listed marine species pursuant to the MMPA and ESA in order to ensure that all necessary and appropriate steps are taken to avoid and minimize adverse effects on marine listed species and thereby avoid and minimize the potential for related adverse effects on Maine's coastal zone. We urge the Navy to build seasonal restrictions into the mitigation scheme, with particular attention being paid to active sonar, torpedo, and use of explosives in right whale critical habitat areas such as the Great South Channel and Cape Cod Bay. Additionally, DMR recommends that the Navy utilize existing datasets to identify habitat and avoid areas of high marine mammal use seasonally for the use of active sonar, such as Marine Protected Areas including Stellwagen Bank Marine Sanctuary, and Jeffery's Ledge in the Northeast. An additional mitigation area should be employed offshore in the Jordan Basin/Outer Fall region during November through January to protect a recently discovered right whale habitat, with possible importance to the breeding success of the species. Right whales utilize vocalizations throughout the breeding process in what is known as Surface Active Groups (SAGs), making this area potentially more sensitive to acoustic disturbance before or during the formation of SAGs.

Additional measures that DMR recommends the Navy take into consideration include:

1) Increase safety zones that trigger measures such as power downs and shut downs in certain instances of active sonar and explosive use to encompass the entire range that causes temporary and permanent hearing threshold shifts. For example, the use of low-frequency and hull-mounted mid-frequency active sonar predicts an average range to permanent threshold shift of 281 yards but the recommended mitigation zone requires only a power

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down up to 200 yards when a shutdown would be triggered, having already potentially caused permanent hearing loss to the individual. Additionally, all ship shock trials come with a recommended mitigation zone that is within the predicted average range to temporary and sometime permanent threshold shifts on the basis that mitigation will only be used when the operational impact is acceptable. If these measures require the area for shipboard lookouts to cover to become too large, then aerial surveys should be deployed to cover the necessary range. The mitigation area should be maintained to ensure the correct level of protection.

2) The primary duties of lookouts should be the detection of marine mammals, sea turtles and other surface obstacles and therefore the enforcement of the relevant safety zones
3) When sonobuoys are being used to detect whale vocalizations, those capabilities should be used to create the relevant safety zones instead of simply informing the lookout of the occurrence. It is very rare that acoustic and visual surveys reveal the same (or as many) individuals. This method can be used to protect marine mammals in the area independent of visual observations, which can account for only 5% of the animals that are actually in the area.
4) Reduce or eliminate exercises during low visibility and night conditions, especially if safety zones are implemented only after visual detection.
5) Dedicated research should be undertaken to study methods in which to decrease the impacts of acoustic sources on marine mammals.

Recommendations regarding pierside testing at BIW and PNSY

Pierside testing of sonar systems at Bath Iron Works (BIW) should be avoided or at least minimized during the period between March 15 and November 30 when diadromous fish would be expected to be in the area.

Pierside testing of sonar systems at the Portsmouth Naval Shipyard (PNSY) should be avoided or at least minimized during the period between March 15 and July 15 when diadromous fish would be expected to be in that area. Personnel assigned to detect marine mammals in the vicinity (within 1000 yards) of those facilities should scan the area at least 30 minutes prior to testing to verify the absence of marine mammals.

Finally, it would be helpful if the Navy could provide the State with more detail on timing and location of particular testing in order for the State to provide more specific information on species that might be impacted and thus minimize those potential impacts.

Thank you for considering these comments.

Sincerely,

PATRICK C. KELIHER
Commissioner,
Maine Department of Marine Resources

Cc: P. Michael Payne, Office of Protected Resources, National Marine Fisheries Service
Linda Mercer, Erin Summers, Gail Wippelhauser, Brian Swan, DMR

OFFICES AT 2 BEECH ST., BAKER BUILDING, HALLOWELL, MAINE
http://www.Maine.gov/dmr
PHONE: (207) 624-6550 FAX: (207) 624-6024

C.2.8 MARYLAND

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1085
December 12, 2012

Mr. Elder A. Ghigiarelli, Jr.
Deputy Administrator Coastal Zone Consistency
Division Wetlands and Waterways Program
Department of the Environment
Montgomery Park Business Center
1800 Washington Blvd.
Baltimore, MD 21230

Dear Mr. Ghigiarelli:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Maryland's Management Program for preparing this consistency determination. Based on the analyses, the Navy determined that the Proposed Action in the Study Area will be consistent to the maximum extent practicable with Maryland's Costal Program. The Navy is unable to be fully consistent with the program, because doing so would limit the Navy's ability to fulfill its mission as mandated by federal law (Title 10 U.S.C. § 5062), which charges the Chief of Naval Operations with the responsibility for ensuring the readiness of the nation's naval forces.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

MARYLAND
Smart, Green & Growing

Martin O'Malley, Governor

March 1, 2013

Mr. Jene Nissen
U.S. Department of Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue Suite 250
Norfolk, VA 23551-2487

VIA EMAIL TO: richard.j.nissen@navy.mil

Re: Maryland Coastal Program's Concurrence with the U.S. Department of the Navy's Federal Consistency Determination for its Atlantic Fleet Training and Testing

The Maryland Department of Natural Resources and the Maryland Department of the Environment have completed the State's review of the Department of the Navy's (Navy) Federal Consistency Determination, prepared pursuant to Section 307 of the Federal Coastal Zone Management Act of 1972, as amended, and the supporting information contained in the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS), for the Atlantic Fleet Training and Testing. Pursuant to 15 CFR 930.41, the Maryland Coastal Program concurs with the Navy's determination that the proposed federal action is consistent, to the maximum extent practicable, with its enforceable policies.

However, while the Maryland Coastal Program concurs with the Navy's determination, we believe there are a number of issues that deserve additional attention. In this regard, the attached comments are provided to help frame future federal-state coordination efforts.

Thank you for the opportunity to review the Navy's Federal Consistency Determination and the supporting EIS/OEIS for the proposed training and testing activities. If you have any questions, please contact Mr. Joe Abe of my staff at (410) 260-8740 or by email at jabe@dnr.state.md.us, or Mr. Elder Ghigiarelli, Jr., Maryland Department of the Environment, at (410) 537-3763 or by email at eghigiarelli@mde.state.md.us.

Sincerely,

Matthew Fleming, Director
Chesapeake and Coastal Service

Cc: Elder Ghigiarelli (MDE)
Joe Abe (DNR)
Joseph Heckwolf (OAG)

C.2.9 MASSACHUSETTS

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1084
December 12, 2012

Mr. Robert L. Boeri
Acting Project Review Coordinator
Office of Coastal Zone Management
Executive Office of Environmental Affairs
251 Causeway Street, Suite 800
Boston, MA 02114

Dear Mr. Boeri:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed the Massachusetts Coastal Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with the Massachusetts Coastal Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

February 15, 2013

J.W. Murphy
Deputy Chief of Staff
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

Re: CZM Federal Consistency Review for the Proposed Atlantic Fleet Training and Testing Study Area, and Associated Range Capability Enhancements; Offshore; Massachusetts.

Dear Mr. Murphy:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the potential environmental impacts in the Study Area resulting from U.S. Navy training and testing activities and associated range capability enhancements.

Based upon our review of applicable information, we concur with your determination and find that the activity's effects on resources and uses in Massachusetts coastal zone as proposed are consistent with the CZM enforceable program policies.

If the above-referenced project is modified in any manner, including any changes resulting from permit, license or certification revisions, including those ensuing from an appeal, or the project is noted to be having effects on coastal resources or uses that are different than originally proposed, it is incumbent upon the proponent to notify CZM, submit an explanation of the nature of the change pursuant to 15 CFR 930, and submit any modified state permits, licenses, or certifications. CZM will use this information to determine if further federal consistency review is required. Thank you for your cooperation with CZM.

Sincerely,

Bruce K. Carlisle
Director

BKC/rlb
CZM#12299

DEVAL L. PATRICK GOVERNOR **TIMOTHY P. MURRAY** LIEUTENANT GOVERNOR **RICHARD K. SULLIVAN JR.** SECRETARY **BRUCE K. CARLISLE** DIRECTOR
www.mass.gov/czm

C.2.10 MISSISSIPPI

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1087
December 12, 2012

Ms. Willa Brantley
Mississippi Coastal Program
Department of Marine Resources
1141 Bayview Avenue
Biloxi, MS 39530

Dear Ms. Brantley:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy has prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Mississippi's Coastal Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with Mississippi's Coastal Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

MISSISSIPPI
DEPARTMENT OF MARINE RESOURCES

January 23, 2013

Mr. Jene Nissen
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

Re: DMR-130194; Department of the Navy, Atlantic Fleet Training and Testing Study Area

Dear Mr. Nissen:

The Department of Marine Resources in cooperation with other state agencies is responsible under the Mississippi Coastal Program (MCP) for managing the coastal resources of Mississippi. Proposed activities in the coastal area are reviewed to insure that the activities are in compliance with the MCP.

The applicant is requesting concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area within the Coastal Zone of Mississippi. The above activity has been reviewed based upon provisions of the Mississippi Coastal Program and Section 307 of the Coastal Zone Management Act of 1972 (as amended). The activity has been determined to be consistent to the maximum extent practicable with the Mississippi Coastal Program.

If you have any questions regarding this letter, please contact Willa Brantley with the Bureau of Wetlands Permitting at (228) 523-4108 or willa.brantley@dmr.ms.gov.

Sincerely,

Danny Guice, Jr.
Deputy Director

DG/wjb

cc: Mr. Damon Young, USACE
Ms. Florance Watson, OPC
Mr. Raymond Carter, SOS

1141 Bayview Avenue • Biloxi, MS 39530 • (228) 374-5000

C.2.11 NEW HAMPSHIRE

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1089
December 12, 2012

Mr. Christian Williams
Federal Consistency Coordinator
New Hampshire Coastal Program
Department of Environmental Services
Pease Field Office
222 International Drive, Suite 175
Portsmouth, NH 03801

Dear Mr. Williams:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed New Hampshire's Coastal Program and analyzed potential impacts to coastal zone uses and resources in preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with New Hampshire's Coastal Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

February 11, 2013

J.W. Murphy
Deputy Chief of Staff
for Fleet Installations and Environmental Readiness
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

RE: File No. 2012-19; Atlantic Fleet Training and Testing Study Area

Dear Mr. Murphy:

The New Hampshire Coastal Program has received the Department of the Navy's federal consistency determination for proposed activities in the Atlantic Fleet Training and Testing Study Area, pursuant to Section 307(c)(1) of the Coastal Zone Management Act, 16 U.S.C. § 1456(c)(1). After reviewing the federal consistency determination and the Atlantic Fleet Training and Testing Draft Environmental Impact Statement/Overseas Environmental Impact Statement dated May 2012, we find the proposal to be consistent, to the maximum extent practicable, with the enforceable policies of New Hampshire's federally approved coastal management program.

Should you have any questions, please feel free to contact me at (603) 559-0025.

Sincerely,

Christian Williams
Federal Consistency Coordinator
New Hampshire Coastal Program

cc: Doug Grout, NH Fish & Game Department

DES Web Site: **www.des.nh.gov**
222 International Drive, Suite 175, Portsmouth, New Hampshire 03801
Telephone: (603) 559-1500 Fax: (603) 559-1510 TDD Access: Relay NH 1-800-735-2964

C.2.12 NEW JERSEY

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1090
December 12, 2012

Ms. Kim Springer
Coastal Management Office
Department of Environmental Protection
401-07D P.O. Box 420
401 East State Street
Trenton, NJ 08625-0420

Dear Ms. Springer:

In accordance with the Coastal Zone Management Act 16 (United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analyses of potential impacts. The Navy reviewed New Jersey's Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy determined that the Proposed Action in the Study Area is consistent to the maximum extent practicable with New Jersey's Coastal Management Program. The Navy is unable to be fully consistent with the program because doing so would limit the Navy's ability to fulfill its mission as mandated by federal law (Title 10 U.S.C. § 5062), which charges the Chief of Naval Operations with the responsibility for ensuring the readiness of the nation's naval forces.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Land Use Regulation
P.O. Box 439
Trenton, New Jersey, 08625
www.state.nj.us/dep/landuse

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

FEB 28 2013

J. W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

RE: Federal Consistency
File No.: 0000-12-0026.1 CDT 130001
United States Navy's Atlantic Fleet Training and Testing Study Area

Dear Deputy Murphy:

The New Jersey Department of Environmental Protection, Division of Land Use Regulation, acting under Section 307 of the Federal Coastal Zone Management Act (P.L. 92-583) as amended, concurs with the certification that the above referenced project is consistent with the approved New Jersey Coastal Management Program.

Specifically, the project consists of training and testing activities within existing range complexes off of the U.S. Atlantic coast, which may include the use of active sonar, fleet training and testing exercises, gunnery exercises, missile testing, the use of explosives, anti-submarine training, electronic warfare and other associated training and testing activities. The proposed action is further described in Chapter 2 of "Atlantic Fleet Training and Testing Draft Environmental Statement/Overseas Environmental Impact Statement" (May 2012).

The Navy's proposed action is a continuation of existing training and testing activities, however the proposal includes an increase in the intensity and frequency of training/testing activities. However, the Navy states that adverse effects to the environmental resources will continue to be minimized through mitigation and monitoring.

New Jersey's environmental review consists of, but is not limited to, reviews from the State Historic Preservation Office (SHPO), Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP), and the Division of Land Use Regulation.

SHPO has reviewed the proposed activities with regard to the potential to affect historic and archeological resources. Based on the information submitted, it appears that the proposed activities will require consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR §800, for the identification, evaluation and treatment of historic resources within the project area.

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ENSP had concerns regarding the protection of fish, sea turtles, marine mammals and avian species. A comment letter was sent to the Navy on June 29, 2012 from the NJDEP Office of Permit Coordination and Environmental Review outlining the ENSP comments regarding the minimization of adverse effects on marine life from the project.

The Division has reviewed the submitted information and has determined that the project is consistent, to the maximum extent practicable, with New Jersey's Rules on Coastal Zone Management N.J.A.C. 7:7E-1.1 et seq., (as amended on November 5, 2012). The Division does encourage the Navy to be responsive to the concerns that have been expressed by the various State agencies, when conducting the training and testing exercises.

This Federal Consistency is authorized pursuant to all parties following the guidelines set forth, and agreed upon, for the proposed activities.

Pursuant to 15 CFR 930.44, the Division reserves the right to object and request remedial action if this proposal is conducted in a manner, or is having an effect on, the coastal zone that is substantially different than originally proposed.

Thank you for your attention to and cooperation with New Jersey's Coastal Zone Management Program. If you have any questions regarding this determination, please do not hesitate to call Kara Turner of our staff at (609) 777-0454.

Sincerely,

David B. Fanz

David B. Fanz, Manager
Division of Land Use Regulation

2/28/13
Date

c: Kim Springer, Coastal Planning

C.2.13 NEW YORK

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1091
December 12, 2012

Denise Caldwell, Consistency Coordinator
Consistency Review Unit
Office of Communities & Waterfronts
New York Department of State
99 Washington Avenue
One Commerce Place, Suite 1010
Albany, New York 12231-0001

Dear Ms. Caldwell:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed New York's Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy will be fully consistent with the policies of the New York Coastal Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/057
March 5, 2013

Terra Sturn
Consistency Review Unit
Office of Communities & Waterfronts
New York Department of State
Suite 1010
One Commerce Place, 99 Washington Avenue
Albany, New York 12231-0001

Dear Ms. Sturn:

The United States Navy (Navy) is in receipt of your letter, dated February 5, 2013, requesting additional information for the Navy's consistency determination for proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area.

My staff has addressed the issues raised in your letter either through email or during a conference call held February 11, 2013. This letter addresses the last outstanding issue, the Long Island Sound Coastal Management Program (LISCMP).

The Navy reviewed the LISCMP and has determined that the proposed activities detailed in the AFTT Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are fully consistent with the LISCMP's enforceable policies. An explanation of determination is provided in the enclosed addendum to our original consistency package that was forwarded to you on December 12, 2012. Accordingly, this fulfills our obligation to address all enforceable policies pursuant to 15 CFR Part 930 Subpart C. The Navy also offers an extension to the coastal consistency review period to March 11, 2013 in order to review the LISCMP addendum.

We appreciate your assistance in this federal consistency process. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: Federal Agency Coastal Zone Management Act, Consistency Determination for New York, Addendum

STATE OF NEW YORK
DEPARTMENT OF STATE
ONE COMMERCE PLAZA
99 WASHINGTON AVENUE
ALBANY, NY 12231-0001

ANDREW M. CUOMO
GOVERNOR

CESAR A. PERALES
SECRETARY OF STATE

March 11, 2013

Mr. Jene Nissen
o/b/o J.W. Murphy, Commander
U.S. Fleet Forces Command
U.S. Department of the Navy
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

Re: **F-2012- 1067 (DA)**
U.S. Department of the Navy, Direct Action
Atlantic Fleet Training and Testing - AFTT or 'Study Area' (*DEIS/ OEIS to assess environmental impacts in the AFTT Study Area that may result from Navy training and testing activities and associated range capability enhancements); the conducting and mitigation of Navy activities addressed within the DEIS/ OEIS*

Dear Mr. Nissen:

The New York State Department of State (DOS) has completed its evaluation of the United States Department of the Navy's determination regarding the consistency of the referenced actions with the New York State Coastal Management Program (NYSCMP). Through submitting its consistency determination pursuant to 15 CFR § 930.36, rather than submitting a negative determination pursuant to 15 CFR §930.35, the Navy has acknowledged that the proposed activities would have reasonably foreseeable impacts on coastal uses or resources and also that the proposed activities are not the same as or similar to activities for which consistency determinations have been prepared in the past.[1]

The Navy has prepared, and submitted for review, a Draft Environmental Impact Statement/ Overseas Environmental Impact Statement (DEIS/OEIS, May 2012) to assess the potential environmental impacts from these activities. A final document (FEIS/OEIS) is anticipated during the summer of 2013. DOS has requested to stay the consistency review period pending the availability of the completed FEIS and provision of sufficient opportunity to review its contents. The Navy has denied this request on the basis that no additional substantive information is expected to be provided at that time.

DOS finds that in lieu of the ability to review a complete proposal, including responses to public comments, it does not, at this time, have the basis from which to draw a conclusive determination regarding either the consistency or inconsistency of the proposed activities with the New York State Coastal Management Program.

[1] 15CFR §930.35 a), a2), and b).

WWW.DOS.NY.GOV • E-MAIL: INFO@DOS.NY.GOV

F-2012-1067 (DA), p.2

The DOS provided an opportunity for public comment via a public notice which appeared in the New York State Register, February 13, 2013.

Comments were received from the following parties:
1) National Resources Defense Council (NRDC) on behalf of its membership, and
2) Artie Koppelman, Ph.D., President, on behalf of the Coastal Research and Education Society of Long Island (CRESLI).

No comments were received from individual members of the general public.

Sincerely,

Fred J. Anders
Natural Resources Bureau Chief

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/101
July 11, 2013

Fred J. Anders
Natural Resources Bureau Chief
New York Department of State
One Commerce Place, 99 Washington Avenue
Albany, New York 12231-0001

Dear Mr. Anders:

The United States Navy (Navy) is in receipt of your letter dated March 11, 2013, in which the State of New York Department of State (DOS) indicated evaluation of the Navy's consistency determination was complete. The DOS also requested a stay of the consistency review period pending the availability of the completed Final Environmental Impact Statement (FEIS).

The federal agency may presume state agency concurrence if the state agency's response is not received within 60 days from receipt of the federal agency's consistency determination and supporting information required by 15 C.F.R. § 930.39(a). The DOS letter of March 11, 2013 does not identify any missing information required by 15 C.F.R. § 930.39(a), and instead states that DOS cannot make a decision without the FEIS. In accordance with the 15 C.F.R. § 930.37 of the Coastal Zone Management Act (CZMA), a federal agency's federal consistency obligations under the CZMA are independent of those required under National Environmental Policy Act. Navy's consistency determination submission was a stand-alone document containing all required 15 C.F.R. § 930.39(a) information. As such, the Navy has determined that DOS's concurrence may be presumed because the Navy has fulfilled its obligation under 15 C.F.R. § 930.39(a) and the state agency has failed to respond within 60 days of submission of the consistency determination.

Based on the analyses contained in the consistency determination, the Navy will be fully consistent with the policies of the New York Coastal Management Program. Based on the your letter of March 11, 2013, the Navy can presume DOS concurrence with our Federal Consistency Determination.

My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Copy to: Ms. Denise Caldwell

C.2.14 NORTH CAROLINA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1088
December 12, 2012

Mr. Steve Rynas
Division of Coastal Management
Department of Environment and Natural Resources
400 Commerce Avenue
Morehead City, NC 28557-3421

Dear Mr. Rynas:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c)and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area. The Navy has prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed North Carolina's Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy determined that the Proposed Action in the Study Area is fully consistent with North Carolina's Coastal Management Program

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Pat McCrory
Governor

Braxton C. Davis
Director

John E. Skvarla, III
Secretary

February 12, 2013

J. W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Commander
US Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

SUBJECT: **CD13-010** – Consistency Concurrence for Proposed Atlantic Fleet Training, Testing, and Associated Range Capability Enhancements, Offshore, North Carolina (DCM#20120122)

Dear Mr. Murphy:

We received your consistency determination on December 14, 2012 for the proposed Atlantic Fleet (Fleet) training, testing, and associated range capability enhancements in the Atlantic Ocean. These various activities are anticipated to include but not be limited to: fleet training and testing exercises, sonar (testing and maintenance), gunnery exercises, missile testing, the use of explosives, anti-submarine training, electronic warfare, and other associated training and testing activities. The proposed action is further described in Chapter 2 of "*Atlantic Fleet Training and Testing Draft Environmental Statement/Overseas Environmental Impact Statement*" (EIS, May 2012). The Navy's preferred alternative is "*Alternative 2*" (Section 2.8).

Overall the study area encompasses the coastal zones of all states bordering the Atlantic Ocean and the Gulf of Mexico. Many of the proposed fleet activities, while in the Atlantic Ocean, will be outside of North Carolina's coastal area. Nevertheless, some Fleet activities, even if outside of North Carolinas coastal area, could potentially affect coastal uses and/or coastal resources located within North Carolina's coastal area. The Navy does not propose any activities on land within North Carolina. The applicability of this consistency concurrence, by the State of North Carolina, is limited to proposed Fleet activities that would affect North Carolina's coastal area.

The Navy's proposed action is a continuation of Fleet training which has been the subject of prior environmental review and subject to prior consistency concurrences. The current environmental

400 Commerce Ave., Morehead City, NC 28557-3421
Phone: 252-808-2808 \ FAX: 252-247-3330 Internet: www.nccoastalmanagement.net

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impact statement is an analytical update and consolidation into one document of six previous environmental impact statements. Nevertheless, the proposed action under this review would be an increase (from the existing situation) in the intensity of training and testing activities. The Navy states, in the current EIS, that environmental resource impacts will remain essentially unchanged from the effects analyzed under the "*No Action*" alternative. Additionally, the Navy states that adverse effects to environmental resources will be minimized through mitigation and monitoring.

The prior three consistency concurrences were DCM#20080169, DCM#20080168, and DCM#20080118. These prior consistency concurrences acknowledged that Fleet training has been an ongoing activity that has spanned many years. The agency and public review process related to these prior Fleet activities did not disclose any inconsistencies with North Carolinas Coastal management program. Nevertheless, those commenting on the previous proposed Fleet actions expressed the following (summarized) concerns related to tourism, fishing, debris accumulation, the need to protect sensitive habitats, and protect threatened and endangered species.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located. It is the objective of the Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed Federal activities would be compatible with safeguarding and perpetuating the biological, social, economic, and aesthetic values of the State's coastal waters.

To solicit public comments, DCM circulated a description of the proposed project to State agencies that would have a regulatory interest. No comments asserting that the proposed activity would be inconsistent with the State's coastal management program were received. Nonetheless, several State agencies reiterated concerns previously expressed. The North Carolina Wildlife Resources Commission (NCWRC) encourages the protection of marine mammals, reptiles, and avian species. Accordingly, the NCWRC endorsed the concerns expressed by the USFWS and NOAA regarding the necessity for Fleet activities to minimize adverse effects on marine life. The North Carolina Division of Parks and Recreation (NCDPR) and the North Carolina Natural Heritage Program (NCNHP) noted that Fleet (increased) activities could affect threatened and endangered species and significant natural heritage areas. Both the NCDPR and the NCNHP recommend that Fleet activities be conducted with extreme care and that monitoring and mitigation be utilized to minimize adverse effects. The North Carolina Division of Marine Fisheries (NCDMF) clarified that hard bottom habitat does not require a "*stony bottom, bedrock, or rubble*" as described in the EIS. Additionally, NCDMF encouraged the Navy to further study the effects of sonar and electromagnetic radiation on marine animals. The Navy provided a response to those comments on January 25, 2013. A copy of each of the comments received from the State agencies has been attached for reference.

DCM has reviewed the submitted information pursuant to the management objectives and enforceable policies of Subchapters 15A NCAC 07H and15A NCAC 07M of Chapter 7 of Title 15A of North Carolina's Administrative Code which are a part of the State's certified coastal

management program and concurs that the proposed Federal activity is consistent, to the maximum extent practicable, with the enforceable policies of North Carolina's coastal management program. This concurrence applies only to the Navy's implementation of Fleet actions as described in the consistency submission which also references adherence to the mitigation measures described in the "*Atlantic Fleet Training and Testing Draft Environmental Statement/Overseas Environmental Impact Statement*" (May 2012). Though we concur with the Navy's consistency determination, we continue to encourage the Navy, when conducting its training exercises, to be responsive to the concerns that have been expressed by the various State agencies.

Should the proposed action be modified, a revised consistency determination could be necessary. This might take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46, or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered by the proposed action or which become significant due to the long-term cumulative effects of the proposed action, a supplemental consistency certification may be required. If you have any questions, please contact Stephen Rynas at 252-808-2808 x209. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Doug Huggett

Doug Huggett
Manager, Major Permits and Consistency Unit

Cc: Jene Nissen, Fleet Installations and Environmental Readiness

Page: 3

C.2.15 PUERTO RICO

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1092
December 12, 2012

Ms. Rose A. Ortiz, Planning Analyst
Puerto Rico Planning Board
P.O. Box 41119
San Juan, Puerto Rico 00940-1119

Dear Ms. Ortiz:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed Puerto Rico's Coastal Zone Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be fully consistent with Puerto Rico's Coastal Zone Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

Puerto Rico Planning Board
Office of the Governor
Commonwealth of Puerto Rico

Roberto Sanchez Vilella Government Center
De Diego Ave., Stop 22, Santurce, PR
P.O. Box 41119, San Juan PR 00940-1119

February 15, 2013

Mr. J.W. Murphy
Deputy Chief of Staff
For Fleet Installations and Environmental Readiness
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue Suite 250
Norfolk, VA 23551-2487

Federal Consistency Determination
CZ-2013-0116-053
Atlantic Fleet Training and Testing Activities
Puerto Rico Jurisdiction

Dear Mr. Murphy:

The Puerto Rico Planning Board has been evaluating the Federal Consistency Determination and Environmental Impact Statement documents for the federal activity at reference. According to provided information, the Department of the Navy is evaluating alternatives as part of an effort to plan and organize the required training and testing activities to guarantee the readiness of the Navy's fleets and personnel for facing the actual National Security threats. The alternative number 2, (selected as preferred) include the Puerto Rico jurisdiction within the Atlantic Fleet Training and Testing (AFTT) Study Area. The proposed activities that have the potential to impact Puerto Rico Coastal Zone are the following:

Federal Activities	No. of events	Ordnance (Number per year)
Gunnery Exercise (Surface to-Air) – Medium-Caliber (GUNEX [S-A]) – Medium-Caliber	14	30,000 rounds
Gunnery Exercise (Surface to-Surface) – Ship Small-Caliber (GUNEX [S-S] – Ship) Small-Caliber	70	201,000 rounds

Federal Activities	No. of events	Ordnance (Number per year)
(GUNEX [S-S] - Ship) - Medium-Caliber	32	3,840 rounds (320 HE)
Gunnery Exercise (Surface to-Surface) - Ship Large-Caliber (GUNEX [S-S] - Ship) - Large-Caliber	18	633 rounds (96 HE)
Gunnery Exercise (Surface to-Surface) - Boat Small-Caliber (GUNEX [S-S] - Boat) - Small-Caliber	18	26,500 rounds
Sinking Exercise (SINKEX)	1	1 HE bomb; 11 HE missiles; 700 HE rounds; 1 HE torpedo (representative scenario)
Tracking Exercise/ Torpedo Exercise – Submarine (TRACKEX/ TORPEX – Sub)	44	
Tracking Exercise/ Torpedo Exercise – Surface (TRACKEX/ TORPEX – Surface)	98	
Tracking Exercise/ Torpedo Exercise – Helicopter (TRACKEX/ TORPEX – Helo)	24	
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	32	N/A
Submarine Sonar Maintenance (in OPAREAs and Ports)	12	N/A
Air Combat Maneuver (ACM)	550	N/A
Air Platform/ Vehicle Test	468	N/A

Federal Activities		**No. of events**	**Ordnance (Number per year)**
ASW Tracking Test - Maritime Patrol Aircraft		16	368 HE sonobuoys
SUW Mission Package Testing	Gun Testing – Small-Caliber	5	2,500
	Gun Testing – Medium-Caliber	5	7,000
	Gun Testing – Large-Caliber	5	7,000
Missile Testing		1	1 missile
Kinetic Energy Weapon Testing		1	5,000
Torpedo (Explosive) Testing		2	28 torpedoes (8 HE torpedoes)
Countermeasure Testing		4	N/A
Radio-Frequency Communications Testing		13	N/A
Hydrodynamic Testing		2	N/A

Although none of the above listed training and testing activities will be conducted on lands within the Puerto Rico jurisdiction, these have the potential to impact the Puerto Rico Coastal Zone depending on their location and timing. Considering that precise information about location and timing of these activities cannot be provided in this phase of the proposed Federal Activities planning process, the Puerto Rico Planning Board provides the following recommendations in order to make the proposed activities consistent as maximum extent practicable with the Puerto Rico Coastal Zone Management Program (PRCZMP):

1- According to the enforceable Law Number 23 of June 20, 1972 (Organic Law of the Department of Natural and Environmental Resources) and applicable regulations, the Secretary of the Department of Natural and Environmental Resources (DNER) has the duty to exert vigilance and conservation of the territorial waters, submerged lands and maritime zone within the Puerto Rico jurisdiction. This Agency is the authority that administers and regulates public and private activities in the Puerto Rico coastal waters. Therefore, coordination with DNER will help the Navy to plan the proposed activities avoiding conflicts with other private and public uses that occur in the surroundings of the Puerto Rico Coastal Zone. The DNER would also provide information that will be helpful to avoid and minimize impacts on marine resources.

2- According to the Puerto Rico Environmental Policy Law (as amended by Law Number 416 of September 22, 2004), the Environmental Quality Board (EQB) is the agency with the duty to regulate activities that impact water and air quality within the Puerto Rico jurisdiction. This agency will be consulted in case that those activities with potential of impacting water and air quality are planned close to the Puerto Rico jurisdiction.

3- According to Law Number 89 of June 21, 1955 (Puerto Rico Culture Institute Organic Law), as amended, the Puerto Rico Culture Institute is the state Agency with the mission of implementing and enforcing the public policies directed to conserve and preserve cultural values of Puerto Rico. This agency safeguards the information about archaeological findings that are important for the Puerto Rico jurisdiction. Therefore, in case that the Navy plans an activity close to the Puerto Rico jurisdiction, coordination with this agency will help in identifying the location of archaeological sites in order to avoid impacts.

The Puerto Rico Planning Board is in the best disposition to collaborate with the Navy by providing required information and assistance in order to satisfy the National Security needs avoiding and minimizing impacts on the Puerto Rico Coastal Zone. For any question or assistance related to this matter, contact Rose A. Ortiz at (787) 722-0101, dial number 3, and extension 16705 or send an e-mail to: ortiz_r@jp.pr.gov

Thank you for the opportunity to comment.

Cordially,

Luis García Pelatti
Chairman

c. Hon. Carmen Guerrero Pérez, Secretary DNER
Mr. Ernesto Díaz, Director PRCZMP

C.2.16 RHODE ISLAND

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1093
December 12, 2012

Mr. Jeff Willis
Coastal Resources Management Council
Stedman Office Building
4808 Tower Hill Road
Wakefield, RI 02879-1900

Dear Mr. Willis:

In accordance with the Coastal Zone Management Act (16 United States Code § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. Based on the analyses, the Navy determined that the Proposed Action in the Study Area will be fully consistent with Rhode Island's Coastal Resources Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/047
February 21, 2013

Mr. Grover J. Fugate
Executive Director
Coastal Resources Management Council
Oliver H. Steadman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

Dear Mr. Fugate:

The United States Navy (Navy) is in receipt of your letter, dated January 25, 2013, requesting that a review of Rhode Island's Ocean Special Area Management Plan (SAMP) be included in the Navy's consistency determination for proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area and a 60 day extension be granted to Coastal Resources Management Council review period.

The Navy reviewed the Ocean SAMP and has determined that proposed activities detailed in the AFTT Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are fully consistent with the Ocean SAMP's enforceable policies. An explanation of determination is provided in the enclosed table. In addition, this table is being submitted as an addendum to our original consistency package which was forwarded to you on December 14, 2012. Accordingly, this fulfills our obligation to address all enforceable policies pursuant to 15 CFR Part 930 Subpart C.

Regarding your request for a 60 day extension to the initial response date of February 17, 2013, we are only able to extend the review period to March 11, 2013. An extension beyond that date would impact our ability to meet the AFTT EIS/OEIS completion timeline which supports our National Marine Fisheries Service permit authorizations.

We appreciate your assistance in this federal consistency process. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: Federal Agency Coastal Zone Management Act, Consistency Determination For Rhode Island, Addendum Table 4.

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/047
February 21, 2013

Mr. Grover J. Fugate
Executive Director
Coastal Resources Management Council
Oliver H. Steadman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

Dear Mr. Fugate:

The United States Navy (Navy) is in receipt of your letter, dated January 25, 2013, requesting that a review of Rhode Island's Ocean Special Area Management Plan (SAMP) be included in the Navy's consistency determination for proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area and a 60 day extension be granted to Coastal Resources Management Council review period.

The Navy reviewed the Ocean SAMP and has determined that proposed activities detailed in the AFTT Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are fully consistent with the Ocean SAMP's enforceable policies. An explanation of determination is provided in the enclosed table. In addition, this table is being submitted as an addendum to our original consistency package which was forwarded to you on December 14, 2012. Accordingly, this fulfills our obligation to address all enforceable policies pursuant to 15 CFR Part 930 Subpart C.

Regarding your request for a 60 day extension to the initial response date of February 17, 2013, we are only able to extend the review period to March 11, 2013. An extension beyond that date would impact our ability to meet the AFTT EIS/OEIS completion timeline which supports our National Marine Fisheries Service permit authorizations.

We appreciate your assistance in this federal consistency process. If you have any further questions, please contact Mr. Jene Nissen at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: Federal Agency Coastal Zone Management Act, Consistency Determination For Rhode Island, Addendum Table 4.

State of Rhode Island and Providence Plantations
Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

(401) 783-3370
Fax (401) 783-3767

March 6, 2013

J. W. Murphy, Deputy Chief of Staff
Fleet Installations and Environmental Readiness
United States Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, VA 23551-2487

RE: The Department of the Navy Consistency Determination regarding proposed activities in the Atlantic Fleet Training and Testing (AFTT) Study Area

Dear Sirs/Madam:

In accordance with Title 15 of the code of Federal Regulations, Part 930, subpart C (Consistency for Federal Activities) and review of the consistency determinations filed by the U.S. Navy on December 17, 2012, and further on February 21, 2013, the Coastal Resources Management Council hereby concurs with the determination that the referenced project is consistent with the Federally approved Rhode Island Coastal Resources Management Council Program and applicable regulations therein.

Please contact this office upon initiation of construction, or if you should have any questions regarding this project.

Sincerely,

Grover J. Fugate, Executive Director
Coastal Resources Management Council

/kc
cc: Jeffrey M. Willis, Deputy Director
Jene Nissen, USN
James Boyd, CRMC Coastal Policy Analyst
CRMC members
Brian Goldman, CRMC Legal Counsel

C.2.17 SOUTH CAROLINA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1094
December 12, 2012

Ms. Barbara Neale, Director
Regulatory Programs
Office of Ocean and Coastal Resource Management
Department of Health and Environmental Control
1362 McMillan Avenue, Suite 400
Charleston, SC 29405-2029

Dear Ms. Neale:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy has prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed South Carolina's Coastal Zone Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be fully consistent with South Carolina's Coastal Zone Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

C.2.18 TEXAS

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1095
December 12, 2012

Ms. Kate Zultner
Consistency Review Coordinator
Coastal Resources Division
Texas General Land Office
P.O. Box 12873
Austin, TX 78711-2873

Dear Ms. Zultner:

In accordance with the Coastal Zone Management Act (16 United States Code § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analyses of potential impacts. The Navy reviewed the Texas Coastal Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be fully consistent with Texas' Coastal Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

C.2.19 U.S. VIRGIN ISLANDS

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1096
December 12, 2012

Mr. Norman Williams
Division of Coastal Zone Management
Department of Planning and Natural Resources
45 Mars Hill
Frederiksted, St. Croix, VI 00840

Dear Mr. Williams:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the United States Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy prepared a Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy reviewed the U.S. Virgin Islands Coastal Management Program for preparing this consistency determination. Based on the analysis, the Navy determined that the Proposed Action in the Study Area is fully consistent with the U.S. Virgin Islands Coastal Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Mr. Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

C.2.20 VIRGINIA

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1078
December 12, 2012

Ms. Ellie Irons
Department of Environmental Quality
629 E. Main Street
Richmond, VA 23219

Dear Ms. Irons:

In accordance with the Coastal Zone Management Act (16 United States Code [U.S.C.] § 1456(c) and 15 Code of Federal Regulations [C.F.R.] Part 930 Subpart C), the U.S. Department of the Navy (Navy) requests concurrence with its Federal Consistency Determination for proposed activities in the Atlantic Fleet Training and Testing Study Area (Study Area). The Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts in the Study Area that may result from Navy training and testing activities and associated range capability enhancements.

The enclosed Draft EIS/OEIS contains detailed information and analysis of potential impacts. The Navy has reviewed Virginia's Coastal Zone Management Program for preparing this consistency determination. Based on the analyses, the Navy has determined that the Proposed Action in the Study Area will be fully consistent with Virginia's Coastal Zone Management Program.

We look forward to your timely review of and concurrence with the Navy's determination. My point of contact for this matter is Jene Nissen and he can be reached at 757-836-5221 or richard.j.nissen@navy.mil.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. Hard copy of the Draft EIS/OEIS
2. CD with electronic copy of Draft EIS/OEIS
3. Federal Consistency Determination

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

February 11, 2013

Mr. J. W. Murphy
Fleet Installations and Environmental Readiness
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, Virginia 23551-2487

RE: Federal Consistency Determination for the Atlantic Fleet Training and Testing, Department of the Navy (DEQ 12-228F).

Dear Mr. Murphy:

The Commonwealth of Virginia has completed its review of the Federal Consistency Determination (FCD) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of Federal Consistency Determinations and responding to appropriate officials on behalf of the Commonwealth. This letter is in response to your submission dated December 12, 2012 (received December 14, 2012) requesting concurrence with the Federal Consistency Determination prepared by the Department of the Navy (Navy). In addition, DEQ conducted a coordinated review of the draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) previously submitted by the Navy and responded on behalf of the Commonwealth on July 9, 2012. The following agencies and planning district commission participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Virginia Marine Resources Commission
Department of Game and Inland Fisheries
Department of Aviation
Department of Health
Department of Historic Resources
Hampton Roads Planning District Commission

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

In addition, the Department of Mines, Minerals, and Energy, Virginia Institute of Marine Science, and Accomack-Northampton Planning District Commission were invited to comment on the proposal.

PROJECT DESCRIPTION

The Department of the Navy (Navy) proposes to conduct military readiness training and research, development, test and evaluation activities within the Atlantic Fleet Training and Testing (AFTT) Area. The AFTT Area is in the western Atlantic Ocean and encompasses the waters off the east coast of North America and the Gulf of Mexico. The area covers approximately 2.6 million nautical square miles of ocean area, and includes designated Navy operating areas and special use airspace. Virginia offshore and inland coastal waters in the Study Area includes the Virginia Capes (VACAPES) Range Complex and the lower Chesapeake Bay. The VACAPES Range Complex spans 270 miles along the coast from Delaware to North Carolina from the shoreline to 155 nautical miles (nm) seaward, and includes special use airspace with associated warning and restricted areas, and surface and subsurface sea space of the VACAPES Operations Area (OPAREA). The VACAPES Range Complex also includes established mine warfare training areas located within the lower Chesapeake Bay and off the coast of Virginia. Proposed activities have the potential to impact sediments and water quality, air quality, marine habitats, marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety.

PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, the public was invited to participate in the review of the FCD. Public notice of this proposed action was published on the DEQ website from December 18, 2012 through January 15, 2013. No public comments were received in response to the notice. On January 23, 2013 (eight days after the public comment period closed) the Natural Resources Defense Council (NRDC) requested that DEQ reopen the public comment period to facilitate members of NRDC to submit comments. DEQ agreed to accept a coordinated response from NRCD on behalf of its members in lieu of several hundred comments from individual members. NRDC accepted the offer but failed to submit any comments to date.

FEDERAL CONSISTENCY CONDITIONAL CONCURRENCE

Based on our review of the Navy's consistency determination and the comments submitted by agencies administering the enforceable policies of the VCP, DEQ conditionally concurs that the proposal is consistent with the VCP provided the proposal complies with all the applicable permits, approvals, and conditions of the enforceable policies of the VCP.

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

The conditions of this concurrence include, but are not limited to, receiving applicable permits for activities affecting the territorial waters of Virginia prior to commencing such activities. Potential applicable permits are related to the following enforceable policies of the VCP:

(i) subaqueous lands management (Virginia Code § 28.2-1200 – 28.2-1213)
(ii) wetlands management (and water quality) (Virginia Code § 62.1-44.15:5 and § 401 of the Clean Water Act)
(iii) dunes management (Virginia Code § 28.2-1400 – 28.2-1420)
(iv) air pollution control (Virginia Code § 10.1-1300 – 10.1-1320)
(v) coastal lands management (Virginia Code § 10.1-2100 – 10.1-2114)

In accordance with the *Federal Consistency Regulations* at 15 CFR Part 930, section 930.4, this conditional concurrence is based on the Navy obtaining necessary authorizations prior to any actions that would impact any of the enforceable policies. If the requirements of section 930.4, sub-paragraphs (a)(1) through (a)(3) are not met, this conditional concurrence becomes an objection under 15 CFR Part 930, section 940.43.

Other state approvals which may apply to this project are not included in this conditional concurrence. Therefore, the Navy must ensure that these activities are conducted in accordance with all applicable federal, state, and local laws and regulations.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972 (§ 1456(c)), as amended, and the federal consistency regulations implementing the CZMA (15 CFR Part 930, Subpart C, § 930.30 *et seq.*) federal actions that can have reasonably foreseeable effects on Virginia's coastal uses or resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia Coastal Zone Management Program (VCP). The VCP is comprised of a network of programs administered by several agencies. In order to be consistent with the VCP, the federal agency activities must be consistent with all the applicable enforceable policies of the VCP prior to commencing the project.

FEDERAL CONSISTENCY ANALYSIS

The analysis that follows addresses the enforceable policies of the Virginia Coastal Zone Management Program that apply to the proposed action. In order to be consistent with the VCP, the Navy must obtain all the applicable permits and approvals listed under the enforceable policies of the VCP prior to commencing with the proposed activities.

According to information in the FCD, the proposed activities would have no effect on the following enforceable policies: subaqueous lands management; wetlands management; dunes management; nonpoint source pollution control; point source pollution control; shoreline sanitation; and coastal lands management. The Navy must ensure that the

proposed action is consistent with the aforementioned policies. In addition, DEQ encourages the Navy to consider the effects of the proposed activities on the advisory policies of the VCP (Attachment 2). The analysis which follows responds to the Navy's discussion of the enforceable policies of the VCP that apply to this project and review comments submitted by agencies that administer the enforceable policies.

1. Fisheries Management. According to the FCC (page 8), the proposed activities have the potential to affect commercial and recreational fisheries. Activities involving repeated ordinance use (particularly explosive ordinance) military expended material, and shallow-water ship and submersible activity could temporarily limit access to areas of the coastal zone, including popular fishing locations. The document finds that there is a remote possibility that individual fish could encounter explosive or non-explosive ordnance or other expended materials. Long-term consequences for populations due to acoustic stressors would not be expected. The Navy has submitted an Essential Fish Habitat Assessment to National Marine Fisheries Service pursuant to the *Magnuson-Stevens Fishery Conservation and Management Act*, and is engaged in consultation.

1(a) Agency Jurisdiction.

(i) Virginia Marine Resources Commission and the Department of Game and Inland Fisheries

The fisheries management enforceable policy is administered by the Virginia Marine Resources Commission (VMRC) (Virginia Code 28.2-200 to 28.2-713) and the Department of Game and Inland Fisheries (DGIF) (Virginia Code 29.1-100 to 29.1-570).

(ii) Virginia Department of Health

The Virginia Department of Health's (VDH) Division of Shellfish Sanitation (DSS) is responsible for protecting the health of the consumers of molluscan shellfish and crustacea by ensuring that shellfish growing waters are properly classified for harvesting, and that molluscan shellfish and crustacea processing facilities meet sanitation standards. The mission of this Division is to minimize the risk of disease from molluscan shellfish and crustacea products at the wholesale level by classifying shellfish waters for safe commercial and recreational harvest; by implementing a statewide regulatory inspection program for commercial processors and shippers; and by providing technical guidance and assistance to the shellfish and crustacea industries regarding technical and public health issues.

1(b) Agency Findings.

(i) Virginia Marine Resources Commission

VMRC finds that, while the majority of activities will occur outside Virginia's designated coastal zone, it appears that many, if not most, of the activities in Virginia waters are the

same or similar training activities that have been occurring or ongoing in the area for some time without significant impact on fishery resources.

Comments on fisheries for the Navy's draft EIS/OEIS were provided by VMRC in May of 2012 and are reproduced as follows.

> *VMRC finds that the Navy's proposed training and testing activities, which may include the use of active sonar and explosives, could be harmful to a spawning run of adult female sturgeon, striped bass, or any alosine species, preparing to migrate into the Chesapeake Bay and also to any young or mature adults returning to the ocean after their spawning migrations are complete.*
>
> *Atlantic sturgeon, currently listed as endangered, and candidate endangered species, alewife, blueback herring, and American eel, have incurred notable declines due to both overfishing and habitat degradations and loss. The National Marine Fisheries Service estimates that the adult population of Atlantic sturgeon in the Chesapeake Bay consists of only 329 adults and 987 sub-adults. Alosine species, such as American shad, alewife, and blueback herring are currently under harvest moratoriums due to population declines. A commercial and recreational harvest moratorium on American shad has been in effect since 1994 (Chesapeake Bay) and 2005 (territorial waters of Virginia). A commercial and recreational harvest moratorium on river herring (alewife and blueback herring) has been in effect since January 1, 2012. Alosines congregate in the offshore waters of Virginia prior to their spawning runs, which can span a time period extending from February 15 through June 30. Any use of active sonar or explosives near these congregations could disrupt spawning behavior.*
>
> *In addition, biological impacts by sonar and explosives to burrowed blue crabs in winter aggregates in the lower Chesapeake Bay, near the Territorial Sea, should be addressed, as this stock is still recovering from a near-collapse of the Chesapeake Bay stock in 2008. Over-wintering female hard crabs represent the harvest potential for the upcoming year's fishery, and the future potential for the population, as the crabs congregate in the lower Chesapeake Bay, and offshore waters of the Territorial Sea, to release their eggs during the spring.*
>
> *The most recent fishery independent winter-dredge survey noted that the number of spawning age females recorded by the survey dropped by roughly 50 percent from 2011 levels, down to 97 million. That level is above the healthy-species threshold, but the low recorded number of spawning age females is a warning signal that requires a risk-averse, prudent management strategy to avert another stock decline. Crab abundance from 1998 through 2008 was at a much reduced level before the bay-wide stock rebuilding program began four years ago.*

In comments to the draft EIS/OEIS VMRC noted the possible need to further consider certain fishery resources impacts. VMRC notes that it does not appear those comments have been specifically addressed to date in the documentation provided for the FCD.

(ii) Department of Game and Inland Fisheries

The Department of Game and Inland Fisheries (DGIF) has no comments on the proposed action.

(iii) Virginia Department of Health

According to the VDH-DSS, the project area includes both condemned and approved shellfish waters.

1(c) Recommendation.

VMRC recommends that the final EIS/OEIS should address its previous fishery related comments.

1(d) Conclusion.

(i) Virginia Marine Resources Commission

VMRC has no objection to ongoing Navy operations or activities with respect to their consistency with the fisheries management enforceable policy of the VCP.

(ii) Department of Game and Inland Fisheries

DGIF did not indicate that the proposed action is inconsistent with the fisheries management enforceable policy of the VCP under its jurisdiction.

(iii) Virginia Department of Health

VDH-DSS concludes that there would be no changes to the number or extent of existing shellfish condemnations based on the activities described.

For further information, contact VMRC, Justine Woodward at (757) 247-8027, DGIF, Amy Ewing at (804) 367-2211, and/or VDH-DSS, Keith Skiles at (804) 864-7487.

2. Subaqueous Lands Management. According to the FCC (page 8), this policy is not applicable as the proposed activities are not of the type that requires permits.

2(a) Agency Jurisdiction. The Virginia Marine Resources Commission, pursuant to Section 28.2-1200 *et seq.* of the *Code of Virginia*, has jurisdiction over any encroachments in, on, or over any state-owned rivers, streams, or creeks in the Commonwealth. VMRC administers the subaqueous lands management enforceable policy of the VCP.

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

The VMRC serves as the clearinghouse for the Joint Permit Application (JPA) used by:

- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands;
- U.S. Army Corps of Engineers for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a Virginia Water Protection Permit; and
- local wetlands board for impacts to wetlands.

2(b) Findings. VMRC finds that the activities described appear to be similar to many that have previously occurred in Virginia waters in the lower Chesapeake Bay and the Atlantic Ocean without significant impact on submerged lands. In addition, previous VMRC comments on the draft EIS/OEIS regarding agency jurisdiction and permitting for activities impacting state-owned subaqueous lands were provided by VMRC in June of 2012. Those comments are as follows.

> *In accordance with §28.2-1203 of the Code of Virginia, permits from the Habitat Management Division of VMRC may be necessary for certain training or testing activities that are to occur over, or that may otherwise impact, the identified state-owned submerged bottomlands. Without identifying all of the potential training activities that could occur, specific activities that will result in the filling or encroachment over state-owned submerged bottomlands will require a VMRC permit. In addition, activities that will result in the disturbance to identified areas of submerged aquatic vegetation (SAV) or the abandonment of vessels, structures, or materials over the state's submerged bottomlands will require a VMRC permit.*
>
> *To obtain a VMRC permit, the Navy must complete and submit a JPA detailing the proposed activities and their impacts and locations. Prior to submitting a JPA, the Navy should contact Habitat Management staff to review all proposed activities and impacts over state-owned submerged bottomlands. Staff will determine if a VMRC permit is required, and then provide guidance and direction for the completion of the JPA, if necessary.*

VMRC finds that it does not appear its previous comments have been specifically addressed in the documentation provided for the consistency review. The activities requiring a permit would be those that could possibly result in, or act as, a fill on state-owned submerged lands. Although the FCD suggests no activities will occur that require a permit pursuant to the subaqueous lands management enforceable policy of the VCP, permits have been issued in the past for Navy training exercises involving the installation of temporary causeways on, and adjacent to the beach over submerged land at both Fort Story and Little Creek.

7

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

2(c) Recommendation.

VMRC recommends that the final EIS/OEIS should address activities that could result in impacts to submerged lands.

2(d) Conclusion. VMRC has no objection to a finding of consistency for ongoing Navy operations or activities, and those that previously received permits, that may result in impacts to state-owned submerged lands. Such activities will require review through the local-state-federal Joint Permit Application process.

For additional information and coordination, contact VMRC, Justine Woodward at (757) 247-8027.

3. Wetlands Management. According to the FCD (page 8), the wetlands management enforceable policy is not applicable to the proposed action. The document states that proposed activities would not take place in tidal wetlands and, therefore, wetlands would not be affected.

3(a) Agency Jurisdiction. The wetlands management enforceable policy is administered by VMRC and DEQ. The tidal wetlands program is administered by VMRC in accordance with Virginia Code 28.2-1301 through 28.2-1320. The Virginia Water Protection Permit program is administered by DEQ and includes the protection of both tidal and non-tidal wetlands in accordance with Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

3(b) Agency Findings.

(i) Virginia Marine Resources Commission

VMRC finds that the activities described appear to be similar to many that have previously occurred in Virginia waters in the lower Chesapeake Bay and the Atlantic Ocean without significant impact on tidal wetlands. Although the FCD finds that no activities will occur that require a permit pursuant to the tidal wetlands program, permits have been issued in the past for Navy training exercises.

(ii) Department of Environmental Quality

The Virginia Water Protection Permit (VWPP) program at the DEQ Tidewater Regional Office (TRO) finds that it appears that much of the proposed activity will fall outside the regulatory purview of the VWPP program as they will occur outside of Virginia's Territorial Sea. In addition, specific activities may not be subject to regulation under the VWPP program.

8

3(c) Agency Requirements.

(i) Virginia Marine Resources Commission

The activities requiring a permit would be those that may result in, or act as, a fill in tidal wetlands. Such activities would be reviewed through the local-state-federal Joint Permit Application process.

(ii) Department of Environmental Quality

A VWPP or other authorizations may be required for those regulated activities that may occur within Virginia waters. Based on the diverse training and testing activities described for this action, it is not possible to provide a definitive assessment of specific regulatory requirements. Should specific activities regulated under Virginia Code Section 62.1-44.15:20 and Virginia Administrative Code Section 9 VAC 25-210 be proposed, all necessary authorizations must be obtained and complied with. In the event of uncertainty concerning a specific activity, early coordination with the VWPP program at DEQ-TRO is recommended.

3(d) Conclusion.

(i) Virginia Marine Resources Commission

VMRC has no objection to a finding of consistency for ongoing Navy operations or activities, and those activities that previously received permits, that may result in impacts to tidal wetlands.

(ii) Department of Environmental Quality

DEQ did not indicate that the proposed action is inconsistent with the wetlands management enforceable policy of the VCP under the agency's jurisdiction.

For additional information and coordination, contact VMRC, Justine Woodward at (757) 247-8027 and/or the VWPP program at DEQ-TRO, Bert Parolari at (757) 518-2166, for additional information,

4. Dunes Management. The FCC (page 8) states that the dunes management enforceable policy is not applicable to the proposed activities. The proposed activities would not impact dunes or dune management since no land activities would occur.

4(a) Agency Jurisdiction. Dune protection is carried out pursuant to The Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. In accordance with the commonwealth's Coastal Primary Sand Dune/Reaches Guidelines: Barrier Island Policy (4 VAC 20-440-10 B. 1), no construction or any other activity which has the potential for encroaching on or otherwise damaging coastal primary sand dunes or state-owned beaches shall occur

without review and approval by VMRC (Virginia Code 28.2-1400 through 28.2-1420) or a local wetland board, or both.

4(b) Agency Findings. As previously noted, VMRC finds that the activities described appear to be similar to many that have previously occurred in Virginia waters in the lower Chesapeake Bay and the Atlantic Ocean. These activities have not resulted in significant impacts to primary sand dunes or state-owned beaches. Although the FCD finds that no activities will occur that require authorization, permits have been issued by VMRC in the past for Navy training exercises that involved the installation of temporary causeways on, and adjacent to the beach at both Fort Story and Little Creek.

4(c) Requirements. According to VMRC, Navy activities requiring a permit would be those that result in impacts to primary sand dunes and state-owned beaches. Such activities must be reviewed through the local-state-federal Joint Permit Application process.

4(d) Conclusion. VMRC has no objection to a finding of consistency for ongoing Navy operations or activities, and those that previously received permits, that may result in impacts to primary sand dunes and beaches.

For further information, contact VMRC, Justine Woodward at (757) 247-8027.

5. Nonpoint Source Pollution Control. According to the FCD (page 8), no soil-disturbing projects would be initiated with the proposed activities. Navy training occurs in coastal and offshore waters, and activities do not include any construction.

5(a) Agency Jurisdiction. The Department of Conservation and Recreation (DCR) Division of Stormwater Management (DSM) administers the nonpoint source pollution control enforceable policy of the VCP through the *Virginia Erosion and Sediment Control Law and Regulations* (*VESCL&R*) and *Virginia Stormwater Management Law and Regulations* (*VSWML&R*).

5(b) Agency Findings. DCR-DSM has no comments on the proposed action.

5(c) Conclusion. The action, as proposed, is consistent with the nonpoint source pollution control enforceable policy of the VCP.

6. Point Source Pollution Control. The FCD (page 8) states that the proposed activities would not result in point source pollution discharges. A National Pollutant Discharge Elimination System permit is not required for the proposed activities.

6(a) Agency Jurisdiction. The point source pollution control enforceable policy is administered by the State Water Control Board (DEQ) pursuant to Virginia Code 62.1-44.15. Point source pollution control is accomplished through the implementation of: (1) the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the

Virginia Pollutant Discharge Elimination System (VPDES) permit program; and (2) the Virginia Water Protection Permit program administered by DEQ; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6(b) Agency Finding. The VPDES program at DEQ TRO has no concerns with proposed action provided water quality and designated uses are maintained as stated in the FCD.

6(c) Conclusion. The action, as proposed, is consistent with the point source pollution control enforceable policy of the VCP.

For additional information, contact DEQ-TRO, Mark Sauer at (757) 518-2105.

7. Air Pollution Control. According to the FCD (page 9), the proposed activities have the potential to temporarily impact air quality in localized areas of the coastal zone. Effects could result from explosive ordnance use (particularly in-air explosive ordnance) and ship and aircraft activity. Emissions from aircraft and surface vessels and byproducts from explosive ordnance could introduce contaminants into the air, temporarily degrading air quality. Air pollutant emissions due to the proposed activities in the Hampton Roads Intrastate Air Quality Control Region was estimated and determined to be below the *de minimis* thresholds for a full conformity determination. The FCD finds that no health effects would result from training- or testing-related emissions of hazardous air pollutants. Residual hazardous air pollutant impacts during respites between the proposed activities would not be detectable and would be below or within historical or desired air quality conditions.

7(a) Agency Jurisdiction. DEQ's Air Quality Division, on behalf of the State Air Pollution Control Board, is responsible to develop regulations that become Virginia's *Air Pollution Control Law*. DEQ is charged to carry out mandates of the state law and related regulations as well as Virginia's federal obligations under the *Clean Air Act* as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issue of necessary permits to construct and operate all stationary sources in the region as well as to monitor emissions from these sources for compliance. As a part of this mandate, the environmental documents of new projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

7(b) Agency Findings. According to the DEQ Air Division, the range area is located in an ozone (O_3) maintenance area and an emission control area for the contributors to ozone pollution, which are volatile organic compounds (VOCs) and nitrogen oxides (NO_x).

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

7(c) Recommendations. The Navy should take all reasonable precautions to limit emissions of VOCs and NO_x, principally by controlling or limiting the burning of fossil fuels.

7(d) Conclusion. The action, as proposed, is consistent with the air pollution control enforceable policy of the VCP.

For further information, contact the DEQ Air Division, Kotur Narasimhan at (804) 698-4415

8. Coastal Lands Management. According to the FCD (page 8), the coastal lands management enforceable policy is not applicable to the proposed action. The document states that the proposed activities will not impact the water quality and economic resources of the Chesapeake Bay.

8(a) Agency Jurisdiction. DCR-DSM Local Implementation (LI) (previously called the Division of the Chesapeake Bay local Assistance) administers the coastal lands management enforceable policy of the VCP which is governed by the *Chesapeake Bay Preservation Act* (Virginia Code §10.1-2100-10.1-2114) and *Chesapeake Bay Preservation Area Designation and Management Regulations* (9 VAC 10-20 *et seq.*).

8(b) Agency Findings. DCR-DSM-LI notes that the action proposes to conduct various training and testing maneuvers for the Navy's Atlantic Fleet, with the project area affecting the waters and, in some cases, the subaqueous bottomlands of various tidal water bodies. However, DCR-DSM-LI finds that in no case is the land affected. Since the Chesapeake Bay Preservation Act program applies solely to land-disturbing activities, there are no requirements under the *Bay Act* for the Atlantic Fleet Training and Testing project.

8(c) Conclusion. The proposed action is consistent with the coastal lands management enforceable policy of the VCP as administered under the *Chesapeake Bay Preservation Act.*

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

In addition to the enforceable policies of the VCP, comments were also provided with respect to applicable requirements and recommendations of the following programs:

1. Solid and Hazardous Waste Management.

1(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by the Virginia Department of Environmental Quality, the Virginia Waste Management Board (VWMB) and the U.S. Environmental Protection Agency. They administer programs created by the federal Resource Conservation and Recovery Act, Comprehensive Environmental Response Compensation and Liability Act, commonly called Superfund,

and the Virginia Waste Management Act. DEQ administers regulations established by the VWMB and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use, and alternative programs such as materials recycling and composting.

1(b) Agency Recommendations. The DEQ Division of Land Protection and Revitalization (DLPR) recommends that, should any on-shore sites in Virginia be impacted, the Navy should conduct an environmental investigation to identify any solid or hazardous waste sites or issues related to related on-shore activities related to the training operations.

(i) Data Base Searches

DEQ-DLPR recommends that the Navy access and analyze the data in DEQ's web-based databases to determine if Navy activities would affect or be affected by any sites identified in the databases. The databases include:

- Permitted Solid Waste Management Facilities;
- Virginia Environmental Geographic Information Systems (Solid Waste, Voluntary Remediation Program, and Petroleum Release sites);
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Facilities; and
- Hazardous Waste Facilities.

Instructions on accessing the data bases are attached to this response. These database searches will include most waste-related site information for each locality based upon the radius of the address selected (such as .5 miles, .25 miles, or .1 mile). In many cases, especially when the project is located in an urban area, the database output for that locality will be extensive. This information is important to identify possible environmental concerns that may impact a new project.

(ii) Pollution Prevention

DEQ encourages the implementation of pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

1(c) Requirements. Soil that is suspected of contamination or wastes that are generated as a result of training and testing activities in Virginia must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations. Some of the applicable state laws and regulations are: *Virginia Waste Management Act*, Code of Virginia Section 10.1-1400 *et seq.*; *Virginia Hazardous Waste Management Regulations* (*VHWMR*) (9 VAC 20-60); *Virginia Solid Waste Management Regulations*

(*VSWMR*) (9 VAC 20-81); and *Virginia Regulations for the Transportation of Hazardous Materials* (9 VAC 20-110). Some of the applicable federal laws and regulations are: the *Resource Conservation and Recovery Act* (*RCRA*), 42 U.S.C. Section 6901 *et seq.*, the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous materials, 49 CFR Parts 107.

For additional information regarding waste comments, contact Steve Coe, DEQ-DLPR at (804) 698-4029.

2. Natural Heritage Resources.

2(a) Agency Jurisdiction.

(i) Department of Conservation and Recreation

The mission of the Virginia Department of Conservation and Recreation (DCR) is to conserve Virginia's natural and recreational resources. The DCR-Natural Heritage Program's (DCR-DNH) mission is conserving Virginia's biodiversity through inventory, protection, and stewardship. The *Virginia Natural Area Preserves Act*, 10.1-209 through 217 of the *Code of Virginia*, was passed in 1989 and codified DCR's powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened, and endangered species, significant natural communities, geologic sites, and other natural features).

(II) Department of Agriculture and Consumer Services

The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the *Code of Virginia*, as amended, authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to conserve, protect and manage endangered species of plants and insects. The VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the U.S. Fish and Wildlife Service, DCR-DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by the U.S. Fish and Wildlife Service, are available, adherence to the order and tasks outlines in the plans are followed to the extent possible.

2(b) Agency Findings. The Parramore Island and Wreck Island Natural Area Preserves are adjacent to the project area and support several different populations of rare nesting birds including the:

- piping plover (*Charadrius melodus,* G3/S2B/S1N/LT/LT);

- least tern (*Sternula antillarum,* G4/S2B/NL/NL); and
- black skimmer (*Rynchops niger,* G4/S2BS1N/NL/NL).

In addition, several state- and federally-listed sea turtles, whales and other marine mammals are located in the project vicinity and may be affected by the proposed activities.

(i) Threatened and Endangered Plant and Insect Species

VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between VDACS and DCR, DCR has the authority to report for VDACS on state-listed plant and insect species. DCR finds that the current activity will not affect any documented state-listed plants or insects.

2(c) Recommendations. DCR recommends the Navy consider the following:

- restrict any activities near Natural Area Preserves from April until August during migration and nesting activities for sea turtles and migratory birds due to the legal status of many of these species;
- coordinate with the Virginia Department of Game and Inland Fisheries (DGIF), United States Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS) for information regarding the possible impacts and to ensure compliance with protected species legislation; and
- access the Virginia Department of Game and Inland Fisheries database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters.

3. Aviation Impacts.

3(a) Agency Jurisdiction. The Virginia Department of Aviation's (DoAv) Airport Services Division provides airport sponsors and managers with technical assistance on a wide range of projects and issues, including the planning, design, construction and maintenance of airport facilities. The division manages funding programs for capital improvements, facilities and equipment, airport maintenance projects, and airport security; the General Aviation Voluntary Security Certification Program; the licensing program for public-use airports; and the registration program for private-use airports. This division conducts statewide aviation system planning and maintains the Virginia Air Transportation System Plan.

3(b) Agency Response. DoAv has no comments on the proposed action.

For additional information, contact DoAv, Rusty Harrington at (804) 236-3624.

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

4. Historic and Archaeological Resources.

4(a) Agency Jurisdiction. The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. DHR, as the designated State's Historic Preservation Office, ensures that federal actions comply with *Section 106 of the National Historic Preservation Act of 1966* (NHPA), as amended, and its implementing regulation at 36 CFR Part 800. The NHPA requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding.

4(b) Requirement. According to DHR, the Navy or its agents must consult directly with DHR, as necessary, pursuant to *Section 106 of the National Historic Preservation Act* (as amended) and its implementing regulations codified at 36 CFR Part 800 which require Federal agencies to consider the effects of their undertakings on historic properties.

5. Regional Planning Area.

5(a) Agency Jurisdiction. In accordance with CFR 930, Subpart A, § 930.6(b) of the *Federal Consistency Regulations*, DEQ, on behalf of the state, is responsible for securing necessary review and comment from other state agencies, the public, regional government agencies, and local government agencies, in determining the Commonwealth's concurrence or objection to a federal consistency certification.

5(b) Agency Comments. The staff of the Hampton Roads Planning District Commission (HRPDC) reviewed the FCD and finds the proposal appears to be consistent with local and regional plans and policies.

For additional information contact Ben McFarlane, HRPDC at (757) 420-8300.

REGULATORY AND COORDINATION NEEDS

1. Subaqueous Lands Management. In accordance with §28.2-1203 of the Code of Virginia, permits from VMRC may be required for activities that occur over, or that may otherwise impact, state-owned subaqueous lands. The Navy must submit a JPA detailing the proposed activities, their impacts, and locations to initiate the review process. It is recommended the Navy contact VMRC Habitat Management staff to review all proposed activities and impacts over state-owned submerged bottomlands to determine if a VMRC permit is required. For additional information and coordination, contact VMRC, Tony Watkinson at (757) 247-2255.

2. Wetlands Management. Tidal wetland impacts associated with this proposal may require authorization from VMRC in accordance with Virginia Code 28.2-1301 through 28.2-1320. In addition, a Virginia Water Protection Permit from the DEQ Tidewater

Regional Office may be required for both tidal and nontidal impacts, including surface waters, pursuant to Virginia Code §62.1-44.15:5. The permit review process is initiated through the submission of a JPA to VMRC. VMRC will distribute the JPA to the appropriate agencies for review. For additional information and coordination contact VMRC, Tony Watkinson at (757) 247-2255 and/or contact DEQ-TRO, Bert Parolari at (757) 518-2166.

3. Dunes Management. Activities impacting primary sand dunes and state-owned beaches require authorization pursuant to The Coastal Primary Sand Dune Protection Act and the Commonwealth's Coastal Primary Sand Dune/Reaches Guidelines: Barrier Island Policy (4 VAC 20-440-10 B.1). No activity which has the potential for encroaching on or otherwise damaging coastal primary sand dunes or state-owned beaches shall occur without review and approval by VMRC (Virginia Code 28.2-1400 through 28.2-1420). The review process is initiated through the submission of a JPA to VMRC. For additional information and coordination contact VMRC, Tony Watkinson at (757) 247-2255.

4. Air Pollution Control. This action is subject to air pollution control regulations administered by the Department of Environmental Quality. Guidance on minimizing the emission of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) may be obtained from DEQ-TRO. For additional information, contact the DEQ Air Division, Kotur Narasimhan at (804) 698-4415.

5. Solid and Hazardous Wastes. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. Some of the applicable state laws and regulations are:

- *Virginia Waste Management Act* (Code of Virginia Section 10.1-1400 *et seq.*);
- *Virginia Hazardous Waste Management Regulations* (*VHWMR*) (9 VAC 20-60);
- *Virginia Solid Waste Management Regulations* (*VSWMR*) (9 VAC 20-81); and
- *Virginia Regulations for the Transportation of Hazardous Materials* (9 VAC 20-110).

Some of the applicable Federal laws and regulations are:

- *Resource Conservation and Recovery Act* (*RCRA*) (42 U.S.C. Section 6901 *et seq.*);
- Title 40 of the Code of Federal Regulations; and
- U.S. Department of Transportation Rules for Transportation of Hazardous materials (49 CFR Part 107).

For additional information, contact DEQ-DLPR, Steve Coe at (804) 698-4029.

6. Natural Heritage Resources. Contact DCR-DNH, Rene Hypes at (804) 371-2708, to secure updated information on natural heritage resources if a significant amount of

Mr. J.W. Murphy
Atlantic Fleet Training and Testing

time passes before the project is implemented, since new and updated information is continually added to the Biotics Data System.

7. Wildlife Resources and Protected Species. DGIF's database may be accessed to identify the locations of threatened and endangered species, trout streams, and anadromous fish waters. This information may be accessed at http://vafwis.org/fwis/ or contact Gladys Cason at (804) 367-0909 or gladys.cason@dgif.virginia.gov).

8. Historic Resources. Coordination of these activities with the Department of Historic Resources pursuant to *Section 106 of the National Historic Preservation Act* (as amended) and its implementing regulations at 36 CRF Part 800 may be accomplished by contacting DHR, Roger Kirchen at (804) 482-6091.

Thank you for the opportunity to comment on this FCD. The detailed comments of reviewing agencies are attached for your review. If you have questions, please call me at (804) 698-4325 or John Fisher at (804) 698-4339.

Sincerely,

Ellie Irons, Program Manager
Environmental Impact Review

Enclosures

Ec: Richard Weeks, DEQ Chief Deputy
Cindy Keltner, DEQ-TRO
Steve Coe, DEQ-DLPR
Kotur Narasimhan, DEQ-Air
Tony Watkinson, VMRC
Robbie Rhur, DCR
Barry Matthews, VDH
Amy Ewing, DGIF
David Spears, DMME
Roger Kirchen, DHR
Pam Mason, VIMS
R.N. Rusty Harrington, DoAv
Ben McFarlane, Hampton Roads PDC
Lauren Packard, NRDC

Cc: Elaine Meil, Accomack-Northampton PDC

18

C.3 ENDANGERED SPECIES ACT

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1026
September 21, 2012

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway, SSMC3, Room 13821
Silver Spring, MD 20910-3282

SUBJECT: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT SECTION 7 FORMAL CONSULTATION FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

In accordance with section 7 of the Endangered Species Act (ESA) the U.S. Navy requests initiation of formal consultation on Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean.

The proposed action may affect listed species that reside within the AFTT study area to sound and other environmental stressors associated with training and testing activities. The AFTT Environmental Impact Statement (EIS) (Enclosure (1)) is the Navy's primary document that provides the required information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting formal consultation on alternative 2 within the EIS. The enclosed supplemental information document (Enclosure (2)) serves as a roadmap for identifying the required information within the EIS, and provides additional, supporting information not found within the EIS. Enclosures 3 and 4 contain detailed tables on Navy activities and sound exposure model output as requested by the National Marine Fisheries Service (NMFS) during the pre-consultation process.

Based on the U.S. Navy's may affect, likely to adversely affect determinations, we are requesting formal consultation on the North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), Kemp's ridley turtle (*Lepidochelys kempii*), loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), largetooth sawfish (*Pristis pristis*), smalltooth sawfish (*Pristis pectinata*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and Gulf sturgeon (*Acipenser oxyrinchus desotoi*). We request concurrence on our may affect, not likely to adversely affect determinations for the bowhead whale (*Balaena mysticetus*), Atlantic salmon (*Salmo salar*), shortnose sturgeon (*Acipenser brevirostrum*), elkhorn coral (*Acropora palmata*),

5090
Ser N46/1026
September 21, 2012

staghorn coral (*Acropora cervicornis*), and designated critical habitats for the Atlantic salmon, smalltooth sawfish, Gulf sturgeon, staghorn coral, and elkhorn coral. The U.S. Navy requests a conference on the ringed seal (*Pusa hispida*), which is proposed for listing under the ESA.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Shore and Environmental
Readiness

Enclosures: 1) AFTT EIS (CD)
2) AFTT ESA Consultation Supplemental Information (CD)
3) Excel File of Master Activity Tables (CD)
4) Excel Files of 1db and 6db Bin Exposure Data (CD)

Copy to: Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

2

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/046
February 20, 2013

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway, SSMC3, Room 13821
Silver Spring, MD 20910-3282

SUBJECT: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT SECTION 7 CONFERENCE FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

In accordance with section 7 of the Endangered Species Act (ESA) the U.S. Navy requests initiation of a conference on Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean. The Navy requests this conference on several species of coral proposed for listing on December 7, 2012. The Navy further requests the conference be included within the broader AFTT consultation initiated on September 21, 2012.

AFTT training and testing activities may affect proposed coral species that reside within the AFTT study area. As explained in the Navy's September 2012 AFTT ESA consultation initiation package, the AFTT Environmental Impact Statement (EIS) and supplemental consultation package contain the supporting analysis for the consultation. The enclosed revision to the invertebrate section of the EIS serves as the supporting analysis for the conference on the proposed coral species.

Based on the enclosed analysis, the Navy is requesting concurrence on our may affect, not likely to adversely affect determinations for the proposed boulder star coral (*Montastraea annularis*), mountainous star coral (*Montastraea faveolata*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), star coral (*Montastraea franksi*), elliptical star coral (*Dichocoenia stokesii*), and Lamarck's sheet coral (*Agaricia lamarcki*).

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: AFTT EIS Revised Invertebrate Section (CD)

Copy to: Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/052
February 21, 2013

Kenneth Graham
Regional Section 7 Coordinator
U.S. Fish and Wildlife Service
1875 Century Boulevard
Atlanta, GA 30345

SUBJECT: ENDANGERED SPECIES ACT SECTION 7 CONSULTATION FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

In accordance with section 7 of the Endangered Species Act (ESA), the U.S. Navy requests concurrence on our determination that Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean will not adversely affect listed species.

The proposed action may affect listed species, that reside within the AFTT action area, to sound and other environmental stressors associated with training and testing activities. The enclosed AFTT Draft Environmental Impact Statement (EIS) is the Navy's primary document that provides the required information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting consultation on alternative 2 within the EIS. The enclosed supplemental information document serves as a roadmap for identifying the required information within the EIS, and provides additional, supporting information not found within the EIS. Please note that the supplemental information document provides updated analysis and affect determinations (not likely to adversely affect) for the West Indian manatee. The updated manatee analysis and determination reflects the elimination of one activity from the proposed action and a correction in the acoustic modeling at Naval Submarine Base Kings Bay, GA. Also enclosed is a summary of the U.S. Fish and Wildlife Service's comments on the draft consultation package and Navy's responses.

We request USFWS concurrence on our may affect, not likely to adversely affect determinations for the following species: Bermuda petrel (*Pterodroma cahow*), roseate tern (*Sterna dougallii*), piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus*), polar bear (*Ursus maritimus*), American crocodile (*Crocodylus acutus*), and American alligator (*Alligator mississippiensis*). In addition, based on a recommendation from USFWS, an ESA determination has been included for the candidate red knot (*Calidris canutus rufa*) because of its anticipated ESA listing by September 2013. Although sea turtles occur within the AFTT action area, the proposed action does not include activities above the mean high tide line where nesting occurs; therefore, sea turtles are not included in this consultation package.

We appreciate your support in helping the U.S. Navy to meet its environmental responsibilities. Please direct any questions to Mr. David MacDuffee (757-836-8473).

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT EIS (CD)
2. AFTT ESA Consultation Supplemental Information (CD)
3. Comments/Responses on Draft Consultation Package (CD)

2

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/050
February 21, 2013

Delfinia M. Montano
Regional Section 7 Coordinator
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

SUBJECT: ENDANGERED SPECIES ACT SECTION 7 CONSULTATION FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

In accordance with section 7 of the Endangered Species Act (ESA), the U.S. Navy requests concurrence on our determination that Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean will not adversely affect listed species.

The proposed action may affect listed species, that reside within the AFTT action area, to sound and other environmental stressors associated with training and testing activities. The enclosed AFTT Draft Environmental Impact Statement (EIS) is the Navy's primary document that provides the required information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting consultation on alternative 2 within the EIS. The enclosed supplemental information document serves as a roadmap for identifying the required information within the EIS, and provides additional, supporting information not found within the EIS. Please note that the supplemental information document provides updated analysis and affect determinations (not likely to adversely affect) for the West Indian manatee. The updated manatee analysis and determination reflects the elimination of one activity from the proposed action and a correction in the acoustic modeling at Naval Submarine Base Kings Bay, GA. Also enclosed is a summary of the U.S. Fish and Wildlife Service's comments on the draft consultation package and Navy's responses.

We request USFWS concurrence on our may affect, not likely to adversely affect determinations for the following species: Bermuda petrel (*Pterodroma cahow*), roseate tern (*Sterna dougallii*), piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus*), polar bear (*Ursus maritimus*), American crocodile (*Crocodylus acutus*), and American alligator (*Alligator mississippiensis*). In addition, based on a recommendation from USFWS, an ESA determination has been included for the candidate red knot (*Calidris canutus rufa*) because of its anticipated ESA listing by September 2013. Although sea turtles occur within the AFTT action area, the proposed action does not include activities above the mean high tide line where nesting occurs; therefore, sea turtles are not included in this consultation package.

We appreciate your support in helping the U.S. Navy to meet its environmental responsibilities. Please direct any questions to Mr. David MacDuffee (757-836-8473).

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT EIS (CD)
2. AFTT ESA Consultation Supplemental Information (CD)
3. Comments/Responses on Draft Consultation Package (CD)

2

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/051
February 21, 2013

Glenn S. Smith
Assistant Regional Endangered Species
Chief Northeast Region
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589

SUBJECT: ENDANGERED SPECIES ACT SECTION 7 CONSULTATION FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

In accordance with section 7 of the Endangered Species Act (ESA), the U.S. Navy requests concurrence on our determination that Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean will not adversely affect listed species.

The proposed action may affect listed species, that reside within the AFTT action area, to sound and other environmental stressors associated with training and testing activities. The enclosed AFTT Draft Environmental Impact Statement (EIS) is the Navy's primary document that provides the required information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting consultation on alternative 2 within the EIS. The enclosed supplemental information document serves as a roadmap for identifying the required information within the EIS, and provides additional, supporting information not found within the EIS. Please note that the supplemental information document provides updated analysis and affect determinations (not likely to adversely affect) for the West Indian manatee. The updated manatee analysis and determination reflects the elimination of one activity from the proposed action and a correction in the acoustic modeling at Naval Submarine Base Kings Bay, GA. Also enclosed is a summary of the U.S. Fish and Wildlife Service's comments on the draft consultation package and Navy's responses.

We request USFWS concurrence on our may affect, not likely to adversely affect determinations for the following species: Bermuda petrel (*Pterodroma cahow*), roseate tern (*Sterna dougallii*), piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus*), polar bear (*Ursus maritimus*), American crocodile (*Crocodylus acutus*), and American alligator (*Alligator mississippiensis*). In addition, based on a recommendation from USFWS, an ESA determination has been included for the candidate red knot (*Calidris canutus rufa*) because of its anticipated ESA listing by September 2013. Although sea turtles occur within the AFTT action area, the proposed action does not include activities above the mean high tide line where nesting occurs; therefore, sea turtles are not included in this consultation package.

We appreciate your support in helping the U.S. Navy to meet its environmental responsibilities. Please direct any questions to Mr. David MacDuffee (757-836-8473).

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT EIS (CD)
2. AFTT ESA Consultation Supplemental Information (CD)
3. Comments/Responses on Draft Consultation Package (CD)

2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/ES

JUL 0 3 2013

Mr. J. W. Murphy
Deputy Chief of Staff
Fleet Installations and Environmental Readiness
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, Virginia 23551-2487

Dear Mr. Murphy:

On February 22, 2013, the U.S. Fish and Wildlife Service (Service) received your consultation request for Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean. Your consultation package addressed the effects of your preferred action alternative on: Bermuda petrel, roseate tern, piping plover, West Indian manatee, polar bear, American crocodile, and American alligator. In addition, the Navy included a discussion of the potential effects of the action on the red knot, a candidate species, because of its potential listing in the near future. In your consultation package, the U.S. Navy (Navy) has concluded that the proposed AFTT activities would have no effect or would not be likely to adversely affect all of the federally-listed species, candidate species, and potentially affected critical habitats considered. As a part of the proposed action, the Navy has included a number of conservation measures including standard operating procedures and mitigating measures to reduce the likelihood that listed species, candidate species or designated critical habitats would be adversely affected. Although sea turtles occur within the AFTT action area, the proposed action does not include activities above the mean high tide line where nesting occurs, therefore, sea turtles were not included as a part of your consultation request.

In response to your consultation request, the Service coordinated your consultation package with all of our affected Field Offices in the Southeast, Southwest, and Northeast Regions. Throughout the Service's coordination process, we discussed any questions or concerns that arose with Mr. David MacDuffee of your office. In every case, Mr. MacDuffee was kind enough to provide information to clarify details of the proposed action or to suggest modifications to the proposed conservation measures to address the Service's concerns.

On April 15, 2013, the Navy responded to comments and concerns about the potential effects of the proposed action on the manatee. The response proposed a modification in Section 3.4.3.3.1.6, Alternative 2, Training Activities, within the AFTT Service Consultation Supplemental Information document. This wording change would apply specifically to the last sentence on page 41, carrying over to page 42. The Navy's proposed change would be "Within the turning basin, basin entrance channel, and all other waterways adjacent to these water bodies at Naval Station (NAVSTA) Mayport, Navy vessels comply with all federal, state, and local Manatee Protection Zones and reduce speed in accordance with established operational safety

and security procedures. Pursuant to the NAVSTA Mayport INRMP, the Station provides training to Harbor Ops personnel to report manatee observations to other vessels in the basin and posts signs at select occasions alerting personnel of the potential presence of manatees and how to report sightings."

In response to North Carolina manatee concerns, the Navy developed the enclosed mitigation measures for pile driving activities at Camp Lejeune. As proposed, the measures would only apply to the pile driving activities addressed in the AFTT proposed action and only at Camp Lejeune. To develop these measures the Navy relied on the Raleigh Ecological Services Field Office's manatee protection guidelines for pile driving activities. For the other activities associated with Joint Logistics Over-the-Shore (JLOTS) training in North Carolina and Virginia, the Navy has proposed to use the same guidelines to develop additional measures and include those in the forthcoming JLOTS BA for Service review.

With regard to the Navy's planned training activities' potential impacts to the piping plover, the Service's Virginia Field Office expressed concern with the Navy's planned flights between Norfolk Naval Station and off-shore training areas. These flights would result in overflights of the southern barrier islands of the Eastern Shore of Virginia, which support the federally listed endangered piping plover. The Navy's subsequent adoption of a one nautical mile buffer between helicopter flights and the southern barrier islands is a sufficient avoidance and minimization effort that will establish an adequate protective buffer from activities which could result in negative effects to plovers. The implementation of these conservation measures allows the Service to concur with the no effect or not likely to adversely affect determinations for the federally listed piping plover within the Northeast Region.

The Service concurs with the Navy's not likely to adversely affect determination for federally endangered Northeastern population of roseate terns. Northeastern roseate terns are most likely to encounter naval training and testing activities during the breeding and post-breeding staging season when large numbers of roseate terns congregate at and near breeding islands and staging areas in New York and New England. However, the Service concurs with the Navy's determination based on impacts to roseate tern prey being negligible and insignificant (only very small numbers of fish may be killed during some exercises) and the extremely low likelihood of post-breeding roseates encountering sonar, explosives or other training exercises off of the coast of Massachusetts (we consider the likelihood for these potential effects to be discountable). The Navy provided the supporting effects assessment in the response to Service comments.

We appreciate the Navy's inclusion of effects analyses for the candidate species, red knot. For the vast majority of planned Naval activities, the Service was able to concur with the Navy's "no effect" and "not likely to adversely affect" determinations. These determinations were made based on numerous factors such as the small number of birds potentially present in the action area; the timing of actions, i.e. the bird's migratory habits don't put it in harms way during Naval exercises; the frequency of potential exposures creates only a discountable risk in most situations; and the likelihood that behavioral and physiological responses rising to an adverse level is insignificant.

Our initial concern for red knot was that the Final Environmental Impact Statement (FEIS) states that birds using wetlands, mud flats, beaches, and other shoreline habitats would be exposed to noise from nearshore helicopter training and aircraft in transit to offshore training areas, as well as intermittent aircraft noise from aircraft originating from airfields located along the coast and

vessel noise from nearshore boats. Beaches, mudflats, and coastal wetlands are the primary habitats of red knots. Disturbance is a threat to non-breeding red knots, as excessive disturbance can impact energy budgets and can preclude use of otherwise preferred habitats. Red knots are known to show disturbance responses to vessels and aircraft. Additional information that was recently provided by the Navy, however, has narrowed down high coastal traffic areas to Norfolk, Virginia, Jacksonville Florida, and Panama City, Florida. Nearshore aircraft/vessel use around Norfolk is not likely to adversely affect red knot based on: (1) Minimal records of knots in or around the station where the flights originate; (2) the 3,000-foot buffer on Fisherman's Island; and (3) aircraft do not operate along Virginia's other Atlantic barrier islands (north of Fisherman's Island).

Our response is based on our review of your consultation package received on February 22, 2013, the clarifications and conservation measures provided by the Navy throughout the consultation process. Our response represents the combined response for the Northeast, Southwest, and Southeast Regions, and is the result of review by all Service Field Offices within the area affected by your proposed action. We concur that the proposed action, and preferred alternative (as described for the Navy's proposed AFTT activities) will have no effect on, or is not likely to adversely affect the federally-listed species, candidate species or designated critical habitat as determined in your consultation package of February 21, 2013. We greatly appreciate your willingness to clarify the proposed action and include conservation measures for the protection of federally-listed species.

Please be reminded that it may be necessary for you to contact the Service for reconsideration of the effects of this proposed action if:

(1) New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in your current determination;
(2) the action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this informal consultation; or
(3) a new species is listed or critical habitat designated that may be affected by this action.

Please address any questions concerning this response to Janet Mizzi, Chief, Endangered Species, Southeast Region, at (404) 679-7169, Delfinia Montano, at (505) 248-6401, or Glenn Smith, at (413) 253-8627.

Sincerely yours,

Leopoldo Miranda
Assistant Regional Director
Ecological Services

Enclosures

AFTT Manatee Mitigation Measures Applicable to Elevated Causeway (ELCAS) Pile Driving at Camp Lejeune, NC

1. The project manager and/or contractor will inform all personnel associated with the project that manatees may be present in the project area, and the need to avoid any harm to these endangered marine mammals. The project manager will ensure that all construction personnel know the general appearance of the species and their habit of moving about completely or partially submerged in shallow water. All construction personnel will be informed that they are responsible for observing water-related activities for the presence of manatees.

2. The project manager and/or the contractor will advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act and the Endangered Species Act.

3. If a manatee is seen within 100 yards of the active pile driving, all appropriate precautions will be implemented to ensure protection of the manatee. These precautions will include the immediate shutdown of pile driving if a manatee comes within 60 yards of the pile driving equipment. Activities will not resume until the manatee has departed the 60-yard shutdown area on its own volition (i.e., it may not be herded or harassed from the area).

4. Any injury to a manatee will be reported immediately. The report must be made to the U.S. Fish and Wildlife Service (ph. 919.856.4520 ext. 28), the National Marine Fisheries Service (ph. 252.728.8762), and the North Carolina Wildlife Resources Commission (ph. 252.448.1546).

5. A log detailing all sightings and/or injuries to manatees during pile driving will be maintained. Upon completion of the action, the project manager will prepare a report which summarizes all information on manatees encountered and submit the report to the Service's Raleigh Field Office.

C.4 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/968
June 4, 2012

Mr. Lou Chiarella
Acting Assistant Regional Administrator
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930

Dear Mr. Chiarella:

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the U.S. Navy has prepared an Essential Fish Habitat (EFH) assessment for Atlantic Fleet Training and Testing (AFTT) activities in the Atlantic Ocean and Gulf of Mexico (see enclosure). The U.S. Navy's assessment concludes that EFH may be adversely affected by training and testing activities and requests initiation of the MSA's EFH consultation process.

Additional information on AFTT may be found at the project website, including the EFH Assessment and the Draft Environmental Impact Statement (EIS), located at: http://aftteis.com. The U.S. Navy's preferred alternative in the Draft EIS and analyzed in the EFH Assessment is Alternative 2.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. Please note that due to the large AFTT study area, a similar letter is concurrently being sent to the National Marine Fisheries Service's Southeast Regional Office, Habitat Conservation Division. You may contact Mr. David MacDuffee ((757) 836-8473 or David.MacDuffee@navy.mil) at U.S. Fleet Forces Command should you have additional questions on this matter.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Shore and Environmental
Readiness

Enclosure: 1. EFH Assessment for AFTT CD

Copy to: Mr. Brian Hopper, NMFS Office of Protected Resources
Dr. Kelly Ebert, OPNAV N45

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/969
June 4, 2012

Ms. Virginia Fay
Assistant Regional Administrator
National Marine Fisheries Service
263 13th Avenue South
Saint Petersburg, Florida 33701

Dear Ms. Fay:

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the U.S. Navy has prepared an Essential Fish Habitat (EFH) assessment for Atlantic Fleet Training and Testing (AFTT) activities in the Atlantic Ocean and Gulf of Mexico (Enclosure [1]). The U.S. Navy's assessment concludes that EFH may be adversely affected by training and testing activities and requests initiation of the MSA's EFH consultation process.

Additional information on AFTT may be found at the project website, including the EFH Assessment and the Draft Environmental Impact Statement (EIS), located at: http://aftteis.com. The U.S. Navy's preferred alternative in the Draft EIS and analyzed in the EFH Assessment is Alternative 2.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. Please note that due to the large AFTT study area, a similar letter is concurrently being sent to the National Marine Fisheries Service's Northeast Regional Office, Habitat Conservation Division. You may contact Mr. David MacDuffee ((757) 836-8473 or David.MacDuffee@navy.mil) at U.S. Fleet Forces Command should you have additional questions on this matter.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Shore and Environmental
Readiness

Enclosure: 1. EFH Assessment for AFTT CD

Copy to: Mr. Brian Hopper, NMFS Office of Protected Resources
Dr. Kelly Ebert, OPNAV N45

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5317; FAX (727) 824-5300
http://sero.nmfs.noaa.gov/

F/SER4:DD

JAN - 8 2013

Mr. J.W. Murphy
Deputy Chief of Staff
Department of the Navy
U.S. Fleet Forces Command
1562 Mitscher Avenue, Suite 250
Norfolk, Virginia 23551-2487

Dear Mr. Murphy:

Enclosed are NOAA's National Marine Fisheries Service (NMFS) essential fish habitat (EFH) conservation recommendations in response to your April 2012 EFH Assessment for Atlantic Fleet Training and Testing activities in the Atlantic Ocean and Gulf of Mexico.

NMFS' comments originate from two regions. The contacts for these offices are:

Southeast Region: Ms. Virginia Fay
Assistant Regional Administrator
NMFS Southeast Region
Habitat Conservation Division
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Northeast Region: Mr. Lou Chiarella
Assistant Regional Administrator
NMFS Northeast Region
Habitat Conservation Division
55 Great Republic Drive
Gloucester, Massachusetts 01930-2276

If we may be of further assistance, please advise.

Sincerely,

Miles M. Croom

for Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

cc: (w/encl.) via electronic mail
F – McCune
F/SER3 – Bernhart, Baker
F/SER4 – Fay, Wilber, Swafford, Dale
F/NER4 – Chiarella, Boelke, O'Brien
NOS/ORR/MDD – Wallace
GMFMC
SAFMC
CFMC
MAFMC
NEFMC

NOAA'S NATIONAL MARINE FISHERIES SERVICE
AND
U.S. DEPARTMENT OF THE NAVY
ATLANTIC FLEET TRAINING AND TESTING
ESSENTIAL FISH HABITAT CONSULTATION
FOR THE
ATLANTIC OCEAN AND GULF OF MEXICO

January 2013

BACKGROUND

In 2012, the United States Department of the Navy (Navy) prepared a draft Environmental Impact Statement (DEIS)/Overseas Environmental Impact Statement (OEIS) for Atlantic Fleet Training and Testing (AFTT) activities. AFTT activities include the use of active sonar and explosives primarily within existing range complexes and testing ranges along the east coast of the United States, in the Atlantic Ocean and Gulf of Mexico, at Navy pierside locations, in port transit channels, and the lower Chesapeake Bay.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 U.S.C. §1801 *et seq.*) requires Federal agencies consult with the Secretary of Commerce, through NOAA's National Marine Fisheries Service (NMFS), with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat (EFH) identified under this Act" 16 U.S.C. § 1855(b)(2). The Navy has prepared an EFH Assessment to assess the impacts of AFTT activities on EFH.

PROPOSED AFTT ACTIVITIES:

The Navy has conducted military readiness activities throughout the northwest Atlantic Ocean and Gulf of Mexico for decades. Through this EFH Assessment, the Navy is consolidating assessments previously prepared for AFTT activities using active sonar and explosives primarily within the following ten range complexes/exercises:

- Atlantic Fleet Active Sonar Training.
- Virginia Capes Range Complex.
- Navy Cherry Point Range Complex.
- Jacksonville Range Complex.
- Naval Surface Warfare Center Panama City Division Mission Activities.
- Gulf of Mexico Range Complex.
- Key West Range Complex.
- Northeast Range Complexes.
- Naval Undersea Warfare Center Division, Newport Testing Range.
- Naval Surface Warfare Center Carderock Division, South Florida Ocean Measurement Facility Testing Range.

Activities occurring on the Undersea Warfare Training Range and other areas such as Navy ports, shipyards and transit channels are also incorporated in this EFH Assessment. These include sonar maintenance and gunnery exercises during ship transits that may occur outside Navy range complexes and testing ranges, and pierside sonar testing conducted during construction, maintenance, or repair activities.

ESSENTIAL FISH HABITAT

While the descriptions of EFH within the EFH Assessment in Section 3.0, "Essential Fish Habitat", are generally adequate, we note the following recent changes to EFH designations implemented by the NMFS:

> Section 3.4.2.7 and Appendix A. The NMFS and Gulf of Mexico Fishery Management Council (GMFMC) repealed the Stone Crab Fishery Management Plan effective October 24, 2011. Therefore, EFH is no longer designated for stone crab in the Gulf of Mexico.
>
> Appendix A. In the 2012 Generic Annual Catch Limit and Accountabilities Amendment, NMFS and the fishery management councils (council) in the NMFS Southeast Region identified species determined to no longer need continued management. Although these modifications to the respective fishery management units did not alter existing EFH designations, the following species were removed by each council:
>
> GMFMC: anchor tilefish, misty grouper, sand perch, dwarf sand perch, blackline tilefish, schoolmaster, red hind, rock hind, dog snapper, and mahogany snapper.
>
> South Atlantic Fishery Management Council (SAFMC): tiger grouper, jack crevalle, yellow jack, black margate, blue-striped grunt, French grunt, porkfish, smallmouth grunt, Spanish grunt, grass porgy, sheepshead, queen triggerfish, and puddingwife.
>
> Caribbean Fishery Management Council: all conch species *except* queen conch (*Strombus gigas*).

Additionally, Section 3.7.2.5 (Artificial Structures) incorrectly states any artificial structure within an area of EFH is also designated as EFH. Only the SAFMC has identified and described, in accordance with the regulatory criteria in 50 C.F.R. 600 Subpart J., an artificial substrate as EFH. The Navy correctly notes that designation is limited to artificial reefs specifically placed for fishery management purposes.

IMPACTS TO ESSENTIAL FISH HABITAT

Training and testing activities are identified in Tables 2-3 through 2-9 in the EFH Assessment. In assessing impacts on EFH, four categories of stressors were utilized (1) acoustic, (2) energy, (3) physical disturbance and strike, and (4) containment. The Navy correctly determines sonar and other active acoustic sources, as well as electromagnetic sources, may affect the habitat value of water columns utilized by managed fishery resources during their life cycles. The EFH Assessment recognizes intense shock waves from underwater explosions could cause breakage, injury, and mortality of reef-building organisms. For example, a single small blast event directly on a reef could take five to ten years to recover (Fox and Caldwell 2006).

NMFS is concerned about marine debris generated within the Navy Range Complexes. NOAA defines marine debris as any persistent, manufactured, or processed solid material directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment (NOAA 2008). Marine debris includes a wide variety of objects (i.e., derelict fishing gear, lost vessel cargo, plastics) that pose a threat to the marine environment, human health, and/or navigation. Marine debris can damage habitats in a variety of ways, including a reduction in the structural complexity of habitats. In addition, marine debris can cause tissue abrasion and mortality of sessile invertebrates (Chiappone et al. 2002). Expended materials are not only a threat to EFH as they strike benthic communities, including deepwater centuries-old coral, but the materials would also persistently degrade fishery habitat as they decompose or are transported and relocated by currents. Military expended materials include:

- Sonobuoys: Parachutes and the sonobuoys themselves.
- Torpedo Launch Accessories: Torpedoes are usually recovered; however, materials such as parachutes used with air-dropped torpedoes, guidance wire used with submarine-launched torpedoes, and ballast weights are expended. Explosive-filled torpedoes expend torpedo fragments.
- Projectiles and Bombs: Non-explosive projectiles, non-explosive bombs, or fragments from explosive projectiles and bombs are expended during training and testing exercises. These items are primarily constructed of lead (most small-caliber projectiles) or steel (medium- and large-caliber projectiles and all bombs).
- Missiles: Non-explosive missiles and missile fragments from explosive missiles are expended during training and testing events. Propellant, and any explosive material involved, is consumed during firing/detonation. Some missiles include a wire which is also expended.
- Countermeasures: Acoustic (except towed acoustic), chaff, and flare countermeasures are expended as a result of training exercises. Chaff activities also include an expended canister, end caps, and pistons. Flares expend only end caps and pistons. Some acoustic measures also include a parachute.
- Targets: Some targets are designed to be expended; other targets, such as aerial drones and remote-controlled boats, are recovered for re-use. Targets struck with an ordinance will result in target fragments.

The Navy determined live/hardbottom habitats, such as deepwater corals, could be damaged if struck by large objects. Projected rates of recovery are a component of assessing the significance of these impacts. The DEIS/OEIS acknowledges repopulation and recovery times of damaged hardbottom habitats would be relatively slow (e.g., years to a decade or more) as compared to soft bottom areas (e.g., less than one year). NMFS believes recovery of coral and live/hardbottom would require several decades based on the age of the deepwater corals and their susceptibility to physical disturbance (Neuman et al. 1977; Fossa et al. 2002). The spatial extent of the impacts to live/hardbottom habitats cannot be determined at this time. It is not feasible to forecast exact locations where non-explosive practice bombs/missiles and large-caliber naval gun

shells will settle upon the seafloor. Further, only a fraction of the seabottom within Navy Range Complexes is adequately mapped for the purpose of determining impacts at fine spatial scales.

MITIGATION MEASURES

The Navy discusses Standard Operating Procedures and Mitigation Measures in Section 5.0, "Mitigation Measures" of the EFH Assessment. Mitigation measures protecting EFH include lookouts and mitigation zones. The Navy proposes to not conduct certain activities within 320 meters (350 yards) of known mapped shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks. The proposed 320 meter (350 yard) mitigation zone is based from the estimated maximum crater impact for explosions discussed in Section 4.1.1.2.1, "Explosives". The use of non-explosive military expended materials would result in a smaller footprint of potential impact; however, the Navy proposes applying the explosive mitigation zone to all explosive and non-explosive activities as listed above for ease of implementation.

NMFS and the Navy have a mutual interest in understanding the potentially effected environment and impacts of current and proposed Navy activities. The NMFS recognizes successful operation of Navy Range Complexes and AFTT activities has significant public interest elements. During previous EFH consultations for Navy Range Complex activities, NMFS Southeast Region Habitat Conservation Division (HCD) recommended a 1-kilometer buffer around known pinnacles of live/hardbottom to avoid adverse impacts to EFH. The Navy provided NMFS with its decision to not adopt the 1-kilometer buffer recommendation satisfying the requirements of the Magnuson-Stevens Act. Following those consultations, NMFS HCD and Navy staffs have engaged in constructive dialogue regarding comments raised during development of National Environmental Policy Act analytical documents for many of the range complexes included in the EFH Assessment.

RECOMMENDATIONS

NMFS recommends continuation of this collaboration for improving coordination on data collection and sharing efforts to the extent national security and other Navy restrictions allow. As data collection and other research yields new habitat data, the Navy will continue to reassess and incorporate such information into future environmental planning for Navy activities. This approach may include (1) NMFS identifying specific, finite areas of known or potential deepwater habitats of concern, (2) the Navy identifying areas where current/proposed activity would result in high use of expended materials that could potentially disturb bottom habitats, and (3) NMFS HCD and the Navy assessing those areas in future environmental planning when overlap of these areas are identified.

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

The NMFS adopts the following Navy Mitigation Measures as EFH Conservation Recommendations:

1. The Navy shall not conduct precision anchoring within the anchor watch circle diameter, or explosive mine countermeasure and neutralization activities within 320 meters (350 yards) of known mapped shallow coral reefs, live hardbottom, artificial reefs, and

shipwrecks.

2. The Navy shall not conduct explosive or non-explosive gunnery and missile exercises using a surface target, explosive and non-explosive bombing exercises, and at-sea explosives testing within 320 meters (350 yards) of known mapped shallow coral reefs.

3. The explosive mitigation zone shall apply to all explosive and non-explosive activities as listed above for ease of implementation.

REVIEW AND COORDINATION

If any modifications are made to Navy activities or the adopted mitigation measures as described in the EFH Assessment which result in changes to potential adverse effects on EFH, the Navy shall notify the appropriate regional NMFS HCD to initiate discussions regarding the necessity to conduct additional EFH consultation. The information and activities in this EFH consultation should be periodically reviewed at an interval of not less than five years. Should new or additional information regarding impacts to NOAA's trust resources become available, we may provide EFH conservation recommendations, as appropriate, to address those changes.

The following are points of contact in each region for technical assistance regarding the recommendations above:

Southeast Region:
Pace Wilber
Supervisor, South Atlantic Branch
NMFS Southeast Regional Office
Habitat Conservation Division
P.O. Box 12559
Charleston, South Carolina 29422

pace.wilber@noaa.gov
843-762-8601

Northeast Region:
Christopher Boelke
Field Offices Supervisor
NMFS Northeast Regional Office
Habitat Conservation Division
55 Great Republic Drive
Gloucester, Massachusetts 01950

christopher.boelke@noaa.gov
978-281-9131

LITERATURE CITED:

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Fox H.E. and R.L. Caldwell. 2006. Recovery from Blast Fishing on Coral Reefs: A Tale of Two Scales. *Ecological Applications*. 16:1631-1635.

Neumann A.C., J.W. Kofoed, G. Keller. 1977. Lithotherms in the Straits of Florida. *Geology* 5:4-10.

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DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/028
February 7, 2013

Dr. Roy Crabtree
Regional Administrator
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Dear Dr. Crabtree:

Thank you for your January 8, 2013 letter regarding the Essential Fish Habitat (EFH) consultation on Navy's Atlantic Fleet Training and Testing (AFTT) activities. This letter is provided to satisfy the Magnuson-Stevens Fishery Conservation and Management Act's requirement to respond in writing to your EFH conservation recommendations.

The National Marine Fisheries Service (NMFS) adopted the Navy's proposed mitigation as EFH conservation recommendations. We appreciate NMFS' thoughtful consideration of our proposed mitigations and agree the measures will help to avoid and minimize impacts on EFH. The Navy will continue incorporating these measures into our mitigation scheme for AFTT activities.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Copy to: Ms. Virginia Fay, NMFS Southeast Regional Office
Mr. Lou Chiarella, NMFS Northeast Regional Office

C.5 MARINE MAMMAL PROTECTION ACT

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/014
April 5, 2012

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway, SSMC3, Room 13821
Silver Spring, MD 20910-3282

SUBJECT: REQUEST FOR MARINE MAMMAL PROTECTION ACT INCIDENTAL TAKE AUTHORIZATION AND REGULATIONS FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

Dear Ms. Golde:

In accordance with the Marine Mammal Protection Act, as amended, and 50 C.F.R. Part 216, the U.S. Navy requests a five-year incidental take authorization and regulations for the incidental taking of marine mammals associated with Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean.

The proposed action may incidentally expose marine mammals that reside within the AFTT study area to sound and other environmental stressors associated with training and testing activities. The enclosed request further describes the AFTT activities and study area, and provides the specific information required by the National Marine Fisheries Service (NMFS) for consideration of an incidental take request.

The U.S. Navy also requests the above regulations authorize, and NMFS issue, two five-year Letters of Authorization; one issued to Commander, United States Fleet Forces Command for training activities, and one issued to Commander, Naval Sea Systems Command for testing activities. Addresses for these commands are provided below:

Commander, U.S. Fleet Forces Command
Attn: Code N46
1562 Mitscher Avenue, Suite 250
Norfolk, Virginia 23551-2487

Commander, Naval Sea Systems Command
Attn: Code SEA 04R
1333 Isaac Hull Avenue, SE
Washington Navy Yard, DC 20376

5090
Ser N46/014
April 5, 2012

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Shore and Environmental
Readiness

Enclosure: Request for Regulations and Letters of Authorization for the Incidental Taking of Marine Mammals Resulting From U.S. NAVY Training and Testing Activities in the AFTT Study Area

Copy to: Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

2

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/1027
September 21, 2012

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway, SSMC3, Room 13821
Silver Spring, MD 20910-3282

SUBJECT: REVISED REQUEST FOR MARINE MAMMAL PROTECTION ACT INCIDENTAL TAKE AUTHORIZATION AND REGULATIONS FOR U.S. NAVY ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES

On April 5, 2012 the U.S. Navy submitted an application for a five-year incidental take authorization and regulations under the Marine Mammal Protection Act (MMPA) for the incidental taking of marine mammals associated with Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean. Since our submittal of the application we have continued to refine our proposed activities and the associated analysis of potential impacts on marine mammals. We have also discussed the initial application with your staff and incorporated additional information based on those discussions. In light of the above refinements and discussions, the U.S. Navy is submitting the enclosed revised application in accordance with the MMPA, as amended, and 50 C.F.R. Part 216, for a five-year incidental take authorization and regulations for AFTT activities.

The primary revisions to the initial application include: 1) corrections to errors, typos, and transcription mistakes; 2) addition of training and testing requirements that were not identified in time to incorporate into the initial application; 3) clarification of how events were modeled; and 4) the addition of post-model quantification to supplement the analysis of acoustic effects to include animal avoidance of sound sources, animal avoidance of areas of activity before use of a sound source or explosive, and implementation of mitigation.

As stated in our April 5, 2012 letter, the U.S. Navy requests the above regulations authorize, and National Marine Fisheries Service (NMFS) issue two five-year Letters of Authorization; one issued to Commander, United States Fleet Forces Command for training activities, and one issued to Commander, Naval Sea Systems Command for testing activities. Addresses for these commands are provided below:

5090
Ser N46/1027
September 21, 2012

- Commander, U.S. Fleet Forces Command
  Attn: Code N46
  1562 Mitscher Avenue, Suite 250
  Norfolk, Virginia 23551-2487

- Commander, Naval Sea Systems Command
  Attn: Code SEA 04R
  1333 Isaac Hull Avenue, SE
  Washington Navy Yard, DC 20376

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Shore and Environmental
Readiness

Enclosure: Request for Regulations and Letters of Authorization for the Incidental Taking of Marine Mammals Resulting From U.S. NAVY Training and Testing Activities in the AFTT Study Area (September 2012)

Copy to: Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5090
Ser N46/1098
December 20, 2012

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway, SSMC3, Room 13821
Silver Spring, MD 20910-3282

Dear Ms. Golde:

On September 24, 2012 the U.S. Navy submitted a revised application for a five-year incidental take authorization and regulations under the Marine Mammal Protection Act (MMPA) for the incidental taking of marine mammals associated with Atlantic Fleet Training and Testing (AFTT) activities occurring within the Gulf of Mexico and Atlantic Ocean. Since our submittal of the revised application we identified additional errors in need of correction.

The enclosed application supplements our previous September 24 submittal with the corrected information. Corrections and supplemental information have been made in colored text for your convenience. These latest revisions will help ensure a clear and accurate representation of the Navy's proposed action.

Again, we appreciate your support in helping the U.S. Navy to meet its environmental responsibilities while retaining our ability to train at sea.

Sincerely,

J. W. MURPHY
Deputy chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: Request for Regulations and Letters of Authorization for the Incidental Taking of Marine Mammals Resulting From U.S. NAVY Training and Testing Activities in the AFTT Study Area (Revised December 2012)

Copy to: Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

C.6 NATIONAL HISTORIC PRESERVATION ACT

Under Section 106 of the National Historic Preservation Act, states/territories have 30 days to respond to the federal agency determination or their concurrence is assumed. On 12 April 2013, the Navy submitted determinations to 18 states and 2 territories adjacent to the Study Area. Letters indicating concurrence were received from 12 states/territories as of 15 August 2013. Concurrence was assumed for the remaining states/territories.

C.6.1 ALABAMA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/065
April 12, 2013

Frank White
Executive Director, Alabama Historical Commission
State Historic Preservation Officer
468 South Perry Street
P.O. Box 300900
Montgomery, AL 36130-0900

Dear Mr. White:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Alabama territorial waters include the Gulf of Mexico (GOMEX) Range Complex and the Naval Surface Warfare Center, Panama City Division Testing Range.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Alabama.

5090
Ser N46/065
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Alabama. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.2 CONNECTICUT

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/066
April 12, 2013

Christopher Bergstrom
Deputy Commissioner, Department of Economic and Community Development
Office of Culture and Tourism
State Historic Preservation Officer
One Constitution Plaza, 2nd Floor
Hartford, CT 06103

Dear Mr. Bergstrom:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Connecticut territorial waters include the Northeast Range Complexes and the Naval Undersea Warfare Center Division, Newport Testing Range. In addition, Naval Submarine Base New London and the Navy contractor shipyard in Groton are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Connecticut.

5090
Ser N46/066
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Connecticut. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.3 DELAWARE

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/067
April 12, 2013

Timothy A. Slavin
Division of Historical and Cultural Affairs
State Historic Preservation Officer
21 The Green
Dover, DE 19901

Dear Mr. Slavin:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Delaware territorial waters include the Virginia Capes (VACAPES) and Northeast Range Complexes.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Delaware.

5090
Ser N46/067
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measure employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Delaware. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

State of Delaware
Historical and Cultural Affairs

21 The Green
Dover, DE 19901-3611

Phone: (302) 736.7400 Fax: (302) 739.5660

June 19, 2013

J.W. Murphy
Department of the Navy
1562 Mitscher Ave, Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

RE: Review of Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS) / Overseas Environmental Impact Statement (OEIS)

Dear Deputy Chief Murphy:

The staff of the Delaware State Historic Preservation Office (DE SHPO) of the Division of Historical & Cultural Affairs has reviewed the above-noted project under Section 106 of the National Historic Preservation Act. Based on the provided information, our office does not concur with the NAVY's proposed finding of "No Historic Properties Affected," which has been modified from the Draft EIS/OEIS' initial finding that "adverse effects could occur to submerged prehistoric sites and unrecorded historic resources" under the No Action Alternative and Alternatives 1 and 2. We recommend continued consultation with our office to determine appropriate identification and evaluation efforts and treatment of historic properties.

Our office's concerns reflect the initial Draft EIS/OEIS's findings regarding the potential adverse effects caused by the AFTT's physical and acoustic stressors. In the absence of any proposed underwater identification efforts, we do not feel the noted measures – to include prohibition of precision anchoring and use of explosive mine countermeasures and neutralization activities within 350 yards of known shipwrecks and obstructions – will sufficiently avoid any potential effects to historic properties. Since this project includes such a large study area, we also feel more site specific information is necessary in order to reach a finding under Section 106.

Future consultation regarding this project can be directed to Craig Lukezic, DE SHPO Archaeologist, at Craig.Lukezic@state.de.us or (302) 736-7407.

Sincerely,

Jesse Zanavich,
Architectural Historian

CC: Jene Nissen, NAVY

State of Delaware
Historical and Cultural Affairs

21 The Green
Dover, DE 19901-3611

Phone: (302) 736.7400 Fax: (302) 739.5660

August 8, 2013 Project 2010.07.21.03

J.W. Murphy
Department of the Navy
1562 Mitscher Ave, Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

RE: Review of Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS) / Overseas Environmental Impact Statement (OEIS)

Dear Deputy Chief Murphy:

The staff of the Delaware State Historic Preservation Office (DE SHPO) of the Division of Historical & Cultural Affairs has reviewed the above-noted project under Section 106 of the National Historic Preservation Act. After a clarification through a conversation with Mr. Bruce Larson, it appears the explosive charges will be quite small, between 3 to 5 pounds. It is doubtful these small charges could impact the potential historic properties on the ocean floor when your protocol is followed. Given the limited nature of impacts associated with this undertaking, our office does concur with the NAVY's proposed finding of "No Historic Properties Affected".

We would be grateful for any survey data on archaeological resources you may gather in this project. If you have any questions, please contact me at Craig.Lukezic@state.de.us or call (302) 736-7407.

Sincerely,

Craig Lukezic
Archaeologist

CC: Jene Nissen, NAVY
Gwen Davis, DESHPO

C.6.4 FLORIDA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/068
April 12, 2013

Robert F. Bendus
Director, Florida Division of Historical Resources
State Historic Preservation Officer
500 South Bronough Street, Room 305
Tallahassee, FL 32399-0250

Dear Mr. Bendus:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Florida territorial waters include the Jacksonville Range Complex, the South Florida Ocean Measurement Facility Testing Range, the Key West Range Complex, and the Naval Surface Warfare Center, Panama City Division Testing Range.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Florida.

5090
Ser N46/068
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Florida. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

FLORIDA DEPARTMENT of STATE

RICK SCOTT
Governor

KEN DETZNER
Secretary of State

Deputy Chief J.W. Murphy
Department of the Navy
1562 Mitscher Avenue, Suite 250
U.S. Fleet Forces Command
Norfolk, Virginia 23551-2487

May 15, 2013

RE: DHR Project File Number: 2013-1891
Draft *Environmental Impact Statement/Overseas Environmental Impact Statement for the Navy Atlantic Fleet Training and Testing*

Dear Chief Murphy:

This office reviewed the referenced project for possible impact to historic properties listed, or eligible for listing, in the *National Register of Historic Places*. The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended, *36 CFR Part 800: Protection of Historic Properties* and the *National Environmental Policy Act of 1969*, as amended.

We have reviewed sections dealing with Cultural Resources of the referenced Environmental Impact Statement (EIS) / Overseas Environmental Impact Statement (OEIS). We find that the EIS/OEIS has adequately addressed cultural resources. Therefore, based on the information provided, it is the opinion of this office that the proposed undertaking is not likely to have an adverse effect on historic properties conditioned that the protection and avoidance procedures stated in the document are followed.

We look forward to working with you on a successful project. If you have any questions concerning our comments, please contact Scott Edwards, Historic Preservationist, by electronic mail *scott.edwards@dos.myflorida.com*, or at 850.245.6333 or 800.847.7278.

Sincerely,

Timothy A. Parsons, DSHPO for

Robert F. Bendus, Director
Division of Historical Resources
and State Historic Preservation Officer

VIVA FLORIDA 500.

DIVISION OF HISTORICAL RESOURCES
R. A. Gray Building • 500 South Bronough Street • Tallahassee, Florida 32399-0250
Telephone: 850.245.6300 • www.flheritage.com
Commemorating 500 years of Florida history www.vivaflorida.com

VIVA FLORIDA 500.

C.6.5 GEORGIA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/069
April 12, 2013

Mark Williams
Historic Preservation Division, Department of Natural Resources
State Historic Preservation Officer
254 Washington Street SW, Ground Level
Atlanta, GA 30334

Dear Mr. Williams:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Georgia territorial waters include the Jacksonville Range Complex. In addition, Naval Submarine Base Kings Bay is included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Georgia.

5090
Ser N46/069
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Georgia. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
HISTORIC PRESERVATION DIVISION

MARK WILLIAMS
COMMISSIONER

DR. DAVID CRASS
DIVISION DIRECTOR

May 16, 2013

J.W. Murphy
Department of the Navy
1562 Mitscher Avenue, Suite 250
U.S. Fleet Forces Command
Norfolk, Virginia 23551
ATTN: Jene Nissen

RE: Draft EIS/OEIS: Atlantic Fleet Training and Testing
Statewide
HP-130416-001

Dear Mr. Murphy:

The Historic Preservation Division (HPD) has received the above referenced document. Our comments are provided to assist the U.S. Navy in complying with the provisions of Section 106 of the National Historic Preservation Act of 1966, as amended.

HPD understands that training and testing ranges within or adjacent to Georgia territorial waters include the Jacksonville Range Complex as well as the Naval Submarine Base Kings Bay. Based on the information provided, HPD understands the U.S. Navy has determined that no historic properties within the jurisdictional waters of Georgia will be affected by the proposed undertaking. While HPD is unable to concur with this finding, it is our opinion that the project as proposed will have **no adverse effect** to historic properties, as defined in 36 CFR Part 800.5(d)(1), provided the measures to ensure protection of submerged cultural resources located in the study area are followed.

If you have any questions, please feel free to contact Elizabeth Shirk, Environmental Review Coordinator, at (404) 651-6624 or elizabeth.shirk@dnr.state.ga.us.

Sincerely,

Karen Anderson-Cordova, Program Manager
Environmental Review & Preservation Planning

KAC/ECS

254 WASHINGTON STREET, SW | GROUND LEVEL | ATLANTA, GEORGIA 30334
404.656.2840 | FAX 404.657.1368 | WWW.GEORGIASHPO.ORG

C.6.6 LOUISIANA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/070
April 12, 2013

Pam Breaux
Louisiana Department of Culture, Recreation, and Tourism
State Historic Preservation Officer
P.O. Box 44247
Baton Rouge, LA 70804

Dear Ms. Breaux:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Louisiana territorial waters include the Gulf of Mexico Range Complex.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Louisiana.

5090
Ser N46/070
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Louisiana. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.7 MAINE

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/071
April 12, 2013

Earle G. Shettleworth, Jr.
Director, Maine Historic Preservation Commission
State Historic Preservation Officer
55 Capitol Street
65 State House Station
Augusta, ME 04333-0065

Dear Mr. Shettleworth:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Maine territorial waters include the Northeast Range Complexes. In addition, the Portsmouth Naval Shipyard in Kittery and the Navy-contractor shipyard in Bath are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Maine.

5090
Ser N46/071
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Maine. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

CONCUR

Kirk F. Mohney,
Deputy State Historic Preservation Officer

4/17/13
Date

5090
Ser N46/071
April 12, 2013

Earle G. Shettleworth, Jr.
Director, Maine Historic Preservation Commission
State Historic Preservation Officer
55 Capitol Street
65 State House Station
Augusta, ME 04333-0065

RECEIVED
APR 16 2013
By H84-10

Dear Mr. Shettleworth:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Maine territorial waters include the Northeast Range Complexes. In addition, the Portsmouth Naval Shipyard in Kittery and the Navy-contractor shipyard in Bath are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Maine.

5090
Ser N46/071
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Maine. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.8 MARYLAND

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/072
April 12, 2013

J. Rodney Little
Director, Maryland Historical Trust
State Historic Preservation Officer
100 Community Place
Crownsville, MD 21032-2023

Dear Mr. Little:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Maryland territorial waters include the Virginia Capes (VACAPES) Range Complex.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Maryland.

5090
Ser N46/072
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Maryland. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

Maryland Department of Planning
Maryland Historical Trust

Sustainable Attainable

May 15, 2013

Department of the Navy
Commander
1562 Mitscher Ave, Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

Attention:
J. W. Murphy
Deputy Chief of Staff
Fleet Installations and Environmental Readiness

Re: Request for review of Modification to Regulatory Finding, Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for Atlantic Fleet Training and Testing (AFTT)

Dear Deputy Chief Murphy:

Thank you for the opportunity to comment on the above-referenced modification.

The Maryland State Historic Preservation Office, the Maryland Historical Trust, does not concur with the modification of the finding under Section 106 of the National Historic Preservation Act from "Adverse effects could occur to submerged prehistoric sites and unrecorded submerged historic resources. Consultation with the appropriate State Historic Preservation Office is required to resolve adverse effects to cultural resources located within state territorial waters (within 3 nm) with the exception of Texas, Puerto Rico, and Florida (Gulf coast only), which have a 9-nm limit" to "no historic properties affected" (DEIS AFTT 3.10.4.2 Regulatory Determinations; Letter dated April 12, 2013 from J.W. Murphy to J. Rodney Little).

No comprehensive identification efforts have been undertaken and it is likely that undocumented sites possessing those qualities of significance and integrity that are necessary for listing on the National Register of Historic Places exist within the study area.

The acoustic and physical stressors outlined in the DEIS submitted for review, including shock waves and craters generated by underwater explosions and bottom impacts from seafloor devices and heavy expended military materials, could result in adverse effects to undocumented historic properties by displacing artifacts and sediments and damaging structural elements (DEIS AFTT 3.10.3.2.2).

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

Richard Eberhart Hall, AICP, Secretary
Matthew J. Power, Deputy Secretary

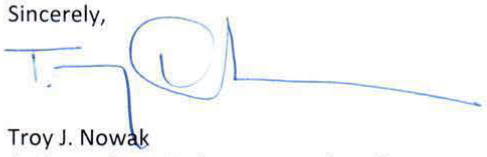
100 Community Place - Crownsville - Maryland - 21032
Tel: 410.514.7600 - Toll Free: 1.800.756.0119 - TTY users: Maryland Relay - MHT.Maryland.gov

The Maryland Historical Trust believes that the Navy's proposed mitigation measures to ensure protection of historic properties, including prohibition of precision anchoring within the anchor swing diameter, prohibition of explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks, and commencement of consultation with the appropriate state historic preservation office in the event that the Navy impacts a submerged historic property will not adequately protect historic properties.

The Maryland Historical Trust recommends continued consultation to determine adequate measures for the identification, evaluation, and treatment of historic properties in Maryland waters.

If you have questions or require further assistance, please contact me at tnowak@mdp.state.md.us.

Sincerely,



Troy J. Nowak
Assistant State Underwater Archaeologist
Maryland Historical Trust

100 Community Place ● Crownsville, Maryland 21032-2023
Telephone: 410.514.7600 ● Fax: 410.987.4071 ● Toll Free: 1.800.756.0119 ● TTY Users: Maryland Relay
Internet: www.marylandhistoricaltrust.net

MDP
Maryland Department of Planning
Maryland Historical Trust
Troy J. Nowak, M.A., R.P.A.
Asst. State Underwater Archaeologist
Maryland Maritime Archaeology Program
410.514.7668
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TNowak@mdp.state.md.us
100 Community Place
Crownsville, Maryland 21032
www.mht.maryland.gov
www.mdp.state.md.us

August 8, 2013

Department of the Navy
Commander
1562 Mitscher Ave, Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

Attention:
J.W. Murphy
Deputy Chief of Staff
Fleet Installations and Environmental Readiness

Re: Regulatory Finding and Section 106 Review, Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for Atlantic Fleet Training and Testing (AFTT)

Dear Deputy Chief Murphy:

Thank you for the opportunity to comment on the AFTT EIS and for the responsiveness of the team from USFF and NAVFAC that coordinated with MHT during our review.

Careful examination of the EIS, supporting documentation, and the additional information provided by the USFF and NAVFAC team has revealed that the majority of proposed activities with potential to affect undocumented historic properties will occur outside of Maryland waters. We believe that this fact coupled with an expansion of Navy's proposed mitigation measures in lieu of traditional identification and evaluation efforts would significantly reduce or eliminate the possibility of causing adverse effects to undocumented historic properties resulting in a finding *of No historic properties affected* for Maryland waters.

We understand that certain AFTT activities will involve data collection that can assist in the identification of historic properties. These include deployment of aircraft, surface vessels and autonomous and remotely operated vehicles equipped with high frequency and side

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

Richard Eberhart Hall, AICP, Secretary
Amanda Stakem Conn, Esq., Deputy Secretary

Maryland Historical Trust - 100 Community Place - Crownsville - Maryland - 21032
Tel: 410.514.7601 - Toll Free: 1.800.756.0119 - TTY users: Maryland Relay - Planning.Maryland.gov

scanning sonar, optical systems, and other electronic remote sensing tools. Furthermore, we understand that site inspections will be conducted by divers prior to, during, and/or following certain training and testing activities. As a result, we recommend that Navy institutes a program to report and avoid seafloor anomalies and anthropogenic materials with potential to represent historic properties identified during AFTT activities in Maryland. This will involve developing a mechanism to share information with our office and maintaining a database containing the locations of areas where no seafloor disturbances should occur during subsequent AFTT activities.

We look forward to discussing the feasibility of this recommended expansion of Navy's mitigation measures and developing appropriate protocols for the reporting and avoidance of potential historic properties.

Please contact me via email (tnowak@mdp.state.md.us) if you have any questions.

Sincerely,

Troy J. Nowak
Assistant State Underwater Archeologist
Maryland Historical Trust

cc: Jene Nissen (USFF Environmental Planning Division)
Beth Cole (Maryland Historical Trust)
Susan Langley (Maryland Historical Trust)

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

Richard Eberhart Hall, AICP, Secretary
Amanda Stakem Conn, Esq., Deputy Secretary

Maryland Historical Trust - 100 Community Place - Crownsville - Maryland - 21032
Tel: 410.514.7601 - Toll Free: 1.800.756.0119 - TTY users: Maryland Relay - Planning.Maryland.gov

C.6.9 MASSACHUSETTS

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/073
April 12, 2013

Brona Simon
Executive Director, Massachusetts Historical Commission
State Historic Preservation Officer
220 Morrissey Boulevard
Boston, MA 02125

Dear Ms. Simon:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Massachusetts territorial waters include the Northeast Range Complexes and the Naval Undersea Warfare Division, Newport Testing Range.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Massachusetts.

5090
Ser N46/073
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

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The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Massachusetts. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

April 25, 2013

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

J.W. Murphy
Deputy Chief of Staff for Fleet Installations
and Environmental Readiness
Department of the Navy
Commander
1562 Mitscher Avenue, Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

Attn: Jene Nissen

RE: Atlantic Fleet Training and Testing Study Area, Offshore Massachusetts. MHC # RC.54094.

Dear Mr. Murphy:

The Massachusetts Historical Commission (MHC), the office of the Massachusetts State Historic Preservation Officer, has reviewed your determination of effect, the Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) and the Draft Technical Memorandum on CD-ROM for the project referenced above, received April 16, 2013, and has the following comments. The proposed project consists of naval training and testing activities within Atlantic Fleet training areas, including anchoring and explosive mine countermeasures practice exercises.

The Navy has determined that there will be no historic properties affected through training and testing projects associated with naval activities within the Atlantic Fleet Training and Testing Study Area, offshore Massachusetts through the implementation of avoidance and minimization measures, such as limitation of anchoring and underwater explosions. The MHC concurs with the Navy's finding of "no historic properties affected" (36 CFR 800.4(d)(1)), and looks forward to consultation if potentially significant historic and archaeological resources are identified during the project.

The MHC notes that the draft technical memorandum presents general maritime historical contexts and information regarding known cultural resources, including a general predictive model for location of historic shipwrecks. Known data on shipwreck locations offshore Massachusetts includes primarily general coordinates of shipwrecks based on current data bases, including the NOAA Office of Coast Survey's Automated Wreck and Obstruction Information System (AWOIS) data base. This data may not have been verified in the field, and locational information may not be accurate or precise. Verification of known cultural resources locational information through consultation with knowledgeable regional agencies, groups and individuals is recommended to incorporate accurate information to assist in the development of avoidance and protection measures, including appropriate surface and seafloor cultural resource buffer zones for potential project impacts.

The MHC recommends that the Navy conduct consultation with other federal regulatory agencies with responsibilities for cultural resources within the offshore continental shelf (OCS) in the New England region, including the Bureau of Ocean Energy Management (BOEM), the United States Coast Guard, the US Army Corps of Engineers, and NOAA. The Massachusetts Board of Underwater Archaeological Resources maintains files on shipwreck locations within Massachusetts state waters, and local dive community representatives may have additional information on known shipwrecks.

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.sec.state.ma.us/mhc

The draft technical memorandum does not identify potential areas of the OCS that may contain buried ancient Native American archaeological sites nor incorporate previous relevant research for these potential archaeological resources, although ancient Native American archaeological sites are referenced in Section 3.10 of the EIS. The MHC notes that a general technical reconnaissance report that incorporates these archaeological resources and includes a regional sensitivity assessment of the New England OCS has been published by BOEM in 2012.

Development of a paleolandscape reconstruction for portions of the New England OCS has been initiated through such state and regional databases as the Rhode Island Ocean Special Area Management Plan (SAMP) coastal planning tool. Geographic Information System (GIS) data layers developed for SAMP include both known areas of cultural resources (e.g. shipwrecks) and geophysical reconstructions of underwater paleolandscapes of the continental shelf in Rhode Island and some of Massachusetts. Paleolandscape reconstruction is especially important to assist in proactive project planning for cultural resource identification by identifying archaeologically sensitive locations within the OCS which may be within project areas of potential impact.

These comments are offered to assist in compliance with Sections 106 and 110 of the National Historic Preservation Act of 1966 as amended. If you need further information or have any questions concerning these comments, please contact Jonathan K. Patton of my staff.

Sincerely,

Brona Simon

Brona Simon
State Historic Preservation Officer
Executive Director
State Archaeologist
Massachusetts Historical Commission

xc: Brian Jordan, BOEM
Karen Kirk Adams, USACOE-NED, Regulatory
Kate Atwood, USACOE-NED
Marc Paiva, USACOE
Bettina Washington, THPO, Wampanoag Tribe of Gay Head (Aquinnah)
Ramona Peters, THPO, Mashpee Wampanoag Tribe
Doug Harris, NITHPO
Louis Brodnitz, Advisory Council on Historic Preservation
Secretary Ian A. Bowles, Massachusetts Executive Office of Energy & Environmental Affairs
Bruce Carlisle, Massachusetts Coastal Zone Management
Victor Mastone, Massachusetts Board of Underwater Archaeological Resources
John A. Peters, Massachusetts Commission on Indian Affairs
Tim Ives, Rhode Island Historic Preservation & Heritage Commission

C.6.10 MISSISSIPPI

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/074
April 12, 2013

H. T. Holmes
Director, Mississippi Department of Archives and History
State Historic Preservation Officer
P. O. Box 571
Jackson, MS 39205-0571

Dear Mr. Holmes:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Mississippi territorial waters include the Gulf of Mexico Range Complex. In addition, the Navy-contractor shipyard in Pascagoula is located within the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Mississippi.

5090
Ser N46/074
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Mississippi. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.11 NEW HAMPSHIRE

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/075
April 12, 2013

Elizabeth Muzzey
Director, New Hampshire Division of Historical Resources
State Historic Preservation Officer
19 Pillsbury Street
Concord, NH 03301-3570

Dear Ms. Muzzey:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to New Hampshire territorial waters include the Northeast Range Complexes.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of New Hampshire.

5090
Ser N46/075
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of New Hampshire. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
State of New Hampshire, Department of Cultural Resources
19 Pillsbury Street, Concord, NH 03301-3570
TDD Access: Relay NH 1-800-735-2964
www.nh.gov/nhdhr
603-271-3483
603-271-3558
FAX 603-271-3433
preservation@dcr.nh.gov

April 30, 2013

J.W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Department of the Navy
1562 Mitscher Ave, Suite 250
US Fleet Forces Command
Norfolk, VA 23551-2487

RE: Section 106 Project Review for Atlantic Fleet Training and Testing DRAFT Environmental Impact Statement/Overseas Environmental Impact Statement (AFTT EIS/OEIS)

Dear Deputy Chief Murphy:

In accordance with Section 106 of the National Historic Preservation Act (16 U.S. C. 470), and with federal Advisory Council on Historic Preservation regulations, *Protection of Historic Properties* (36 CFR Part 800), the New Hampshire Division of Historical Resources / State Historic Preservation Office has reviewed the undertaking referenced above, with respect to potential effects on properties listed, or potentially eligible for listing, in the National Register of Historic Places.

Based on the information which you have provided for review it has been determined that the undertaking, as proposed for training and testing activities within or adjacent to New Hampshire territorial waters will have no affect on historic properties. The Division of Historical Resources concurs with your finding of "no historic properties affected."

If any other historical or archaeological resources should be discovered or affected as a result of project planning or implementation, the Division of Historical Resources is to be consulted on the need for appropriate evaluative studies, determinations of National Register eligibility, and mitigative measures (redesign, resource protection, or data recovery, as required by federal law and regulations). For the purpose of compliance with the ACHP procedures, the NH Division of Historical Resources concurs with the proposed finding of ***"No Historic Properties Affected"***.

This fulfills the Navy's responsibilities for "Section 106" historic preservation review for the State of New Hampshire.

Sincerely,

Richard Boisvert, State Archaeologist
Deputy State Historic Preservation Officer

RAB:emf

C.6.12 NEW JERSEY

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/076
April 12, 2013

Bob Martin
Director, New Jersey Department of Environmental Protection
Historic Preservation Office
State Historic Preservation Officer
P.O. Box 420
Trenton, NJ 08625-0420

Dear Mr. Martin:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to New Jersey territorial waters include the Northeast Range Complexes. In addition, the waters around Earle are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of New Jersey.

5090
Ser N46/076
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of New Jersey. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site File Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

HPO Project #12-1584-3
HPO-E2013-184
Page 1 of 3

State of New Jersey

MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
P.O. Box 420
Trenton, NJ 08625-0420
TEL. (609) 984-0176 FAX (609) 984-0578

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

May 17, 2013

J. W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Department of the Navy
Commander
1562 Mitscher Ave, Suite 250
U.S Fleet Forces Command
Norfolk, Virginia 23551-2487

Dear Deputy Chief Murphy:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published in the *Federal Register* on December 12, 2000 (65 FR 77725-77739) and amended on July 6, 2004 (69 FR 40544-40555), I am providing continuing Consultation Comments for the following proposed undertaking:

Statewide
Atlantic Fleet Training and Testing Study Area
Draft Environmental Impact Statement
Department of the Navy

Thank you for providing the Historic Preservation Office (HPO) the opportunity to review and comment on the potential for the above-referenced project to affect historic and archaeological resources. According to the submitted Draft Environmental Impact Statement (DEIS), the Navy intends to conduct Section 106 consultation concurrently with the preparation of the Environmental Impact Statement (EIS) for the above-referenced undertaking. The following comments are based in part on the following technical memorandum describing the results of a literature search and predictive model for submerged cultural resources:

Burns, Jason M.
2011 *Draft Technical Memorandum (Ranges and Operating Areas) Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for the US Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).* Prepared for Parsons Infrastructure &

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Technology, Inc. Pasadena, California. Prepared by Southeastern Archaeological Research, Inc. Pensacola, Florida.

800.3 Initiation of the Section 106 Process

At this point in time, it is unclear whether all interested parties (including local governments, Historic Preservation Commissions, Historical Societies, etc.) have been identified and if initiation of consultation, pursuant to 36 CFR § 800.3, has begun. The HPO requests documentation that these parties have been identified and that consultation has been initiated.

Please note, in the past the following federally recognized Native American Tribes have expressed interest in undertakings within the State of New Jersey:

- Delaware Nation
- Shawnee Tribe of Oklahoma
- Absentee-Shawnee Tribe of Indians of Oklahoma
- Stockbridge-Munsee Band of the Mohicans
- Delaware Tribe of Indians
- Oneida Nation of New York

800.4 Identification of Historic Properties

The HPO has concerns regarding the information submitted. According to the documentation provided, the Navy has determined that there will be no historic properties affected by the above-referenced undertaking, provided the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards of shipwrecks. However, efforts to identify historic properties are limited to a literature review, site file search, and sensitivity assessment of the project area of potential effects (APE) in which the highly variable and usually poor positional accuracy of the potential resources is acknowledged. In addition, the documentation provided identifies that adverse effects may occur to submerged Native American and other unrecorded submerged historic properties through the employment of the No Action Alternative, Alternative 1, or Alternative 2.

From the documentation submitted, it does not appear the United States Navy intends to complete additional identification efforts. At this point in time, it is also not clear how the undertaking would have no effect on historic properties with the described level of identification and the documentation or potential adverse effects. The HPO requests clarification of the finding of no historic properties affected in light of this assessment. Once the HPO receive clarification regarding these issues, we will be able to provide additional consultation comments under Section 106 of the National Historic Preservation Act.

Additional Comments

Thank you for providing this opportunity to comment on this proposed project. If additional consultation with the HPO is needed for this undertaking, please reference the HPO project number 12-1584 in any future calls, emails, or written correspondence to help expedite your

review and response. If you have any questions, please feel free to contact Jesse West-Rosenthal (609-984-6019) of my staff with questions regarding archaeology.

Sincerely,

Daniel D. Saunders
Deputy State Historic
Preservation Officer

Cc: Jene Nissen – Navy

HPO Project #12-1584-4
HPO-G2013-229
Page 1 of 2

State of New Jersey
MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
P.O. Box 420
Trenton, NJ 08625-0420
TEL. (609) 984-0176 FAX (609) 984-0578

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

July 29, 2013

J. W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Department of the Navy
Commander
1562 Mitscher Ave, Suite 250
U.S Fleet Forces Command
Norfolk, Virginia 23551-2487

Dear Deputy Chief Murphy:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published in the *Federal Register* on December 12, 2000 (65 FR 77725-77739) and amended on July 6, 2004 (69 FR 40544-40555), I am providing continuing Consultation Comments for the following proposed undertaking:

Statewide
Atlantic Fleet Training and Testing Study Area
Department of the Navy

800.4 Identification of Historic Properties

Thank you for your submission regarding the proposed Atlantic Fleet Training and Testing undertaking. Based on the documentation submitted, the Navy is proposing to conduct training and testing activities, which may include the use of sound navigation and ranging, and explosives. Communication between Laura Busch of your office and Jesse West-Rosenthal of the HPO has indicated that only a select amount of activities analyzed in the Navy's Draft Environmental Impact Statement have the potential to occur within the territorial waters of New Jersey. Civilian Port Defense was the only activity identified as likely to occur and was also identified as the only activity which includes the use of underwater explosives within the coastal zone. Ms. Busch outlined that placement of underwater explosives as a result of this activity would be done by Navy divers would avoid placing explosives on any obstruction or shipwrecks.

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800.5 Assessment of Adverse Effects

Therefore, pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and it's implementing regulations, 36 CFR §800.5(b), I concur with your finding that the project will **not adversely affect** historic properties provided that the placement of underwater explosives as a result of this activity would be done by Navy divers who will avoid placing explosives on any obstruction or shipwrecks. Pursuant to 800.5(c), if no consulting parties object to this finding within the 30 day review period, the project may proceed, as proposed, unless resources are discovered during project implementation, pursuant to 800.13.

Additional Comments

Thank you for providing this opportunity to review and comment on this proposed project. If additional consultation with the HPO is needed for this undertaking, please reference the HPO project number 12-1584 in any future calls, emails, submissions or written correspondence to help expedite your review and response. If you have any questions, please feel free to contact Jesse West-Rosenthal (609-984-6019) of my staff with questions regarding archaeology.

Sincerely,

/km

Daniel D. Saunders
Deputy State Historic
Preservation Officer

Cc: Laura Busch – US Navy

C.6.13 NEW YORK

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/077
April 12, 2013

Rose Harvey
Commissioner, New York State Division for Historic Preservation
New York State Office of Parks, Recreation, and Historic Preservation
State Historic Preservation Officer
Peebles Island State Park
P.O. Box 189
Waterford, NY 12188-0189

Dear Ms. Harvey:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to New York territorial waters include the Northeast Range Complexes and the Naval Undersea Warfare Center Division, Newport Testing Range.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of New York.

5090
Ser N46/077
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of New York. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

OFFICE OF PARKS, RECREATION & HISTORIC PRESERVATION
NEW YORK STATE

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

April 25, 2013

J.W. Murphy
Deputy Chief of Staff for Fleet Installations and Environmental Readiness
Department of the Navy
1562 Mitscher Avenue, Suite 250
Norfolk, Virginia 23551-2487

Re: DOD/ Navy **Ser N46/077**
Atlantic Fleet Training and Testing (AFTT) Final Environmental Impact Statement (EIS)/ Overseas Environmental Impact Statement (OEIS)
North Atlantic - NY State Waters/State-Wide, STATE-WIDE County
13PR01835

Dear Mr. Murphy:

Thank you for requesting the comments of the State Historic Preservation Office (SHPO). We have reviewed the submitted *Atlantic Fleet Training and Testing (AFTT) Final Environmental Impact Statement (EIS)/ Overseas Environmental Impact Statement (OEIS)* received by our office on April 18, 2013. The project information for the proposed undertaking has been reviewed in accordance with Section 106 of the National Historic Preservation Act of 1966, *as amended*, and it's implementing regulations 36 CFR Part 800 – Protection of Historic Properties.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

The Navy has made the determination of *No Historic Properties* Affected [as per 36 CFR Section 800.4(d)(1)] by the proposed action within the jurisdictional waters of New York. Based upon the provided information in the ATFF EIS/OEIS, our agency concurs with this finding.

Should you have any questions, please feel free to contact me directly at (518) 237-8643, Extension 3288 or via electronic mail at Brian.Yates@oprhp.state.ny.us. If further correspondence is required regarding this project, please be sure to refer to the OPRHP Project Review (PR) number noted above.

Sincerely,

Wm. Brian Yates
Historic Preservation Specialist

C.6.14 NORTH CAROLINA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/078
April 12, 2013

Kevin Cherry, Ph.D.
Deputy Secretary, North Carolina Office of Archives and History
State Historic Preservation Officer
4619 Mail Service Center
Raleigh, NC 27699-4619

Dear Dr. Cherry:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to North Carolina territorial waters include the Cherry Point Range Complex. In addition, the waters around Morehead City and Wilmington are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of North Carolina.

5090
Ser N46/078
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of North Carolina. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

North Carolina Department of Cultural Resources
State Historic Preservation Office
Ramona M. Bartos, Administrator

Governor Pat McCrory
Secretary Susan Kluttz

Office of Archives and History
Deputy Secretary Kevin Cherry

May 2, 2013

J. W. Murphy
Department of the Navy
1562 Mitscher Avenue, Suite 250
US Fleet Forces Command
Norfolk, VA 23551-2487

Re: Training and Testing Within the Atlantic Fleet Training and Testing Study Area of the Western Atlantic Ocean, Multi County, CH 10-1376

Dear Mr. Murphy:

Thank you for your letter of April 12, 2013, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

Location: 109 East Jones Street, Raleigh NC 27601 **Mailing Address**: 4617 Mail Service Center, Raleigh NC 27699-4617 **Telephone/Fax**: (919) 807-6570/807-6599

C.6.15 PUERTO RICO

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/084
April 12, 2013

Carlos A. Rubio Cancela
Executive Director, State Historic Preservation Office
State Historic Preservation Officer
Office of the Governor
P.O. Box 9066581
San Juan, PR 00906-6581

Dear Mr. Rubio Cancela:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the territorial waters of Puerto Rico.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

5090
Ser N46/084
April 12, 2013

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Puerto Rico. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: AFTT Draft EIS/OEIS

2

OFICINA ESTATAL DE
CONSERVACIÓN HISTÓRICA
OFICINA DEL GOBERNADOR

STATE HISTORIC
PRESERVATION OFFICE
OFFICE OF THE GOVERNOR

SHPO
OECH

May 24, 2013

J. W. Murphy
Deputy Chief of Staff
for Fleet Installations and Environmental Readiness
Department of the Navy
1562 Mitscher Ave., Suite 220
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

SHPO: 04-29-13-01 PREPARATION OF A FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) / OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (OEIS) FOR ATLANTIC FLEET TRAINING AND TESTING STUDY AREA, ISLANDWIDE, PUERTO RICO

Dear Mr. Murphy:

We acknowledge receipt of the draft EIS/OEIS prepared for the above referenced activities. In reviewing the document, we were unable to discern if any training activities are actually contemplated within the territorial waters of the Commonwealth of Puerto Rico. In terms of training activities within the Caribbean, the only references we could find described training and testing around the Florida Keys. In order of us to effectively advise and assist the U. S. Navy in meeting its historic preservation responsibilities, we will need a clearer description of the actions and locations under consideration within our territorial waters.

If you have any questions, please contact Miguel Bonini of our Office at 787-721-3737 or by e-mail at mbonini@prshpo.gobierno.pr.

Sincerely,

Diana López Sotomayor

Diana López Sotomayor, Archaeologist
State Historic Preservation Officer

DLS/BRS/MB

WWW.OECH.GOBIERNO.PR

P.O. Box 9023935
San Juan, PR 00902-3935

Teléfono/Phone | 787.721-3737
Fax | 787.721-3773

PUERTO RICO VERDE

OFICINA ESTATAL DE
CONSERVACIÓN HISTÓRICA
OFICINA DEL GOBERNADOR

STATE HISTORIC
PRESERVATION OFFICE
OFFICE OF THE GOVERNOR

SHPO
OECH

July 18, 2013

J. W. Murphy
Deputy Chief of Staff
for Fleet Installations and Environmental Readiness
Department of the Navy
1562 Mitscher Ave., Suite 220
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

SHPO: 04-29-13-01 PREPARATION OF A FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) / OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (OEIS) FOR ATLANTIC FLEET TRAINING AND TESTING STUDY AREA, ISLANDWIDE, PUERTO RICO

Dear Mr. Murphy:

We acknowledge receipt of additional documentation regarding possible U. S. Navy activities within the coastal zone of Puerto Rico. According to the information submitted, no activities in the proposed action would be conducted on land in Puerto Rico. As for activities that may occur within the territorial waters of Puerto Rico, we have reviewed the list provided and concur that it is unlikely that these may affect historic properties. However, if historic properties are discovered or unanticipated effects on historic properties found at any point during these activities, you should notify the SHPO immediately.

If you have any questions, please contact Miguel Bonini of our Office at 787-721-3737 or by e-mail at mbonini@prshpo.gobierno.pr.

Sincerely,

Diana López Sotomayor

Diana López Sotomayor, Archaeologist
State Historic Preservation Officer

DLS/BRS/MB

WWW.OECH.GOBIERNO.PR

P.O. Box 9023935
San Juan, PR 00902-3935

Teléfono/Phone | 787.721-3737
Fax | 787.721-3773

PUERTO RICO VERDE

C.6.16 RHODE ISLAND

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/079
April 12, 2013

Edward F. Sanderson
Executive Director
Rhode Island Historic Preservation and Heritage Commission
State Historic Preservation Officer
Old State House
150 Benefit Street
Providence, RI 02903

Dear Mr. Sanderson:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Rhode Island territorial waters include the Northeast Range Complexes and the Naval Undersea Warfare Division, Newport Testing Range.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Rhode I

5090
Ser N46/079
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Rhode Island. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.17 SOUTH CAROLINA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/080
April 12, 2013

W. Eric Emerson, Ph.D.
Director, South Carolina Department of Archives and History
State Historic Preservation Officer
8301 Parklane Road
Columbia, SC 29223

Dear Dr. Emerson:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to South Carolina territorial waters include the Jacksonville Range Complex.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of South Carolina.

5090
Ser N46/080
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of South Carolina. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

C.6.18 TEXAS

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/081
April 12, 2013

Mark S. Wolfe
Executive Director, Texas Historical Commission
State Historic Preservation Officer
P.O. Box 12776
Austin, TX 78711

Dear Mr. Wolfe:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges within or adjacent to Texas territorial waters include the Gulf of Mexico Range Complex. In addition, the waters around Beaumont and Corpus Christi are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Texas.

5090
Ser N46/081
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Texas. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

TEXAS HISTORICAL COMMISSION
real places telling real stories

May 20, 2013

J. W. Murphy
Department of the Navy
1562 Mitscher Ave., Suite 250
U.S. Fleet Forces Command
Norfolk, VA 23551-2487

Re: Project review under Section 106 of the National Historic Preservation Act of 1966 and the Antiquities Code of Texas
Atlantic Fleet Training and Testing Study
THC Tracking No. 201307377

Dear Mr. Murphy:

Thank you for your correspondence describing the above referenced project. This letter serves as comment on the proposed federal undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission. As the state agency responsible for administering the Antiquities Code of Texas, these comments also provide recommendations on compliance with state antiquities laws and regulations.

The review staff, led by State Marine Archeologist Amy A. Borgens, has completed its review. These comments address both the proposed actions and the draft technical memorandum on predictive modeling for submerged cultural resources for the study area. The military readiness activities that are proposed in western Atlantic Coast, Gulf of Mexico, and Caribbean include training that will or may occur in Texas territorial waters (see Appendix A). The locations of some activities that will occur in Texas waters are specifically listed and others are only categorized as general Gulf of Mexico or Gulf of Mexico Range Complex (GOMEX) locations. These latter activities have the potential to occur in Texas. Many, if not most, of the training exercises listed in Appendix A occur on or above the water's surface and would not pose a threat to historic or prehistoric sites (both recorded and undiscovered) on the seafloor or in the water column. Section 3.10 of the draft EIS/OEIS (Vol. 1) lists both acoustic and physical stressors that have the potential to impact cultural resources as part of the proposed training.

The Navy has proposed a mitigation (avoidance) zone of 320 m for shipwrecks and other submerged cultural resources in the study area to ensure they will be protected from ground-disturbing activities. The proposed avoidance area exceeds the state avoidance buffer required by the Texas Administrative Code which is 50 m within the 3 mile line in the Gulf of Mexico and 150 meters beyond this demarcation to the state's maritime boundary (Texas Administrative Code, Title 13, Part 2 Chapter 28, RULE §28.6). In addition to archeological sites discovered in state waters, significant magnetic anomalies encountered during the course of cultural resources remote-sensing surveys are considered sensitive targets (the equivalent of unevaluated archeological sites) and are also to be avoided by all ground-disturbing activities (Texas Administrative Code, Title 13, Part 2 Chapter 28,

RULE §28.6). The locations of both archeological sites and significant magnetic anomalies are on file with the Texas Historical Commission (THC).

There is concern that the technical memorandum entitled *Draft Technical Memorandum (Ranges and Operating Areas) Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for the US Atlantic Fleet Training and Testing Environmental Impact/Overseas Environmental Impact Statement (EIS/OEIS)* may lack sufficient detail to ensure (to the reader) that the predictive model proposed for this project adequately includes all state resources pertinent to the project. Federal databases are described but state databases are not individually listed. The THC maintains an online listing of both discovered and reported shipwrecks in state waters that is restricted to registered users. More than 1800 shipwrecks are recorded or reported in Texas territorial waters (approximately 300 are in rivers). These shipwreck entries are, for the most part, not duplicates of wrecks listed in the NOAA AWOIS, BOEMRE, or GDWD datasets. The THC database, among others, is not referred to in the text or the examples provided on page 37 of the memorandum. The results section additionally mentions that wrecks are located "across the entire AFTT study area" yet the study focuses only on the specific operating areas in building the predictive model. Wherein the restricted Sites Atlas lists more than 1800 reported shipwrecks and sites throughout Texas, the Corpus Christi Operating Area appears to have more than 200 from this dataset alone.

For the No Action Alternative, the THC concurs with the Navy's determination that no historic properties will be affected by the proposed activities. If Alternatives 1 or 2 are selected, the THC would, however, like additional information regarding the explosives used for training exercises if they were to occur in Texas state waters. This information would include more specific locations of detonation and associated impact footprints (as listed in Tables 3.3-5, 3.3-6, and 3.3-7). Archeological remote-sensing surveys may be recommended if impacts are substantial and these are to occur in areas that have a high probability to contain shipwrecks sites. Additional consultation with this agency is requested so that both known archeological sites and significant magnetic anomalies identified in previous remote-sensing surveys are avoided by any ground-disturbing activities.

Thank you for your cooperation in this federal and state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Amy Borgens at 512-463-9505.**

Sincerely,

for
Mark Wolfe
State Historic Preservation Officer
MW/ab

RICK PERRY, GOVERNOR • MATTHEW F. KREISLE, III, CHAIRMAN • MARK WOLFE, EXECUTIVE DIRECTOR
P.O. BOX 12276 • AUSTIN, TEXAS • 78711-2276 • P 512.463.6100 • F 512.475.4872 • TDD 1.800.735.2989 • www.thc.state.tx.us

APPENDIX A: Training Activities listed in Table 2.8-1 that may occur in Texas Territorial Waters

No Action Alternative activities include Anti-Air Warfare (AAW) surface to Air missile exercises; Anti-Surface Warfare (ASUW) Maritime Security Operations – Anti Swimmer Grenades; ASUW Ship Gunnery Exercise – surface to surface (small caliber and medium caliber rounds); ASUW Boat Gunnery Exercise – surface to surface (small caliber and medium caliber rounds); ASUW Missile Exercise – Air to surface; ASUW Torpedo (Non-Explosive) Testing; Anti-Submarine Warfare (ASW) – Tracking/Torepdo Exercise – Submarine; ASW - Tracking/Torpedo Exercise – Helicopter; ASW Tracking Exercise/Torpedo Exercise - Maritime Patrol Aircraft; ASW Tracking Exercise - Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys (highly explosive); ASW Integrated Anti-Submarine Warfare Course (no ordnance); ASW For Composite Training Unit Exercise; Mine Warfare (MIW) Mine Countermeasures Exercise – Ship Sonar; Anti-Air Warfare (AAW) Air Combat Maneuver; AAW Air Platform/Vehicle Test, and major exercises such as Composite Training Unit Exercise, Precision Anchoring, and Surface Ship Sonar Maintenance

Alternatives 1 and 2 propose to add new activities to GOMEX and the Gulf of Mexico including an Anti-Air Warfare (AAW) Air Defense Exercise, Amphibious Warfare (AMW) Naval Surface Fire Support Exercise – At Sea; Anti-Surface Warfare (ASUW) Maritime Security Operations; ASUW Ship Gunnery Exercise – surface to surface (small medium, and large caliber rounds); ASUW air to surface (medium caliber rounds); ASUW Bombing exercise - air to surface; ASUW Air-to-Surface Missile Test; Electronic Warfare (EW) Counter Targeting Flare Exercise; EW Counter Targeting Chaff Exercise; EW Counter Targeting Chaff Exercise; MIW Mine Neutralization –Explosive Ordnance Disposal (EOD) (highly explosive); MIW Airborne Mine Countermeasure (AMCM) – Towed Mine Neutralization; MIW Airborne Mine Countermeasure (AMCM) –Mine Detection; MIW Mine Countermeasure (MCM) - Mine Neutralization – Remotely Operated Vehicle; MIW Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises; MIW Civilian Port Defense; New Ship Construction Sea Trials (propulsion testing, gun testing, missile testing, decoy testing, surface warfare testing, anti-submarine warfare testing; Life Cycle activities (ship signature testing); MIW Mine Countermeasure / Neutralization Testing; Unmanned Vehicle testing; At-Sea Explosives Testing

C.6.19 U.S. VIRGIN ISLANDS

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/082
April 12, 2013

Robert Mathes
Commissioner
U.S. Virgin Islands Department of Planning and Natural Resources
State Historic Preservation Officer
Virgin Islands State Historic Preservation Office
Dronningens Gade 71 and 72A, Kongens Quarter
Charlotte Amalie, VI 00802

Dear Mr. Mathes:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year period. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area generally follows the Commander Task Force 80 area of operations, covering approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the territorial waters of the U.S. Virgin Islands.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

5090
Ser N46/082
April 12, 2013

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of the U.S. Virgin Islands. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosure: AFTT Draft EIS/OEIS

2

C.6.20 VIRGINIA

DEPARTMENT OF THE NAVY
COMMANDER
1562 MITSCHER AVE, SUITE 250
U.S. FLEET FORCES COMMAND
NORFOLK, VA 23551-2487

5090
Ser N46/083
April 12, 2013

Kathleen Kilpatrick
Director, Virginia Department of Historic Resources
State Historic Preservation Officer
2801 Kensington Avenue
Richmond, VA 23221

Dear Ms. Kilpatrick:

The Navy is preparing a Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with two categories of military readiness activities - training and testing - that are proposed to occur within the Atlantic Fleet Training and Testing (AFTT) Study Area over a five-year planning horizon. The AFTT EIS/OEIS Study Area is situated off the east coast of North America and is primarily comprised of the western Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. The Study Area starts seaward from the mean high water line east to the 45-degree west longitude line, north to the 65-degree north latitude line, and south to approximately the 20-degree north latitude line. The Study Area covers approximately 2.6 million square nautical miles (nm^2) of ocean area, and includes designated Navy operating areas (OPAREAs) and special use airspace. Navy pierside locations and port transit channels where sonar maintenance and testing occur, and bays and civilian ports where training occurs are also included in the Study Area. No land ranges are included in the Study Area.

Training and testing ranges that occur within or adjacent to Virginia territorial waters include the Virginia Capes (VACAPES) Range Complex. In addition, the lower Chesapeake Bay, Naval Station Norfolk, Joint Expeditionary Base Little Creek-Fort Story, Norfolk Naval Shipyard, and the Navy contractor shipyard in Newport News are included in the Study Area.

For your review, the draft AFTT EIS/OEIS is provided as an enclosure. Since the release of the draft EIS/OEIS, however, the Navy modified the regulatory finding under Section 106 of the National Historic Preservation Act in the final AFTT EIS/OEIS to one of "no historic properties affected." Section 3.10 of the EIS/OEIS provides an assessment of the potential impacts on cultural resources as a result of the proposed training and testing activities in the Study Area. The EIS/OEIS identifies two stressors - acoustic stressors and physical stressors - that have the potential to result in adverse effects on submerged cultural resources. These stressors may occur in the state territorial waters of Virginia.

5090
Ser N46/083
April 12, 2013

In addition, a technical memorandum describing the results of a literature search and predictive model for submerged cultural resources to further identify any cultural resources that might be within Navy training and testing ranges is enclosed for your review.

To ensure protection of submerged cultural resources in the AFTT Study Area, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yards (320 meters) of shipwrecks. This avoidance will be accomplished by providing locational information for these resources to all Navy operators.

While there is a possibility that unintentional impacts to National Register-eligible properties could occur as a result of the Proposed Action, it is believed that chances of such impacts are remote due to the mitigation measures employed. Furthermore, while impacts on previously unidentified historic properties are possible, such impacts are also expected to be very unlikely. In the event that the Navy impacts a submerged historic property, it will immediately commence consultation with the appropriate state historic preservation officer in accordance with the provisions found at 36 Code of Federal Regulations Section 800.13(a)(3).

The Navy has made the determination of no historic properties affected by the Proposed Action within the jurisdictional waters of Virginia. We request that you provide your concurrence on our finding of no historic properties affected within 30 days of receipt of this letter. If a response has not been received by that time, concurrence with this finding will be assumed. Please contact Jene Nissen of my staff at (757) 836-5221 with any questions.

Sincerely,

J. W. MURPHY
Deputy Chief of Staff
for Fleet Installations
and Environmental Readiness

Enclosures: 1. AFTT Draft EIS/OEIS
2. Draft Technical Memorandum Literature Review, Site Files Search, and Predictive Modeling for Submerged Cultural Resources for AFTT EIS/OEIS

2

COMMONWEALTH of VIRGINIA

Douglas W. Domenech
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick
Director

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MEMORANDUM

DATE: 2 May 2013 **DHR File #** 2013-0515

TO: J. W. Murphy
NAVY

FROM: Marc E. Holma, Architectural Historian (804) 482-6090
Office of Review and Compliance

PROJECT: Final Environmental Impact Statement for Two Categories of Military Readiness Activities (Testing and Training) off of the Coast of Virginia

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___ This project will have an effect on historic resources. Based on the information provided, the effect will not be adverse.

___ This project will have an adverse effect on historic properties. Further consultation with DHR is needed under Section 106 of the NHPA.

___ Additional information is needed before we will be able to determine the effect of the project on historic resources. **Please see attached sheet.**

_X_ No further identification efforts are warranted. No historic properties will be affected by the project. Should unidentified historic properties be discovered during implementation of the project, please notify DHR.

___ We have previously reviewed this project. Attached is a copy of our correspondence.

___ Other (Please see comments below)

COMMENTS:

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Petersburg, VA 23803
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C.7 NATIONAL MARINE SANCTUARIES ACT

As part of the EIS/OEIS process, the Navy has had information discussions with the Office of National Marine Sanctuaries in accordance with the requirements under the National Marine Sanctuaries Act. Since the Draft EIS/OEIS was released, adjustments were made to add additional details to the analysis contained within Section 6.1.2.5 (National Marine Sanctuaries) based on feedback received from the Office of National Marine Sanctuaries. These changes can be found in this Final EIS/OEIS. In addition to this feedback, the Navy received two specific recommendations from the Office of National Marine Sanctuaries. The responses to these recommendations can be found in Table C-1.

Table C-1: Responses to Recommendations from the Office of National Marine Sanctuaries

Recommendation	Response
ONMS recommends that the Navy continue the spatial mitigation measure to restrict all active sonar use inside and within a 2.7 nm buffer around the Stellwagen Bank, Monitor, Gray's Reef, Florida Keys and Flower Garden Banks national marine sanctuaries (AFTT EIS section 5.3.4.8). In accordance, ONMS recommends that the Navy not employ sonar and other active acoustic sources within 2.7 nm of Gray's Reef National Marine Sanctuary (AFTT EIS section 6.1.2.5.2 (2)).	As discussed in Section 6.1.2.5 (National Marine Sanctuaries), the Navy does not plan to use sonar or other active acoustic sources within the Gerry E. Studds Stellwagen Bank National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action. For Florida Keys National Marine Sanctuary, the Navy only plans to use sonar and other active acoustic sources that were specifically exempted, which include those involved in mine countermeasure research, acoustic research, submarine activities, sonobuoy testing, and special warfare activities. The Navy does not plan to use any other sonar or other active acoustic sources within the Florida Keys National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action. For Gray's Reef, *Monitor,* and Flower Garden Banks National Marine Sanctuaries, sonar and other active acoustic sources are not likely to injure sanctuary resources or qualities, therefore mitigation is not warranted. Section 6.1.2.5 (National Marine Sanctuaries) provides a detailed analysis of the potential impacts from sonar and other active acoustic sources on sanctuary resources within each specific sanctuary. Due to the water depth in the vicinity of Gray's Reef National Marine Sanctuary specifically, the types of active sonar and other acoustic sources that could be used would typically be limited to lower source levels and higher frequency systems such as mine-hunting, bottom mapping and underwater communication type systems. Regarding the more powerful hull-mounted mid-frequency sonars, the types of activities that could occur would typically be limited to maintenance, testing or mine countermeasure training, and these events would typically be less than an hour in the vicinity of the sanctuary. Therefore, sonar and other active acoustic sources are not likely to destroy, cause the loss of, or injure sanctuary resources.
ONMS recommends that observations and monitoring information on the effects of electromagnetic devices on sanctuary resources be shared with ONMS as appropriate.	Navy will share observations and monitoring information on the effects of electromagnetic devices on sanctuary resources if any such data becomes available.

APPENDIX D

AIR QUALITY EXAMPLE EMISSIONS CALCULATIONS AND EXAMPLE RECORD OF NON-APPLICABILITY

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D.1 AIR QUALITY EXAMPLE CALCULATIONS

This appendix discusses emission factor development and calculations including assumptions employed in the analyses presented in the Air Quality section of Chapter 3 (Section 3.2). Section D.2 includes an example Record of Non-Applicability developed using the methods described in this Section D.1.

D.1.1 SURFACE ACTIVITIES EMISSIONS

Surface activities consist of activities associated with boat and ship traffic. Fleet training activities incorporate a variety of marine vessels including cruisers, destroyers, frigates, carriers, submarines, amphibious vessels, and rigid hull inflatable boats. Testing activities at the Naval Undersea Warfare Center Division, Newport Testing Range incorporate a variety of marine vessels including the testing support vessel (TWR-81), a work boat (WB-30), various torpedo recovery vessels, unmanned surface vehicles, and rigid hull inflatable boats. Testing activities at Naval Surface Warfare Center, Panama City Division Testing Range incorporate a variety of marine craft including the Athena 1, Athena 2, Research Vessel (R/V) Mr. Offshore, several 13 to 25 feet (ft.) (4.0 to 7.6 meters [m]) outboard motor boats, a 30 ft. (9.1 m) rigid hull inflatable boat, and 32 ft. (9.8 m), 65 ft. (20 m), and 68 ft. (21 m) inboard diesel vessels. Testing at the South Florida Ocean Measurement Facility Testing Range involves a mix of testing support vessels. Marine vessels participating in sea trials, shock trials, lifecycle activities, and combat system ship qualification trials are similar to those used in fleet training activities. Each of these vessels incorporates different propulsion methods such as marine outboard engines, diesel engines, and gas turbines. Calculations were developed utilizing the propulsion mechanism.

Marine Outboard Engines:

The U.S. Environmental Protection Agency (USEPA) has published emissions factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. The most conservative emission factors for two-stroke engines of various horsepower are represented in Table D-1.

Table D-1: Emission Factors for Two-Stroke Engines

USEPA Outboard Engine Emissions Factors (grams/hp-hr)			
NOx	**CO**	**VOC**	**SOx**
0.018	0.63	0.25	0.00108

Source: USEPA, 1999, Exhaust Emissions Factors for Non-Road Engine Modeling-Spark Ignition. Report No. NR-010b; Office of Mobile Sources, Assessment and Modeling Division, EPA-R-99-009.

CO: Carbon Monoxide; hp: Horsepower; hr: Hour; NOx: Nitrogen Oxides; Sox: Sulfur Oxides; USEPA: United States Environmental Protection Agency; VOC: Volatile Organic Compound

Emissions estimates for surface craft utilizing outboard engines were calculated using USEPA AP-42 factors and multiplied by the engine horsepower and hours of operation.

$$Emissions = HP \times HR/YR \times EF \times ENG \times CF$$

Where:

Emissions = Surface craft Emissions (lb. per year)
HP = Horsepower (reflective of a particular load factor/engine power setting)
HR/YR = Hours per year
EF = Emission factor for specific engine type
ENG = Number of engines
CF = Conversion Factor for grams to tons

To determine the entire project emissions, a calculation was conducted for each surface vessel type and for each pollutant and converted to tons, then compared to the baseline Study Area emissions. These values were summed according to the appropriate pollutant to provide the cumulative emissions associated with surface vessel emissions activities.

Diesel Engines:

Limited data were available for large marine diesel engines. Therefore, USEPA AP-42 emissions factors for industrial reciprocating engines were used to calculate diesel engine emissions. Another source utilized for vessel emissions factors included data presented in, John J. McMullen Associates as referenced in previous Navy EIS/OEIS documentation. Diesel was assumed to be the primary fuel to ensure an overly conservative approach. A similar calculation methodology to the outboard engines was employed to ascertain emissions from the diesel engines.

$$Emissions = HP \times HR/YR \times EF \times ENG \times CF$$

Where:

Emissions = Surface craft Emissions (lb. per year)
HP = Horsepower (reflective of a particular load factor/engine power setting)
HR/YR = Hours per year
EF = Emission factor for specific engine type (lb. per hour)
ENG = Number of engines
CF = Conversion Factor for pounds to tons

Diesel engine emission factors were multiplied by the engine horsepower and annual hours of operation to calculate the pounds of pollutant emissions per year. This value was then converted to a tons per year value for comparison with the Study Area total summed emissions on an individual pollutant basis.

D.1.2 AIR ACTIVITIES EMISSIONS

Fleet training and Naval Air Systems Command testing consists of various activities associated with airplanes or helicopters including, but not limited to, the F/A-18, P-3, SH-60B, MH-53, MH-60S, and Lear jets. Testing activities at Naval Surface Warfare Center, Panama City Division Testing Range consist of various activities associated with airplanes or helicopters including the 1UH-1N, SH-60B, MH-53, MH-60S, and Cessna-172. Aircraft activities of concern are those that occur from ground level up to 3,000 feet (ft.) (914 meters [m]) above ground level. The 3,000 ft. (914 m) above ground level ceiling was assumed to be the atmospheric mixing height above which any pollutant generated would not contribute to increased pollutant concentrations at ground level (known as the mixing zone). All pollutant emissions from aircraft generated greater than 3,000 ft. (914 m) above ground level are excluded from this analysis. The pollutant emission rate is a function of the engine's operating mode, the fuel flow rate, and the engine's overall efficiency. Emissions for one complete flight for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

For this EIS/OEIS, emission factors for most military engines were obtained from Navy's Aircraft Environmental Support Office (AESO) memoranda and the Federal Aviation Administration's Emissions and Dispersion Modeling System model. For those aircraft for which engine data was unavailable, an applicable surrogate was used. Emissions factors vary depending on engine power mode, time in each

mode, and fuel flow. Using these data, as well as information on activity levels (i.e., number of sorties), pollutant emissions for each aircraft and activity were calculated by applying the equation below.

$$Emissions = TIM \times FF \times EF \times ENG \times CF$$

Where:

Emissions = Aircraft Emissions (lb. per activity) (for EF in lb./1000 gallon fuel)
TIM = Time-in-mode at a specified power setting (hr/activity).
FF = Fuel flow at a specified power setting (gallons/hr/engine)
EF = Emission factor for specific engine type and power setting (lb./1000 gallons of fuel used)
ENG = Number of engines on aircraft
CF = Conversion Factor (0.001)

As the equation indicates, emissions were estimated by first calculating total fuel used in each of the different modes with the appropriate emission factor.

The following is a list of emissions factor sources used in the EIS/OEIS:

- AESO Memorandum Report No. 9961, Revision A, November 2009
- AESO Memorandum Report No. 9963, Revision B, July 2001
- AESO Memorandum Report No. 2000-10B, January 2001
- AESO Memorandum Report No. 9959, Revision B, January 2001
- AESO Memorandum Report No. 9960B, April 2000
- AESO Memorandum Report No. 9943B, April 2000
- AESO Memorandum Report No. 9941, Revision B, December 2009
- AESO Memorandum Report No. 9933, Revision B, November 2002
- AESO Memorandum Report No. 9933, Revision D, March 2011
- AESO Memorandum Report No. 9929, February 1999
- AESO Memorandum Report No. 9929, Revision A, November 2009
- AESO Memorandum Report No. 9948, Revision C, March 2010
- AESO Memorandum Report No. 9915A, March 2000
- AESO Memorandum Report No. 9824, Revision B, November 2009
- AESO Memorandum Report No. 9962, Revision A, November 2009
- FEIS for the Introduction of the P-8A Multi-Mission Maritime Aircraft into the U.S. Navy Fleet, October 2008
- USAF Institute for Environment, Safety and Occupational Health Risk Analysis, October 2002
- USEPA 1978 - Air Pollutant Emission Factors for Military and Civil Aircraft

D.1.3 ORDNANCE AND MUNITIONS EMISSIONS

Available emissions factors (AP-42, Compilation of Air Pollutant Emission Factors) were utilized. These factors were then multiplied by the net weight of the explosive (or a conversion factor for pounds per item) and the number of times that the munition was used during a designated time frame. This calculation provided annual pounds per year of emissions, which were converted to tons per year for comparison purposes.

Emissions = EXP/YR×EF×Net Wt×CF

Where:

Emissions = Ordnance Emissions (lb. per year)
EXP/YR = Explosives, propellants, and pyrotechnics used per year
EF = Emissions factor
Net Wt = Net Weight of explosive
CF = Conversion Factor for pounds to tons

D.1.4 EMISSIONS ESTIMATES SPREADSHEETS

The following spreadsheets (Tables D-2, D-3, and D-4) are the emissions calculations for vessels, aircraft, and munitions, respectively. The examples provided for vessels and aircraft are for baseline training within the Virginia Capes Range Complex. These examples are representative of similar calculation spreadsheets developed for each range complex or testing area. Moreover, they are representative of the calculations developed for each alternative analyzed in this EIS/OEIS. The example included for ordnance emissions is for baseline ordnance emissions for all range complexes and testing areas utilized for training and testing within the AFTT Study Area. The full set of calculation spreadsheets is available upon request.

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Anti-Air Warfare																																		
Air Combat Maneuver	Northeast	0			Aircraft emissions																													
	VACAPES	2,320																																
	Cherry Pt	385																																
	JAX	498																																
	Key West	5,700																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	8,903																																
Air Defense Exercise	Northeast	0	36	CVN	Nuclear Carrier (No	0.06	1.0	100%	36	0%	0%	100%	0.0	0.0	35.7																			
	VACAPES	595	184	CG	Cruiser	0.31	1.0	100%	184	0%	0%	100%	0.0	0.0	184.5	0	0	0	0	0	0	0	0	0	0	19,880	8,691	1,627	3,877	485	158	29,143	613,579	20	17	620,113
	Cherry Pt	21	369	DDG	Guided Missile Destroyer	0.62	1.0	100%	369	0%	0%	100%	0.0	0.0	368.9	0	0	0	0	0	0	0	0	0	0	38,362	18,039	2,962	6,618	907	160	59,024	1,242,691	40	35	1,255,926
	JAX	117	6	FFG	Guided Missile Frigate	0.01	1.0	100%	6	0%	0%	100%	0.0	0.0	6.0	0	0	0	0	0	0	0	0	0	0	398	403	46	69	19	68	405	8,518	0	0	8,609
	Key West	0																																
	GOMEX	80																																
	Outside RCs	0																																
	Total	813																																
Gunnery Exercise, Air-to-Air (Medium-Caliber)	Northeast	0			Aircraft emissions																													
	VACAPES	30																																
	Cherry Pt	10																																
	JAX	23																																
	Key West	36																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	99																																
Missile Exercise, Air-to-Air	Northeast	0			Aircraft emissions																													
	VACAPES	160																																
	Cherry Pt	20																																
	JAX	22																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	202																																
Gunnery Exercise, Surface-to-Air (Large-Caliber)	Northeast	0	0	CVN	Nuclear Carrier (No		2.0	100%	0	0%	0%	100%	0.0	0.0	0.0																			
	VACAPES	18	5	CG	Cruiser	0.25	3.0	100%	14	0%	0%	100%	0.0	0.0	13.5	0	0	0	0	0	0	0	0	0	0	1,455	636	119	284	36	158	2,133	44,908	1	1	45,386
	Cherry Pt	0	5	DDG	Guided Missile Destroyer	0.25	3.0	100%	14	0%	0%	100%	0.0	0.0	13.5	0	0	0	0	0	0	0	0	0	0	1,404	660	108	242	33	160	2,160	45,477	1	1	45,961
	JAX	13	9	FFG	Guided Missile Frigate	0.5	3.0	100%	27	0%	0%	100%	0.0	0.0	27.0	0	0	0	0	0	0	0	0	0	0	1,804	1,828	211	312	88	68	1,836	38,655	1	1	39,067
	Key West	0	18	AOE	Logistics/Support	1	4.9	100%	88	0%	0%	100%	0.0	0.0	88.2	0	0	0	0	0	0	0	0	0	0	329	1,940	246	5,834	1,171	1,599	141,032	2,969,284	96	84	3,000,906
	GOMEX	0																																
	Outside RCs	0																																
	Total	31																																
Gunnery Exercise, Surface-to-Air (Medium-Caliber)	Northeast	0	0	CVN	Nuclear Carrier (No		2.0	100%	0	0%	0%	100%	0.0	0.0	0.0																			
	VACAPES	30	8	CG	Cruiser	0.25	3.0	100%	23	0%	0%	100%	0.0	0.0	22.5	0	0	0	0	0	0	0	0	0	0	2,425	1,060	198	473	59	158	3,555	74,847	2	2	75,644
	Cherry Pt	0	8	DDG	Guided Missile Destroyer	0.25	3.0	100%	23	0%	0%	100%	0.0	0.0	22.5	0	0	0	0	0	0	0	0	0	0	2,340	1,100	181	404	55	160	3,600	75,794	2	2	76,602
	JAX	11	15	FFG	Guided Missile Frigate	0.5	3.0	100%	45	0%	0%	100%	0.0	0.0	45.0	0	0	0	0	0	0	0	0	0	0	3,007	3,047	351	521	146	68	3,060	64,425	2	2	65,111
	Key West	0	30	AOE	Logistics/Support	1	4.9	100%	147	0%	0%	100%	0.0	0.0	147.0	0	0	0	0	0	0	0	0	0	0	548	3,233	410	9,723	1,952	1,599	235,053	4,948,806	161	140	5,001,511
	GOMEX	0																																
	Outside RCs	0																																
	Total	41																																
Missile Exercise, Surface-to-Air	Northeast	0	0	CVN	Nuclear Carrier (No	0	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0																			
	VACAPES	24	6	CG	Cruiser	0.25	4.0	100%	24	0%	0%	100%	0.0	0.0	24.0	0	0	0	0	0	0	0	0	0	0	2,587	1,131	212	504	63	158	3,792	79,837	3	2	80,687
	Cherry Pt	8	6	DDG	Guided Missile Destroyer	0.25	4.0	100%	24	0%	0%	100%	0.0	0.0	24.0	0	0	0	0	0	0	0	0	0	0	2,496	1,174	193	431	59	160	3,840	80,847	3	2	81,708
	JAX	8	12	FFG	Guided Missile Frigate	0.5	4.0	100%	48	0%	0%	100%	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	3,207	3,251	375	555	156	68	3,264	68,720	2	2	69,452
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	40																																
Intelligence, Surveillance, & Reconnaissance Test	Northeast	0			Aircraft emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Amphibious Warfare																																		
Naval Surface Fire Support Exercise - Land Based Target (FIREX-Land)	Northeast	0	0	CG	Cruiser	1	9.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.42	9.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	30																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	30																																
Naval Surface Fire Support Exercise - At Sea (FIREX-at Sea)	Northeast	0	22	CG	Cruiser	1	9.0	100%	198	0%	0%	100%	0.0	0.0	198.0	0	0	0	0	0	0	0	0	0	0	21,340	9,330	1,746	4,162	521	158	31,284	658,653	21	19	665,668
	VACAPES	22	9	DDG	Guided Missile Destroyer	0.42	9.0	100%	83	0%	0%	100%	0.0	0.0	83.2	0	0	0	0	0	0	0	0	0	0	8,648	4,067	668	1,492	205	160	13,306	280,136	9	8	283,120
	Cherry Pt	2																																
	JAX	10																																
	Key West	0																																
	GOMEX	8																																
	Outside RCs	0																																
	Total	42																																
MEU Certification Exercise (CERTEX)	Northeast	0	0	LHA	Amphib. Assault Ship - Tarawa	1	6.0	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,119	0	0	0	0	0
	VACAPES	0	0	LHD	Large Helicopter-Dock Ships	1	2.5	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Cherry Pt	0	0	LPD	Amphibious Transport Dock - Wasp	1	2.5	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	933	0	0	0	0	0
	JAX	0	0	LCU	Landing Craft Utility	6	3.0	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0
	Key West	0	0	AAV/EFV	Amphibious Assault Vehicle	14	6.0	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0
	GOMEX	0	0	LCAC	Landing Craft Air Cushioned	5	3.0	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	523	0	0	0	0	0
	Outside RCs	0	0	CRRC	Combat Raiding Rubber Craft	0	6.0	100%	0	10%	30%	60%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
	Total	0																																
Amphibious Assault	Northeast	0	0	CRRC	Combat Raiding Rubber Craft	13	2.0	100%	0	100%	0%	0%	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
	VACAPES	0	0	LPD	Amphibious Transport Dock - Wasp	1	2.0	100%	0	100%	0%	0%	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Cherry Pt	10	0	LCU	Landing Craft Utility	2	2.0	100%	0	100%	0%	0%	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0
	JAX	0	0	LCAC	Landing Craft Air Cushioned	2	2.0	100%	0	100%	0%	0%	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	523	0	0	0	0	0
	Key West	0	0	AAV/EFV	Amphibious Assault Vehicle	6	2.0	100%	0	100%	0%	0%	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0
	GOMEX	0																																
	Outside RCs	0																																
	Total	10																																
Amphibious Raid / Humanitarian Assistance	Northeast	0	0	LHD	Large Helicopter-Dock Ships	2	8.0	100%	0	38%	38%	25%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	933	0	0	0	0	0
	VACAPES	0	0	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	0	38%	38%	25%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,119	0	0	0	0	0
	Cherry Pt	24	0	LPD	Amphibious Transport Dock - Wasp	3	8.0	100%	0	38%	38%	25%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	JAX	0	0	LCAC	Landing Craft Air Cushioned	4	8.0	100%	0	38%	38%	25%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	523	0	0	0	0	0
	Key West	0	0	LCU	Landing Craft Utility	4	8.0	100%	0	38%	38%	25%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0
	GOMEX	0																																
	Outside RCs	0																																
	Total	24																																
Strike Warfare																																		
High-speed Anti-Radiation (Air-to-Surface) (HARMEX [A-S])	Northeast	0			Aircraft emissions																													
	VACAPES	26																																
	Cherry Pt	8																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	34																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Anti-Surface Warfare																																		
Maritime Security Ops (MSO)	Northeast	0	34	CG	Cruiser	0.25	4.0	100%	136	0%	0%	100%	0.0	0.0	136.0	0	0	0	0	0	0	0	0	0	0	14,658	6,408	1,200	2,859	358	158	21,488	452,408	15	13	457,226
	VACAPES	136	69	DDG	Guided Missile Destroyer	0.51	4.0	100%	136	0%	0%	100%	0.0	0.0	136.0	0	0	0	0	0	0	0	0	0	0	14,143	6,650	1,092	2,440	335	160	21,760	458,135	15	13	463,014
	Cherry Pt	68	14	FFG	Guided Missile Frigate	0.1	4.0	100%	277	0%	0%	100%	0.0	0.0	277.4	0	0	0	0	0	0	0	0	0	0	18,539	18,788	2,167	3,210	902	68	18,866	397,203	13	11	401,433
	JAX	150	5	LPD	Amphibious Transport Dock - Wasp	0.04	4.0	100%	54	0%	0%	100%	0.0	0.0	54.4	0	0	0	0	0	0	0	0	0	0	100	592	75	1,782	358	320	17,408	366,508	12	10	370,411
	Key West	0	14	LSD	Landing Ship Dock	0.1	4.0	100%	22	0%	0%	100%	0.0	0.0	21.8	0	0	0	0	0	0	0	0	0	0	40	237	30	713	143	320	6,963	146,603	5	4	148,165
	GOMEX	54																																	
	Outside RCs	0																																	
	Total	408																																	
Maritime Security Ops - Anti-Swimmer Grenades	Northeast	0	9	CG	Cruiser	0.25	4.0	100%	36	0%	0%	100%	0.0	0.0	36.0	0	0	0	0	0	0	0	0	0	0	3,880	1,696	318	757	95	158	5,688	119,755	4	3	121,031
	VACAPES	36	18	DDG	Guided Missile Destroyer	0.51	4.0	100%	36	0%	0%	100%	0.0	0.0	36.0	0	0	0	0	0	0	0	0	0	0	3,744	1,760	289	646	89	160	5,760	121,271	4	3	122,563
	Cherry Pt	0	4	FFG	Guided Missile Frigate	0.1	4.0	100%	73	0%	0%	100%	0.0	0.0	73.4	0	0	0	0	0	0	0	0	0	0	4,907	4,973	574	850	239	68	4,994	105,142	3	3	106,262
	JAX	96	1	LPD	Amphibious Transport Dock - Wasp	0.04	4.0	100%	14	0%	0%	100%	0.0	0.0	14.4	0	0	0	0	0	0	0	0	0	0	27	157	20	472	95	320	4,608	97,017	3	3	98,050
	Key West	0	4	LSD	Landing Ship Dock	0.1	4.0	100%	6	0%	0%	100%	0.0	0.0	5.8	0	0	0	0	0	0	0	0	0	0	11	63	8	189	38	320	1,843	38,807	1	1	39,220
	GOMEX	8																																	
	Outside RCs	0																																	
	Total	140																																	
Gunnery Exercise, Surface-to-Surface, (Ship) Small-Caliber	Northeast	0	26	CG	Cruiser	0.22	2.5	100%	0	0%	28%	72%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	120	54	DDG	Guided Missile Destroyer	0.45	2.5	100%	66	0%	28%	72%	0.0	18.5	47.5	0	0	0	0	0	1,922	904	148	332	45	4,942	2,324	382	853	117	160	10,560	222,330	7	6	224,698
	Cherry Pt	82	18	FFG	Guided Missile Frigate	0.15	2.5	100%	135	0%	28%	72%	0.0	37.8	97.2	0	0	0	0	0	2,526	2,560	295	437	123	6,495	6,582	759	1,125	316	68	9,180	193,276	6	5	195,334
	JAX	44	1	LPD	Amphibious Transport Dock - Wasp	0.006	2.5	100%	45	0%	28%	72%	0.0	12.6	32.4	0	0	0	0	0	23	137	17	413	83	60	353	45	1,061	213	320	14,400	303,178	10	9	306,406
	Key West	0	0	LSD	Landing Ship Dock	0.003	2.5	100%	2	0%	28%	72%	0.0	0.5	1.3	0	0	0	0	0	1	5	1	17	3	2	14	2	42	9	320	576	12,127	0	0	12,256
	GOMEX	8	0	LHD	Large Helicopter-Dock Ships	0.003	2.5	100%	1	0%	28%	72%	0.0	0.3	0.6	0	0	0	0	0	1	9	1	26	5	4	23	3	68	14	320	288	6,064	0	0	6,128
	Outside RCs	0	14	PC	Patrol Coastal	0.12	2.5	100%	1	0%	28%	72%	0.0	0.3	0.6	0	0	0	0	0	4	10	1	2	0	11	25	2	5	1	90	81	1,705	0	0	1,724
	Total	254																																	
Gunnery Exercise, Surface-to-Surface, (Ship) Medium-Caliber	Northeast	0	26	CG	Cruiser	0.22	2.5	100%	0	0%	28%	72%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	120	54	DDG	Guided Missile Destroyer	0.45	2.5	100%	66	0%	28%	72%	0.0	18.5	47.5	0	0	0	0	0	1,922	904	148	332	45	4,942	2,324	382	853	117	160	10,560	222,330	7	6	224,698
	Cherry Pt	18	18	FFG	Guided Missile Frigate	0.15	2.5	100%	135	0%	28%	72%	0.0	37.8	97.2	0	0	0	0	0	2,526	2,560	295	437	123	6,495	6,582	759	1,125	316	68	9,180	193,276	6	5	195,334
	JAX	44	1	LPD	Amphibious Transport Dock - Wasp	0.006	2.5	100%	45	0%	28%	72%	0.0	12.6	32.4	0	0	0	0	0	23	137	17	413	83	60	353	45	1,061	213	320	14,400	303,178	10	9	306,406
	Key West	0	0	LSD	Landing Ship Dock	0.003	2.5	100%	2	0%	28%	72%	0.0	0.5	1.3	0	0	0	0	0	1	5	1	17	3	2	14	2	42	9	320	576	12,127	0	0	12,256
	GOMEX	16	0	LHD	Large Helicopter-dock Ships	0.003	2.5	100%	1	0%	28%	72%	0.0	0.3	0.6	0	0	0	0	0	1	9	1	26	5	4	23	3	68	14	320	288	6,064	0	0	6,128
	Outside RCs	0	14	PC	Patrol Coastal	0.12	2.5	100%	1	0%	28%	72%	0.0	0.3	0.6	0	0	0	0	0	4	10	1	2	0	11	25	2	5	1	90	81	1,705	0	0	1,724
	Total	198																																	
Gunnery Exercise, Surface-to-Surface, (Ship) Large-Caliber	Northeast	0	30	CG	Cruiser	0.22	2.5	100%	0	0%	28%	72%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	137	62	DDG	Guided Missile Destroyer	0.45	2.5	100%	75	0%	28%	72%	0.0	21.1	54.3	0	0	0	0	0	2,194	1,032	169	378	52	5,642	2,653	436	973	133	160	12,056	253,827	8	7	256,530
	Cherry Pt	34	21	FFG	Guided Missile Frigate	0.15	2.5	100%	154	0%	28%	72%	0.0	43.2	111.0	0	0	0	0	0	2,884	2,922	337	499	140	7,415	7,515	867	1,284	361	68	10,481	220,656	7	6	223,006
	JAX	99	1	LPD	Amphibious Transport Dock - Wasp	0.006	2.5	100%	51	0%	28%	72%	0.0	14.4	37.0	0	0	0	0	0	27	157	20	471	95	68	403	51	1,212	243	320	16,440	346,128	11	10	349,814
	Key West	0	0	LSD	Landing Ship Dock	0.003	2.5	100%	2	0%	28%	72%	0.0	0.6	1.5	0	0	0	0	0	1	6	1	19	4	3	16	2	48	10	320	658	13,845	0	0	13,993
	GOMEX	16	0	LHD	Large Helicopter-dock Ships	0.003	2.5	100%	1	0%	28%	72%	0.0	0.3	0.7	0	0	0	0	0	2	10	1	30	6	4	26	3	77	16	320	329	6,923	0	0	6,996
	Outside RCs	0	16	PC	Patrol Coastal	0.12	2.5	100%	1	0%	28%	72%	0.0	0.3	0.7	0	0	0	0	0	5	11	1	2	0	13	28	2	6	1	90	92	1,947	0	0	1,968
	Total	286																																	
Gunnery Exercise, Surface-to-Surface, (Boat) Small-Caliber	Northeast	0	36	BW	Boston Whaler	1	2.0	100%	0	25%	75%	0%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0
	VACAPES	36	36		Bayliner	1	2.0	100%	72	25%	75%	0%	18.0	54.0	0.0	0	5	473	0	0	0	14	1,420	0	0	0	0	0	0	0	9	648	13,643	0	0	13,788
	Cherry Pt	0																																	
	JAX	192																																	
	Key West	0																																	
	GOMEX	10																																	
	Outside RCs	0																																	
	Total	238																																	

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Gunnery Exercise, Surface-to-Surface, (Boat) Med Caliber	Northeast	0	36	BW	Boston Whaler	1	2.0	100%	0	25%	75%	0%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0
	VACAPES	36	36		Bayliner	1	2.0	100%	72	25%	75%	0%	18.0	54.0	0.0	0	5	473	0	0	0	14	1,420	0	0	0	0	0	0	0	9	648	13,643	0	0	13,788
	Cherry Pt	0																																		
	JAX	96																																		
	Key West	0																																		
	GOMEX	4																																		
	Outside RCs	0																																		
	Total	136																																		
Missile Exercise, Surface-to-Surface	Northeast	0	0	CG	Cruiser	0.5	11.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.5	11.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
Gunnery Exercise, Air-to-Surface, Small-Caliber	Northeast	0			Aircraft emissions																															
	VACAPES	522																																		
	Cherry Pt	120																																		
	JAX	168																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	810																																		
Gunnery Exercise, Air-to-Surface, Medium Caliber	Northeast	0			Aircraft emissions																															
	VACAPES	11																																		
	Cherry Pt	20																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	40																																		
	Outside RCs	0																																		
	Total	71																																		
Missile Exercise, Air-to-Surface, Rocket	Northeast	0			Aircraft emissions																															
	VACAPES	97																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	97																																		
Missile Exercise, Air-to-Surface	Northeast	0			Aircraft emissions																															
	VACAPES	80																																		
	Cherry Pt	16																																		
	JAX	73																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	169																																		
BOMBEX, Air-to-Surface	Northeast	0			Aircraft emissions																															
	VACAPES	266																																		
	Cherry Pt	88																																		
	JAX	155																																		
	Key West	0																																		
	GOMEX	49																																		
	Outside RCs	0																																		
	Total	558																																		
Laser Targeting	Northeast	0			Aircraft emissions																															
	VACAPES	272																																		
	Cherry Pt	0																																		
	JAX	303																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	575																																		
Sinking Exercise	Northeast	0	0	CG	Cruiser	1.00	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	2.00	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.00	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0	0	DD	Destroyer	2.00	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Key West	0	0	SSN	Submarines (No emissions)	1																														
	GOMEX	0																																		
	Outside RCs	6																																		
	Total	6																																		

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
High Energy Laser Weapons Test	Northeast	0	0	CG	Cruiser	0.5	11.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.5	11.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
Anti-Submarine Warfare																																				
TRACKEX/ TORPEX-Submarine	Northeast	30	10	TRB	Torpedo Retrieval Boats	1	3.6	100%	36	1%	10%	89%	0.4	3.6	32.0	2.8	11.9	0.2	1.2	0.4	27.5	119.1	2.1	12.2	4.2	245	1060	19	109	37	51	1,836	38,655	1	1	39,067
	VACAPES	10																																		
	Cherry Pt	14																																		
	JAX	45																																		
	Key West	0																																		
	GOMEX	1																																		
	Outside RCs	0																																		
	Total	100																																		
TRACKEX/ TORPEX-Surface	Northeast	0	15	CG	Cruiser	0.210526	3.6	100%	52	1%	10%	89%	0.5	5.2	46.5	56.4	24.6	4.6	11.0	1.4	563.6	246.4	46.1	109.9	13.8	5016	2193	411	978	122	158	8,263	173,960	6	5	175,813
	VACAPES	69	22	DDG	Guided Missile Destroyer	0.32	2.0	100%	44	1%	10%	89%	0.4	4.4	38.8	45.3	21.3	3.5	7.8	1.1	453.2	213.1	35.0	78.2	10.7	4033	1897	311	696	95	160	6,973	146,802	5	4	148,365
	Cherry Pt	91	11	FFG	Guided Missile Frigate	0.16	2.0	100%	22	1%	10%	89%	0.2	2.2	19.4	14.6	14.8	1.7	2.5	0.7	145.6	147.6	17.0	25.2	7.1	1296	1313	151	224	63	68	1,482	31,195	1	1	31,528
	JAX	292	22	TRB	Torpedo Retrieval Boats	0.315789	3.6	100%	78	1%	10%	89%	0.8	7.8	69.8	6.0	26.0	0.5	2.7	0.9	59.9	259.6	4.6	26.6	9.1	533	2310	41	237	81	51	4,001	84,228	3	2	85,125
	Key West	0																																		
	GOMEX	5																																		
	Outside RCs	0																																		
	Total	457																																		
TRACKEX/ TORPEX-Helicopter	Northeast	0	5	CG	Cruiser	0.2	3.6	100%	18	1%	10%	89%	0.2	1.8	16.0	19.4	8.5	1.6	3.8	0.5	194.0	84.8	15.9	37.8	4.7	1727	755	141	337	42	158	2,844	59,878	2	2	60,515
	VACAPES	25	13	DDG	Guided Missile Destroyer	0.5	3.6	100%	45	1%	10%	89%	0.5	4.5	40.1	46.8	22.0	3.6	8.1	1.1	468.0	220.1	36.1	80.7	11.1	4165	1958	322	718	99	160	7,200	151,589	5	4	153,203
	Cherry Pt	25	8	TRB	Torpedo Retrieval Boats	0.3	3.6	100%	27	1%	10%	89%	0.3	2.7	24.0	2.1	8.9	0.2	0.9	0.3	20.6	89.3	1.6	9.2	3.1	184	795	14	81	28	51	1,377	28,991	1	1	29,300
	JAX	115																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	165																																		
TRACKEX-MPA	Northeast	238	7	CG	Cruiser	0.086957	2	100%	14	5%	10%	85%	0.7	1.4	11.7	74.0	32.4	6.1	14.4	1.8	148.1	64.7	12.1	28.9	3.6	1259	550	103	245	31	158	2,171	45,704	1	1	46,190
	VACAPES	79	14	DDG	Guided Missile Destroyer	0.173913	2	100%	27	5%	10%	85%	1.4	2.7	23.4	142.9	67.2	11.0	24.6	3.4	285.7	134.4	22.1	49.3	6.8	2429	1142	188	419	57	160	4,397	92,564	3	3	93,550
	Cherry Pt	111	10	FFG	Guided Missile Frigate	0.130435	2	100%	21	5%	10%	85%	1.0	2.1	17.5	68.9	69.8	8.0	11.9	3.3	137.7	139.6	16.1	23.8	6.7	1171	1186	137	203	57	68	1,401	29,505	1	1	29,819
	JAX	356	48	TRB	Torpedo Retrieval Boats	0.608696	2	100%	96	5%	10%	85%	4.8	9.6	81.7	36.7	159.1	2.8	16.3	5.6	73.5	318.2	5.7	32.6	11.2	625	2705	48	277	95	51	4,905	103,267	3	3	104,367
	Key West	0																																		
	GOMEX	7																																		
	Outside RCs	0																																		
	Total	791																																		
TRACKEX/ TORPEX MPA-Sonobuoy	Northeast	34	3	CG	Cruiser	0.086957	2	100%	6	5%	10%	85%	0.3	0.6	5.0	31.9	13.9	2.6	6.2	0.8	63.7	27.9	5.2	12.4	1.6	542	237	44	106	13	158	934	19,670	1	1	19,879
	VACAPES	34	6	DDG	Guided Missile Destroyer	0.173913	2	100%	12	5%	10%	85%	0.6	1.2	10.1	61.5	28.9	4.7	10.6	1.5	123.0	57.8	9.5	21.2	2.9	1045	492	81	180	25	160	1,892	39,838	1	1	40,262
	Cherry Pt	34	4	FFG	Guided Missile Frigate	0.130435	2	100%	9	5%	10%	85%	0.4	0.9	7.5	29.6	30.0	3.5	5.1	1.4	59.3	60.1	6.9	10.3	2.9	504	511	59	87	25	68	603	12,698	0	0	12,834
	JAX	34	21	TRB	Torpedo Retrieval Boats	0.608696	2	100%	41	5%	10%	85%	2.1	4.1	35.2	15.8	68.5	1.2	7.0	2.4	31.6	137.0	2.4	14.0	4.8	269	1164	21	119	41	51	2,111	44,444	1	1	44,917
	Key West	0																																		
	GOMEX	34																																		
	Outside RCs	0																																		
	Total	170																																		
SEASWITI	Northeast	0	0	CG	Cruiser	1	60	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	1	60	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	1	60	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	JAX	4																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	4																																		

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Integrated Anti-Submarine Warfare Course	Northeast	0	0	CG	Cruiser	1	60	100%	12	0%	0%	100%	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1293	565	106	252	32	158	1,896	39,918	1	1	40,344
	VACAPES	0	0	DDG	Guided Missile Destroyer	1	60	100%	12	0%	0%	100%	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1248	587	96	215	30	160	1,920	40,424	1	1	40,854
	Cherry Pt	1	0	FFG	Guided Missile Frigate	1	60	100%	12	0%	0%	100%	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	802	813	94	139	39	68	816	17,180	1	0	17,363
	JAX	2																																	
	Key West	0																																	
	GOMEX	1																																	
	Outside RCs	0																																	
	Total	5																																	
Group Sail	Northeast	0	3	CG	Cruiser	1	60	100%	180	0%	0%	100%	0.0	0.0	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19400	8482	1588	3784	473	158	28,440	598,776	19	17	605,153
	VACAPES	3	3	DDG	Guided Missile Destroyer	1	60	100%	180	0%	0%	100%	0.0	0.0	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18718	8802	1445	3229	443	160	28,800	606,355	20	17	612,813
	Cherry Pt	4	3	FFG	Guided Missile Frigate	1	60	100%	180	0%	0%	100%	0.0	0.0	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12028	12190	1406	2083	585	68	12,240	257,701	8	7	260,445
	JAX	13																																	
	Key West	0																																	
	GOMEX	0																																	
	Outside RCs	0																																	
	Total	20																																	
Submarine Command Course Operations	Northeast	0		SSN	No emissions																														
	VACAPES	0																																	
	Cherry Pt	0																																	
	JAX	2																																	
	Key West	0																																	
	GOMEX	0																																	
	Outside RCs	0																																	
	Total	2																																	
ASW for Composite Training Unit Exercise (COMPTUEX)	Northeast	0			Conducted during COMPTUEX																														
	VACAPES	1																																	
	Cherry Pt	1																																	
	JAX	1																																	
	Key West	0																																	
	GOMEX	1																																	
	Outside RCs	0																																	
	Total	5																																	
ASW for Joint Task Force Exercise (JTFEX) Sustainment Exercise (SUSTAINEX)	Northeast	0			Conducted during JTFEX																														
	VACAPES	1																																	
	Cherry Pt	1																																	
	JAX	1																																	
	Key West	0																																	
	GOMEX	0																																	
	Outside RCs	0																																	
	Total	2																																	
Electronic Warfare																																			
Electronic Warfare Operations	Northeast	0	60	CG	Cruiser	0.2	6.5	100%	393	0%	3%	97%	0.0	11.8	380.8	0.0	0.0	0.0	0.0	0.0	1269.4	555.0	103.9	247.6	31.0	41045	17944	3359	8005	1002	158	62,031	1,305,996	42	37	1,319,905
	VACAPES	302	42	DDG	Guided Missile Destroyer	0.14	6.5	100%	275	0%	3%	97%	0.0	8.2	266.6	0.0	0.0	0.0	0.0	0.0	857.4	403.2	66.2	147.9	20.3	27721	13036	2141	4782	656	160	43,971	925,770	30	26	935,629
	Cherry Pt	2,620	36	FFG	Guided Missile Frigate	0.12	6.5	100%	236	0%	3%	97%	0.0	7.1	228.5	0.0	0.0	0.0	0.0	0.0	472.2	478.6	55.2	81.8	23.0	15268	15474	1785	2644	743	68	16,018	337,245	11	10	340,836
	JAX	181																																	
	Key West	0																																	
	GOMEX	0																																	
	Outside RCs	0																																	
	Total	3,103																																	
Flare Exercise	Northeast	0			Aircraft emissions																														
	VACAPES	80																																	
	Cherry Pt	107																																	
	JAX	94																																	
	Key West	900																																	
	GOMEX	368																																	
	Outside RCs	0																																	
	Total	1,549																																	
Chaff Exercise - Ship	Northeast	0	21	CG	Cruiser	0.75	2.75	100%	58	0%	3%	97%	0.0	1.7	56.0	0.0	0.0	0.0	0.0	0.0	186.7	81.6	15.3	36.4	4.6	6038	2640	494	1177	147	158	9,125	192,107	6	5	194,153
	VACAPES	28	7	DDG	Guided Missile Destroyer	0.25	2.75	100%	19	0%	3%	97%	0.0	0.6	18.7	0.0	0.0	0.0	0.0	0.0	60.1	28.2	4.6	10.4	1.4	1942	913	150	335	46	160	3,080	64,846	2	2	65,537
	Cherry Pt	74																																	
	JAX	74																																	
	Key West	0																																	
	GOMEX	14																																	
	Outside RCs	0																																	
	Total	190																																	

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

OPERATIONAL INFORMATION - VESSELS															EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Chaff Exercise - Aircraft	Northeast	0			Aircraft emissions																													
	VACAPES	1,981																																
	Cherry Pt	572																																
	JAX	424																																
	Key West	3,000																																
	GOMEX	368																																
	Outside RCs	0																																
	Total	6,345																																
Mine Warfare																																		
Mine Countermeasure Exercise - Ship Sonar	Northeast	0	0	CG	Cruiser	0.2	1.5	100%	0	0%	62%	38%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.14	1.5	100%	0	0%	62%	38%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.12	1.5	100%	0	0%	62%	38%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Mine Neutralization - EOD	Northeast	0	72	RHIB	Rigid Hulled	3	12	100%	864	100%	0%	0%	864.0	0.0	0.0	34.6	1373.8	8.6	146.9	17.3	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	12	10,368	218,288	7	6	220,613
	VACAPES	24																																
	Cherry Pt	20																																
	JAX	12																																
	Key West	0																																
	GOMEX	12																																
	Outside RCs	0																																
	Total	68																																
Underwater Mine Countermeasure (UMCM) Raise, Tow, Beach, and Exploitation Operations	Northeast	0	0	RHIB	Rigid Hulled	3	12	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	12	0	0	0	0	0
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Airborne Mine Countermeasures (AMCM) Towed Mine Neutralization	Northeast	0			Aircraft emissions																													
	VACAPES	980																																
	Cherry Pt	183																																
	JAX	134																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	1,297																																
Airborne Mine Countermeasures (AMCM) - Mine Detection	Northeast	0			Aircraft emissions																													
	VACAPES	1,232																																
	Cherry Pt	393																																
	JAX	322																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	1,947																																
Mine Countermeasures (MCM) - Mine Neutralization Small- and Medium-Caliber	Northeast	0			Aircraft emissions																													
	VACAPES	110																																
	Cherry Pt	27																																
	JAX	27																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	164																																
Mine Countermeasures - Mine Neutralization - ROV	Northeast	0	210	RHIB	Rigid Hulled Inflatable Boat	1	12	100%	2,520	100%	0%	0%	2520.0	0.0	0.0	100.8	4006.8	25.2	428.4	50.4	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	12	30,240	636,673	21	18	643,454
	VACAPES	210																																
	Cherry Pt	27																																
	JAX	27																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	264																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2}-e
Mine Laying	Northeast	0			Aircraft emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Coordinated Unit Level Helicopter AMCM Exercises	Northeast	0			Aircraft emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Major Training Events																																		
Composite Training Unit Exercise (COMPTUEX)	Northeast	0	1	CVN	Nuclear Carrier (No emissions)	1	120.0	100%	0	0%	0%	100%	0.0	0.0	0.0																			
	VACAPES	1	3	CG	Cruiser	2	120.0	100%	300	0%	0%	100%	0.0	0.0	300.0	0	0	0	0	0	0	0	0	0	0	32,334	14,136	2,646	6,306	789	158	47,400	997,960	32	28	1,008,588
	Cherry Pt	1	3	DDG	Guided Missile Destroyer	2	120.0	100%	300	0%	0%	100%	0.0	0.0	300.0	0	0	0	0	0	0	0	0	0	0	31,197	14,670	2,409	5,382	738	160	48,000	1,010,592	33	29	1,021,355
	JAX	1	1	FFG	Guided Missile Frigate	1	120.0	100%	150	0%	0%	100%	0.0	0.0	150.0	0	0	0	0	0	0	0	0	0	0	10,023	10,158	1,172	1,736	488	68	10,200	214,751	7	6	217,038
	Key West	0	1	AOE	Logistics/Support	1	120.0	100%	150	0%	0%	100%	0.0	0.0	150.0	0	0	0	0	0	0	0	0	0	0	560	3,299	419	9,921	1,992	1,599	239,850	5,049,802	164	143	5,103,582
	GOMEX	1																																
	Outside RCs	0																																
	Total	5																																
Joint Task Force Exercise (JTFEX) /Sustainment Exercise (SUSTAINEX)	Northeast	0	1	CVN	Nuclear Carrier (No emissions)	1	120.0	100%	0	0%	0%	100%	0.0	0.0	0.0																			
	VACAPES	1	2	CG	Cruiser	3	120.0	100%	238	0%	0%	100%	0.0	0.0	237.6	0	0	0	0	0	0	0	0	0	0	25,609	11,196	2,096	4,994	625	158	37,541	790,384	26	22	798,802
	Cherry Pt	1	2	DDG	Guided Missile Destroyer	3	120.0	100%	238	0%	0%	100%	0.0	0.0	237.6	0	0	0	0	0	0	0	0	0	0	24,708	11,619	1,908	4,263	584	160	38,016	800,389	26	23	808,913
	JAX	1	1	FFG	Guided Missile Frigate	1	120.0	100%	79	0%	0%	100%	0.0	0.0	79.2	0	0	0	0	0	0	0	0	0	0	5,292	5,363	619	916	257	68	5,386	113,388	4	3	114,596
	Key West	0	1	AOE	Logistics/Support	1	120.0	100%	79	0%	0%	100%	0.0	0.0	79.2	0	0	0	0	0	0	0	0	0	0	295	1,742	221	5,238	1,052	1,599	126,641	2,666,295	86	75	2,694,691
	GOMEX	0																																
	Outside RCs	0																																
	Total	2																																
Other Training																																		
Search and Rescue (SAR)	Northeast	0			Aircraft emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	42																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	42																																
Precision Anchoring	Northeast	0	0	CG	Cruiser	0.33	3	100%	0	0%	50%	50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.33	3	100%	0	0%	50%	50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.33	3	100%	0	0%	50%	50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	JAX	168																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	168																																
Elevated Causeway System (ELCAS)	Northeast	0	0	LCU		2	4	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Submarine Navigational (SUBNAV)	Northeast	165		SSN	No emissions																													
	VACAPES	78																																
	Cherry Pt	0																																
	JAX	57																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	300																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS														EMISSIONS/YEAR (lb.) BY JURISDICTION																
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2}-e
Submarine Under Ice Certification	Northeast	0		SSN	No emissions																												
	VACAPES	0																															
	Cherry Pt	0																															
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	0																															
Surface Ship Object Detection	Northeast	0	22	CG	Cruiser	0.33	4	100%	90	0%	50%	50%	0.0	44.9	44.9	0.0	0.0	0.0	0.0	0.0	4837.2	2114.7	395.8	943.4	118.0	4837	2115	396	943	118	158	14,182	298,590	10	8	301,769
	VACAPES	68	22	DDG	Guided Missile Destroyer	0.33	4	100%	90	0%	50%	50%	0.0	44.9	44.9	0.0	0.0	0.0	0.0	0.0	4667.1	2194.6	360.4	805.1	110.4	4667	2195	360	805	110	160	14,362	302,369	10	9	305,589
	Cherry Pt	0	22	FFG	Guided Missile Frigate	0.33	4	100%	90	0%	50%	50%	0.0	44.9	44.9	0.0	0.0	0.0	0.0	0.0	2998.9	3039.3	350.5	519.3	145.9	2999	3039	351	519	146	68	6,104	128,507	4	4	129,875
	JAX	40																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	108																															
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	Northeast	0	20	CG	Cruiser	0.33	4	100%	81	0%	50%	50%	0.0	40.3	40.3	0.0	0.0	0.0	0.0	0.0	4339.2	1897.1	355.1	846.3	105.9	4339	1897	355	846	106	158	12,722	267,852	9	8	270,705
	VACAPES	61	20	DDG	Guided Missile Destroyer	0.33	4	100%	81	0%	50%	50%	0.0	40.3	40.3	0.0	0.0	0.0	0.0	0.0	4186.6	1968.7	323.3	722.3	99.0	4187	1969	323	722	99	160	12,883	271,243	9	8	274,132
	Cherry Pt	82	20	FFG	Guided Missile Frigate	0.33	4	100%	81	0%	50%	50%	0.0	40.3	40.3	0.0	0.0	0.0	0.0	0.0	2690.2	2726.4	314.4	465.8	130.8	2690	2726	314	466	131	68	5,475	115,278	4	3	116,506
	JAX	263																															
	Key West	0																															
	GOMEX	4																															
	Outside RCs	0																															
	Total	410																															
Submarine Sonar Maintenance (in OPAREAs and Ports)	Northeast	66		SSN	No emissions																												
	VACAPES	34																															
	Cherry Pt	0																															
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	100																															
Civilian Port Defense	Northeast	0	0	BW	Boston Whaler	1	2.0	100%	0	75%	25%	0%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0
	VACAPES	0	0		Bayliner	1	2.0	100%	0	75%	25%	0%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
	Cherry Pt	0																															
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	0																															
Testing - New Ship Construction																																	
Surface Combatant Sea Trials-Propulsion Testing	Northeast	0	0	CG	Cruiser	0.33	16	100%	0	0%	15%	85%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.33	16	100%	0	0%	15%	85%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.33	16	100%	0	0%	15%	85%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	0																															
Aicraft Carrier Sea Trials	Northeast	0		CVN	no emissions																												
	VACAPES	0																															
	Cherry Pt	0																															
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	0																															
Sea Basing Ship Sea Trial	Northeast	0	0	AOE	Logistics/Support	1	40.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,599	0	0	0	0	0
	VACAPES	0																															
	Cherry Pt	0																															
	JAX	0																															
	Key West	0																															
	GOMEX	0																															
	Outside RCs	0																															
	Total	0																															

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS														EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Amphibious Ship Sea Trial	Northeast	0	0	LPD	Amphibious Transport Dock - Wasp	0.33	40.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	VACAPES	0	0	LSD	Landing Ship Dock	0.33	40.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Cherry Pt	0	0	LHD	Large Helicopter-Dock Ships	0.33	40.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
Submarine Sea Trial	Northeast	0		SSN	No emissions																															
	VACAPES	0																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
Other Class Ship Sea Trials	Northeast	0	0	CG	Cruiser	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	GOMEX	0	0	LHD	Large Helicopter-Dock Ships	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Outside RCs	0	0	PC	Patrol Coastal	0.1429	16.0	100%	0	0%	15%	85%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0
	Total	0																																		
LCS Sea Trials and Mission Package Testing	Northeast	0	0	FFG	Guided Missile Frigate	1	40	100%	0	0.0	15%	85%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	VACAPES	0																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
Post-Homeporting Test (all Classes)	Northeast	0	0	CG	Cruiser	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	GOMEX	0	0	LHD	Large Helicopter-Dock Ships	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Outside RCs	0	0	PC	Patrol Coastal	0.1429	16.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0
	Total	0																																		
Testing - Shock Trials																																				
Aircraft Carrier Full Ship Shock Trial	Northeast	0		CVN	No emissions																															
	VACAPES	0																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial	Northeast	0	0	DDG	Guided Missile Destroyer	1	24	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	VACAPES	0																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

OPERATIONAL INFORMATION - VESSELS															EMISSIONS/YEAR (lb.) BY JURISDICTION																		
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Littoral Combat Ship Full Ship Shock Trial	Northeast	0	0	FFG	Guided Missile Frigate	1	24	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0	0
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Testing - Lifecycle Activities																																					
Ship Signature Test	Northeast	0	0	CG	Cruiser	0.33	16	100%	0	50%	50%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.33	16	100%	0	50%	50%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.33	16	100%	0	50%	50%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0	0
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Shipboard Protection Systems and																																					
Shipboard Protection Systems Testing	Northeast	0	0	CG	Cruiser	0.2	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.2	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.2	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.2	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.2	2.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Chemical/ Biological Simulant Testing	Northeast	0	0	CG	Cruiser	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Unmanned Vehicle Testing																																					
Underwater Deployed UAV Testing	Northeast	0		SSN	No emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Unmanned Vehicle Development and Payload Testing	Northeast	0	0	TRB	Torpedo Retrieval Boats	1	8	100%	0	75%	25%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	51	0	0	0	0	0	0
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Other Testing																																					
Test and Evaluation Catapult Launch	Northeast	0		CVN	no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS														EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Air Platform Shipboard Integrate Test	Northeast	0		CVN	no emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Shipboard Electronic Systems Evaluation	Northeast	0	0	CG	Cruiser	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.2	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Maritime Security	Northeast	0	0	CG	Cruiser	0.25	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.51	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.1	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0	0	LPD	Amphibious Transport Dock - Wasp	0.04	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	Key West	0	0	LSD	Landing Ship Dock	0.1	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Countermeasure Testing: Acoustic System Testing	Northeast	0	0	CG	Cruiser	0.33	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0	0	0	0
	VACAPES	0	0	DDG	Guided Missile Destroyer	0.33	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0
	Cherry Pt	0	0	FFG	Guided Missile Frigate	0.33	4.0	100%	0	0%	0%	100%	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Special Warfare Testing	Northeast	0	0	RHIB	Rigid Hulled Inflatable Boat	2	6	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	12	0	0	0	0	0
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Radio-Frequency Testing	Northeast	0	0	TRB	Torpedo Retrieval Boats	1	8	100%	0	75%	25%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	51	0	0	0	0	0
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Hydrodynamic Testing	Northeast	0		SSN	no emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
At-Sea Explosives Testing	Northeast	0	0	TRB	Torpedo Retrieval Boats	1	8	100%	0	0%	0%	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	51	0	0	0	0	0
	VACAPES	0																																		
	Cherry Pt	0																																		
	JAX	0																																		
	Key West	0																																		
	GOMEX	0																																		
	Outside RCs	0																																		
	Total	0																																		
RANGE COMPLEX TOTAL (lb)																789.91	5,997.73	1,036.51	709.54	94.24	43,486.89	29,222.16	6,880.16	9,251.92	1,711.18	530,729.98	318,031.61	47,512.48	134,045.11	23,045.77		1,677,480.09	35,317,665.89	1,145.72	998.10	35,693,798.86
RANGE COMPLEX TOTAL (TPY)																0.39	3.00	0.52	0.35	0.05	21.74	14.61	3.44	4.63	0.86	265.36	159.02	23.76	67.02	11.52		838.74	17,658.83	0.57	0.50	17,846.90
Testing: NSWC Panama City Division (GOMEX Range Complex)																																				
AUV Demo		0																																		
		0																																		
Mine Detect		0																																		
		0																																		
MCM Testing		0																																		
		0																																		
Stationary Test		0																																		
		0																																		
Spec War Test		0	0	RHIB	Rigid Hulled Inflatable Boat	0	6	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	12	0	0	0	0	0
		0		SDV	No emissions																															
UUV Test		0																																		
		0																																		
Ord Test		0																																		
		0																																		
CM Test		0																																		
		0																																		
Total		0																																		
Testing: NUWC Division Newport, RI																																				
Launcher Test		0																																		
		0																																		
Torpedo Test		0																																		
		0																																		
Towed Equip Test		0																																		
		0																																		
UUV Test		0																																		
		0																																		
USV Test		0																																		
		0																																		
UAV Test		0																																		
		0																																		
Semi-Stationary Equip Test		0																																		
		0																																		
AUV Demo		0																																		
		0																																		
Pierside Int Swimmer Defense		0																																		
		0																																		
Total	Total	0																																		

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

			OPERATIONAL INFORMATION - VESSELS													EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
South Florida Ocean Measurement Facility Testing																																		
Signature Analysis Ops		0																																
		0																																
Mine RDT&E		0																																
		0																																
Surface Testing		0																																
		0																																
Subsurface Testing		0																																
		0																																
UUV Demos		0																																
		0																																
Total		0																																
Pierside Events																																		
Surface Combatant Sea Trials: Pierside Sonar Testing	Pierside, Bath ME	0	0	CG	Cruiser	0.33	4	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	Pierside, Groton CT	0	0	DDG	Guided Missile Destroyer	0.33	4	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Pierside , RI	0	0	FFG	Guided Missile Frigate	0.33	4	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	Pierside, Norfolk Little Creek or Newport News	0																																
	Pierside Kings Bay GA	0																																
	Pierside, Mayport FL	0																																
	Pierside, Port Canaveral FL	0																																
	Pierside, Pascagoula MS	0																																
	Total	0																																
Submarine Sea Trials- Pierside Sonar Testing	Pierside, Bath ME	0		SSN	No emissions																													
	Pierside, Groton CT	0																																
	Pierside , RI	0																																
	Pierside, Norfolk Little Creek or Newport News	0																																
	Pierside Kings Bay GA	0																																
	Pierside, Mayport FL	0																																
	Pierside, Port Canaveral FL	0																																
	Pierside, Pascagoula MS	0																																
	Total	0																																

Table D-2: Virginia Capes Range Complex - Training Related - Vessel Air Emissions—No-Action Alternative (Continued)

OPERATIONAL INFORMATION - VESSELS															EMISSIONS/YEAR (lb.) BY JURISDICTION																	
			Ship / Vessel / Boat				Range Time (hr.)			Distribution (%)			Distribution (hr.)			State (0-3 nm offshore)					Waters of U.S. (3-12 nm)					International Waters (> 12 nm)						Greenhouse Gas Emissions				
Training or Testing Event	Location	Annual Operations (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	CO	NO_x	VOC	SO_x	PM	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Pierside Integrated Swimmer Defense	Pierside, Bath ME	0	0	CG	Cruiser	0.33	3	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	158	0	0	0	0	0
	Pierside, Groton CT	0	0	DDG	Guided Missile Destroyer	0.33	3	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	160	0	0	0	0	0
	Pierside , RI	0	0	FFG	Guided Missile Frigate	0.33	3	100%	0	100%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	68	0	0	0	0	0
	Pierside, Norfolk Little Creek or Newport News	0																																	
	Pierside Kings Bay GA	0																																	
	Pierside, Mayport FL	0																																	
	Pierside, Port Canaveral FL	0																																	
	Pierside, Pascagoula MS	0																																	
	Total	0																																	

AAV: amphibious assault vehicle; AFTT: Atlantic Fleet Training and Testing; AOE: fast combat support ship; ASW: anti-submarine warfare; AUV: autonomous underwater vehicle; BOMBEX: bombing exercise; BW: boston whaler; CG: cruiser; CH4: methane; Cherry Pt: Navy Cherry Point Range Complex; CM: countermeasures; CO: carbon monoxide; CO2: carbon dioxide; CO2e: carbon dioxide equivalent; CVN: aircraft carrier; DDG: destroyer; EFV: expeditionary fighting vehicle; EOD: explosive ordnance disposal; FFG: frigate; gal: gallon; GHG: greenhouse gas; GOMEX: Gulf of Mexico Range Complex; GPH: gallons per hour; hr: hour; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; lb: pound; LCAC: landing craft air cushion; LCU: landing craft utility; LHA: amphibious assault ship; LHD: landing helicopter dock; LPD: landing platform dock; LSD: landing ship dock; MCM: mine countermeasures; MPA: maritime patrol aircraft; N2O: nitrous oxide; nm: nautical mile; Northeast: Northeast Range Complexes; NOx: nitrogen oxides; NSWC: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; Ord: ordnance; Outside RCs: Other AFTT Areas; PC: patrol coastal; PM: particulate matter; RDT&E: research, development, test, and evaluation; RHIB: rigid hull inflatable boat; ROV: remotely operated vehicle; SDV: SEAL delivery vehicle; SEASWITI: southeast anti-submarine warfare integration training initiative; SFOMF: South Florida Ocean Measurement Facility; SOx: sulfur oxides; SSN: nuclear powered fast attack submarine; TORPEX: torpedo exercise; TRACKEX: tracking exercise; TRB: torpedo retrieval boat; UAV: unmanned aerial vehicle; USV: unmanned surface vehicle; UUV: unmanned undersea vehicle; VACAPES: Virginia Capes Range Complex; VOC: volatile organic compounds

NOTES: A standardized calculation worksheet was developed for all training and testing locations; for each alternative; and for each training and testing activity listed in Chapter 2 (Description of Proposed Action and Alternatives). Emissions estimates for the VACAPES Range Complex example are based on the VACAPES Range Complex activities (Annual Operations #) presented in Column C. Applied emission factors not shown.

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative

			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from Shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Anti-Air Warfare																																					
Air Combat Maneuver	Northeast	0	1.75	4,060	FA-18E/F	1.0	4,060	0%	0.0	4%	11%	85%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41,972,280	5,996,040	126,240,626	4,095	3568	127,585,088
	VACAPES	2,320	0.25	580	AV-8B	1.0	580	0%	0.0	4%	11%	85%	0.00	0.00	0.00	1	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,480,000	497,143	10,466,846	340	296	10,578,318
	Cherry Pt	385																																			
	JAX	498																																			
	Key West	5,700																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	8,903																																			
Air Defense Exercise	Northeast	0	0.14	83	E-2	1.0	83	50%	41.7	0%	0%	100%	0.00	0.00	41.65	2	1,100	0	0	0	0	0	0	0	0	0	0	198	739	45	37	364	183,260	26,180	551,194	18	16	557,064
	VACAPES	595	0.86	512	FA-18E/F	1.0	512	50%	255.9	0%	0%	100%	0.00	0.00	255.85	2	5,169	0	0	0	0	0	0	0	0	0	0	1,904	39,013	317	1,058	17,351	5,289,955	755,708	15,910,672	516	450	16,080,121
	Cherry Pt	21																																			
	JAX	117																																			
	Key West	0																																			
	GOMEX	80																																			
	Outside RCs	0																																			
	Total	813																																			
Gunnery Exercise, Air-to-Air (Medium-Caliber)	Northeast	0	1.75	53	FA-18E/F	1.0	53	0%	0.0	4%	11%	85%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	542,745	77,535	1,632,422	53	46	1,649,807
	VACAPES	30	0.25	8	AV-8B	1.0	8	0%	0.0	4%	11%	85%	0.00	0.00	0.00	1	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45,000	6,429	135,347	4	4	136,789
	Cherry Pt	10																																			
	JAX	23																																			
	Key West	36																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	99																																			
Missile Exercise, Air-to-Air	Northeast	0	0.33	53	FA-18A/C	2.0	106	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700,762	100,109	2,107,691	68	60	2,130,138
	VACAPES	160	0.5	80	FA-18E/F	2.0	160	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,654,080	236,297	4,975,000	161	141	5,027,984
	Cherry Pt	20	0.09	14	E-2C	4.0	58	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	1,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	126,720	18,103	381,138	12	11	385,197
	JAX	22	0	0	EA-18G	2.0	0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0	0.08	13	DC-130	4.0	51	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	230,400	32,914	692,977	22	20	700,358
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	202																																			
Gunnery Exercise, Surface-to-Air (Large-Caliber)	Northeast	0	0.58	10	Learjet	3.0	31	50%	15.7	0%	0%	100%	0.00	0.00	15.66	2	532	0	0	0	0	0	0	0	0	0	0	373	98	71	7	21	33,324	4,761	100,231	3	3	101,298
	VACAPES	18																																			
	Cherry Pt	0																																			
	JAX	13																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	31																																			
Gunnery Exercise, Surface-to-Air (Medium-Caliber)	Northeast	0	0.58	17	Learjet	3.0	52	50%	26.1	0%	0%	100%	0.00	0.00	26.10	2	532	0	0	0	0	0	0	0	0	0	0	622	164	118	11	35	55,541	7,934	167,051	5	5	168830
	VACAPES	30																																			
	Cherry Pt	0																																			
	JAX	11																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	41																																			
Missile Exercise, Surface-to-Air	Northeast	0	0.33	8	SH-60B	3.0	24	100%	23.8	0%	0%	100%	0.00	0.00	23.76	2	600	0	0	0	0	0	0	0	0	0	0	178	182	16	11	120	28,512	4,073	85,756	3	2	86,669
	VACAPES	24	0.33	8	P-3	3.0	24	67%	15.8	0%	0%	100%	0.00	0.00	15.85	4	1,200	0	0	0	0	0	0	0	0	0	0	138	641	31	30	302	114,048	16,293	343,024	11	10	346,677
	Cherry Pt	8	0.33	8	Learjet	3.0	24	67%	15.8	0%	0%	100%	0.00	0.00	15.85	2	532	0	0	0	0	0	0	0	0	0	0	377	99	72	7	21	25,281	3,612	76,037	2	2	76,847
	JAX	8	0	0	C-130	3.0	0	67%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0																														37	323		19,904	419,061			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	40																																			
Intelligence, Surveillance, & Reconnaissance Test	Northeast	0	1	0	P-3c	6.0	6	60%		0%	0%	100%	0.00	0.00	3.60	4	1,200	0	0	0	0	0	0	0	0	0	0	31	146	7	7	69	28,800	4,114	86,622	3	2	87,545
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Amphibious Warfare																																					
Naval Surface Fire Support Exercise - Land based target (FIREX-Land)	Northeast	0			Vessel emisisons																																
	VACAPES	0																																			
	Cherry Pt	30																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	30																																			
Naval Surface Fire Support Exercise - at sea (FIREX-at sea)	Northeast	0			Vessel emisisons																																
	VACAPES	22																																			
	Cherry Pt	2																																			
	JAX	10																																			
	Key West	0																																			
	GOMEX	8																																			
	Outside RCs	0																																			
	Total	42																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

TRAINING OPS INFORMATION - AIRCRAFT																Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
MEU Certification Exercise (CERTEX)	Northeast	0	0.34	0	FA-18A/C	0.5	0	15%	0.0	20%	50%	30%	0.00	0.00	0.00	2	3,318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0	0	FA-18E/F	0.5	0	15%	0.0	20%	50%	30%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0	0.13	0	AV-8B	0.5	0	25%	0.0	90%	5%	5%	0.00	0.00	0.00	1	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	0	0.09	0	AH-1	1.0	0	100%	0.0	90%	5%	5%	0.00	0.00	0.00	2	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0	0.04	0	C-130	1.4	0	0%	0.0	20%	50%	30%	0.00	0.00	0.00	4	1,125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	0	0.09	0	H-53	1.5	0	100%	0.0	90%	5%	5%	0.00	0.00	0.00	3	1,488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Outside RCs	0	0.26	0	H-46	1.5	0	100%	0.0	90%	5%	5%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0.06	0	UH-1	1.0	0	100%	0.0	90%	5%	5%	0.00	0.00	0.00	2	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amphibious Assault	Northeast	0	0.33	0	AH-1	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.22	0	CH-46	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	10	0.12	0	CH-53	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	3	1,488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	0	0.14	0	AV-8B	3.0	0	100%	0.0	0%	100%	0%	0.00	0.00	0.00	1	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0	0.19	0	UH-1	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	10																																			
Amphibious Raid / Humanitarian Assistance	Northeast	0	0.33	0	AH-1	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.22	0	CH-46	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	24	0.12	0	CH-53	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	3	1,488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	0	0.14	0	AV-8B	3.0	0	100%	0.0	0%	100%	0%	0.00	0.00	0.00	1	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0	0.19	0	UH-1	3.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	24																																			
Strike Warfare																																					
High-speed Anti-Radiation (Air-to-Surface) (HARMEX [A-S])	Northeast	0	1	26	FA-18E/F	6.6	172	50%	85.8	0%	0%	100%	0.00	0.00	85.80	2	5,169	0	0	0	0	0	0	0	0	0	0	639	13,083	106	355	5,819	1,774,001	253,429	5,335,688	173	151	5,392,513
	VACAPES	26																																			
	Cherry Pt	8																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	34																																			
Anti-Surface Warfare																																					
Maritime Security Ops (MSO)	Northeast	0	0.74	101	SH-60B	4.0	403	100%	402.6	0%	0%	100%	0.00	0.00	402.56	2	600	0	0	0	0	0	0	0	0	0	0	3,019	3,092	266	193	2,029	483,072	69,010	1,452,943	47	41	1,468,416
	VACAPES	136	0.25	34	SH-60F	4.0	136	100%	136.0	0%	0%	100%	0.00	0.00	136.00	2	600	0	0	0	0	0	0	0	0	0	0	1,020	1,044	90	65	685	163,200	23,314	490,859	16	14	496,087
	Cherry Pt	68																																			
	JAX	150																																			
	Key West	0																																			
	GOMEX	54																																			
	Outside RCs	0																																			
	Total	408																																			
Maritime Security Ops - Anti-Swimmer Grenades	Northeast	0	0.74	27	SH-60B	4.0	107	100%	106.6	0%	0%	100%	0.00	0.00	106.56	2	600	0	0	0	0	0	0	0	0	0	0	799	818	70	51	537	127,872	18,267	384,602	12	11	388,698
	VACAPES	36	0.25	9	SH-60F	4.0	36	100%	36.0	0%	0%	100%	0.00	0.00	36.00	2	600	0	0	0	0	0	0	0	0	0	0	270	276	24	17	181	43,200	6,171	129,933	4	4	131,317
	Cherry Pt	0																																			
	JAX	96																																			
	Key West	0																																			
	GOMEX	8																																			
	Outside RCs	0																																			
	Total	140																																			
Gunnery Exercise, Surface-to-Surface, (Ship) Small-Caliber	Northeast	0			vessel emissions																																
	VACAPES	120																																			
	Cherry Pt	82																																			
	JAX	44																																			
	Key West	0																																			
	GOMEX	8																																			
	Outside RCs	0																																			
	Total	254																																			
Gunnery Exercise, Surface-to-Surface, (Ship) Medium-Caliber	Northeast	0			vessel emissions																																
	VACAPES	120																																			
	Cherry Pt	18																																			
	JAX	44																																			
	Key West	0																																			
	GOMEX	16																																			
	Outside RCs	0																																			
	Total	198																																			
Gunnery Exercise, Surface-to-Surface, (Ship) Large-Caliber	Northeast	0			vessel emissions																																
	VACAPES	137																																			
	Cherry Pt	34																																			
	JAX	99																																			
	Key West	0																																			
	GOMEX	16																																			
	Outside RCs	0																																			
	Total	286																																			
Gunnery Exercise, Surface-to-Surface, (Boat) Small-Caliber	Northeast	0			vessel emissions																																
	VACAPES	36																																			
	Cherry Pt	0																																			
	JAX	192																																			
	Key West	0																																			
	GOMEX	10																																			
	Outside RCs	0																																			
	Total	238																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

		TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																		
			Aircraft			Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Gunnery Exercise, Surface-to-Surface, (Boat) Medium-Caliber	Northeast	0			vessel emissions																													
	VACAPES	36																																
	Cherry Pt	0																																
	JAX	96																																
	Key West	0																																
	GOMEX	4																																
	Outside RCs	0																																
	Total	136																																
Missile Exercise, Surface-to-Surface	Northeast	0			vessel emissions																													
	VACAPES	0																																
	Cherry Pt	0																																
	JAX	0																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Gunnery Exercise, Air-to-Surface, Small-Caliber	Northeast	0	0.74	386	SH-60B	1.0	386	100%	386.3	0%	50%	50%	0.00	193.14	193.14	2	600	0	0	0	0	0	1207	1236	106	77	811	1,449	1,483	127	93	973	463,536	66,219	1,394,184	45	39	1,409,032
	VACAPES	522	0.25	131	SH-60F	1.0	131	100%	130.5	0%	50%	50%	0.00	65.25	65.25	2	600	0	0	0	0	0	408	418	36	26	274	489	501	43	31	329	156,600	22,371	471,008	15	13	476,024
	Cherry Pt	120	0.01	5	MH-60R/S	1.0	5	100%	5.2	0%	50%	50%	0.00	2.61	2.61	2	600	0	0	0	0	0	16	17	1	1	11	20	20	2	1	13	6,264	895	18,840	1	1	19,041
	JAX	168																																
	Key West	0																																
	GOMEX	0																																
	Outside RCs	0																																
	Total	810																																
Gunnery Exercise, Air-to-Surface, Medium-Caliber	Northeast	0	0.74	8	SH-60B	1.0	8	100%	8.1	0%	25%	75%	0.00	2.04	6.11	2	600	0	0	0	0	0	13	13	1	1	9	46	47	4	3	31	9,768	1,395	29,379	1	1	29,692
	VACAPES	11	0.25	3	SH-60F	1.0	3	100%	2.8	0%	25%	75%	0.00	0.69	2.06	2	600	0	0	0	0	0	4	4	0	0	3	15	16	1	1	10	3,300	471	9,925	0	0	10,031
	Cherry Pt	20	0.01	0	MH-60R/S	1.0	0	100%	0.1	0%	25%	75%	0.00	0.03	0.08	2	600	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	132	19	397	0	0	401
	JAX	0																																
	Key West	0																																
	GOMEX	40																																
	Outside RCs	0																																
	Total	71																																
Missile Exercise, Air-to-Surface, Rocket	Northeast	0	0.33	32	SH-60B	3.0	96	100%	96.0	0%	25%	75%	0.00	24.01	72.02	2	600	0	0	0	0	0	150	154	13	10	101	540	553	48	35	363	115,236	16,462	346,597	11	10	350,288
	VACAPES	97	0.17	16	SH-60F	3.0	49	100%	49.5	0%	25%	75%	0.00	12.37	37.10	2	600	0	0	0	0	0	77	79	7	5	52	278	285	24	18	187	59,364	8,481	178,550	6	5	180,452
	Cherry Pt	0	0.18	17	FA-18A/C	2.0	35	10%	3.5	0%	25%	75%	0.00	0.87	2.62	2	3,318	0	0	0	0	0	2	6	0	0	6	42	117	8	7	111	231,729	33,104	696,975	23	20	704,398
	JAX	0	0.18	17	FA-18E/F	2.0	35	10%	3.5	0%	25%	75%	0.00	0.87	2.62	2	5,169	0	0	0	0	0	1	13	0	0	6	19	399	3	11	178	361,003	51,572	1,085,794	35	31	1,097,357
	Key West	0	0.14	14	S-3B	3.0	41	10%	4.1	0%	25%	75%	0.00	1.02	3.06	2	1,145	0	0	0	0	0	14	4	2	0	4	99	28	13	3	25	93,295	13,328	280,604	9	8	283,592
	GOMEX	0																																
	Outside RCs	0																																
	Total	97																																
Missile Exercise, Air-to-Surface	Northeast	0	0.33	26	SH-60B	3.0	79	100%	79.2	0%	0%	100%	0.00	0.00	79.20	2	600	0	0	0	0	0	0	0	0	0	0	594	608	52	38	399	95,040	13,577	285,853	9	8	288,898
	VACAPES	80	0.17	14	SH-60F	3.0	41	100%	40.8	0%	0%	100%	0.00	0.00	40.80	2	600	0	0	0	0	0	0	0	0	0	0	306	313	27	20	206	48,960	6,994	147,258	5	4	148,826
	Cherry Pt	16	0.18	14	FA-18A/C	2.0	29	10%	2.9	0%	0%	100%	0.00	0.00	2.88	2	3,318	0	0	0	0	0	0	0	0	0	0	47	129	8	8	122	191,117	27,302	574,825	19	16	580,947
	JAX	73	0.18	14	FA-18E/F	2.0	29	10%	2.9	0%	0%	100%	0.00	0.00	2.88	2	5,169	0	0	0	0	0	0	0	0	0	0	21	439	4	12	195	297,734	42,533	895,500	29	25	905,037
	Key West	0	0.14	11	S-3B	3.0	34	10%	3.4	0%	0%	100%	0.00	0.00	3.36	2	1,145	0	0	0	0	0	0	0	0	0	0	108	31	14	3	28	76,944	10,992	231,426	8	7	233,890
	GOMEX	0																																
	Outside RCs	0																																
	Total	169																																
BOMBEX, Air-to-Surface	Northeast	0	0	0	SH-60B	1.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	266	0.2	53	F-15	1.0	53	10%	5.3	0%	0%	100%	0.00	0.00	5.32	2	3,098	0	0	0	0	0	0	0	0	0	0	119	1,540	21	13	269	329,627	47,090	991,424	32	28	1,001,983
	Cherry Pt	88	0	0	FA-18A/C	1.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	155	0.7	186	FA-18E/F	1.0	186	10%	18.6	0%	0%	100%	0.00	0.00	18.62	2	5,169	0	0	0	0	0	0	0	0	0	0	139	2,839	23	77	1,263	1,924,936	274,991	5,789,656	188	164	5,851,316
	Key West	0	0.1	27	S-3B	1.0	27	10%	2.7	0%	0%	100%	0.00	0.00	2.66	2	1,145	0	0	0	0	0	0	0	0	0	0	86	25	11	2	22	60,914	8,702	183,212	6	5	185,163
	GOMEX	49																																
	Outside RCs	0																																
	Total	558																																
Laser Targeting	Northeast	0	0	0	SH-60B	1.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	272	0.2	54	F-15	1.0	54	10%	5.4	0%	0%	100%	0.00	0.00	5.44	2	3,098	0	0	0	0	0	0	0	0	0	0	122	1,575	22	13	275	337,062	48,152	1,013,787	33	29	1,024,584
	Cherry Pt	0	0	0	FA-18A/C	1.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	303	0.7	190	FA-18E/F	1.0	190	10%	19.0	0%	0%	100%	0.00	0.00	19.04	2	5,169	0	0	0	0	0	0	0	0	0	0	142	2,903	24	79	1,291	1,968,355	281,194	5,920,250	192	167	5,983,301
	Key West	0	0.1	27	S-3B	1.0	27	10%	2.7	0%	0%	100%	0.00	0.00	2.72	2	1,145	0	0	0	0	0	0	0	0	0	0	88	25	12	2	23	62,288	8,898	187,345	6	5	189,340
	GOMEX	0																																
	Outside RCs	0																																
	Total	575																																
Sinking Exercise	Northeast	0	0.15	0	E-2	16.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	2	1,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.62	0	FA-18E/F	16.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0	0.08	0	P-3	16.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	0	0.15	0	SH-60B	16.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0																																
	GOMEX	0																																
	Outside RCs	6																																
	Total	6																																
High Energy Laser Weapons Test	Northeast	0	0.33	0	SH-60B	1.0	0	100%	0.0	0%	50%	50%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.17	0	SH-60F	1.0	0	100%	0.0	0%	50%	50%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0	0.18	0	FA-18A/C	1.0	0	10%	0.0	0%	50%	50%	0.00	0.00	0.00	2	3,318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	0	0.18	0	FA-18E/F	1.0	0	10%	0.0	0%	50%	50%	0.00	0.00	0.00	2	5,169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Key West	0	0.14	0	S-3B	1.0	0	10%	0.0	0%	50%	50%	0.00	0.00	0.00	2	1,145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	0																																
	Outside RCs	0																																
	Total	0																																
Anti-Submarine Warfare																																		
TRACKEX/TORPEX-Submarine	Northeast	30			SSN-no emissions																													
	VACAPES	10																																
	Cherry Pt	14																																
	JAX	45																																
	Key West	0																																
	GOMEX	1																																
	Outside RCs	0																																
	Total	100																																

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
TRACKEX/TORPEX-Surface	Northeast	0			vessel emissions																																
	VACAPES	69																																			
	Cherry Pt	91																																			
	JAX	292																																			
	Key West	0																																			
	GOMEX	5																																			
	Outside RCs	0																																			
	Total	457																																			
TRACKEX/TORPEX-Helicopter	Northeast	0	0.17	4	SH-60B	3.6	15	100%	15.3	0%	24%	76%	0.00	3.61	11.69	2	600	0	0	0	0	0	23	23	2	1	15	88	90	8	6	59	18,360	2,623	55,222	2	2	55,810
	VACAPES	25	0.83	21	SH-60F	3.6	75	100%	74.7	0%	24%	76%	0.00	17.63	57.07	2	600	0	0	0	0	0	110	113	10	7	74	428	438	38	27	288	89,640	12,806	269,612	9	8	272,483
	Cherry Pt	25			MH-60R	3.6	0	100%	0.0	0%	24%	76%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAX	115																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	165																																			
TRACKEX-MPA	Northeast	238	1	79	P-3	6.0	474	25%	118.5	5%	10%	85%	5.93	11.85	100.73	4	1,200	52	240	12	11	113	22	100	5	5	47	880	4,076	198	193	1,919	2,275,200	325,029	6,843,152	222	193	6,916,031
	VACAPES	79	0	0	P8-MMA	6.0	0	25%	0.0	5%	10%	85%	0.00	0.00	0.00	2	1,631	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	111																																			
	JAX	356																																			
	Key West	0																																			
	GOMEX	7																																			
	Outside RCs	0																																			
	Total	791																																			
TRACKEX/TORPEX - MPA-Sonobuoy	Northeast	34	1	34	P-3	6.0	204	25%	51.0	5%	10%	85%	2.55	5.10	43.35	4	1,200	22	103	5	5	49	9	43	2	2	20	379	1,754	85	83	826	979,200	139,886	2,945,154	96	83	2,976,520
	VACAPES	34	0	0	P8-MMA	6.0	0	25%	0.0	5%	10%	85%	0.00	0.00	0.00	2	1,631	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	34																																			
	JAX	34																																			
	Key West	0																																			
	GOMEX	34																																			
	Outside RCs	0																																			
	Total	170																																			
SEASWITI	Northeast	0	1	0	P-3	16.0	0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	2	0	SH-60B	16.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0																																			
	JAX	4																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	4																																			
Integrated Anti-Submarine Warfare Course	Northeast	0	1	0	P-3	16.0	3	10%	0.3	0%	0%	100%	0.00	0.00	0.32	4	1,200	0	0	0	0	0	0	0	0	0	0	3	13	1	1	6	15,360	2,194	46,198	1	1	46,691
	VACAPES	0	2	0	SH-60B	16.0	6	100%	6.4	0%	0%	100%	0.00	0.00	6.40	2	600	0	0	0	0	0	0	0	0	0	0	48	49	4	3	32	7,680	1,097	23,099	1	1	23,345
	Cherry Pt	1																																			
	JAX	2																																			
	Key West	0																																			
	GOMEX	1																																			
	Outside RCs	0																																			
	Total	5																																			
Group Sail	Northeast	0	1	3	P-3	16.0	48	10%	4.8	0%	0%	100%	0.00	0.00	4.80	4	1,200	0	0	0	0	0	0	0	0	0	0	42	194	9	9	91	230,400	32,914	692,977	22	20	700,358
	VACAPES	3	4	12	SH-60B	16.0	192	100%	192.0	0%	0%	100%	0.00	0.00	192.00	2	600	0	0	0	0	0	0	0	0	0	0	1,440	1,475	127	92	968	230,400	32,914	692,977	22	20	700,358
	Cherry Pt	4																																			
	JAX	13																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	20																																			
Submarine Command Course Operations	Northeast	0		SSN	No emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	2																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	2																																			
ASW for Composite Training Unit Exercise (COMPTUEX)	Northeast	0			Conducted during COMPTUEX																																
	VACAPES	1																																			
	Cherry Pt	1																																			
	JAX	1																																			
	Key West	0																																			
	GOMEX	1																																			
	Outside RCs	0																																			
	Total	5																																			
ASW for Joint Task Force Exercise (JTFEX) Sustainment Exercise (SUSTAINEX)	Northeast	0			Conducted during JTFEX																																
	VACAPES	1																																			
	Cherry Pt	1																																			
	JAX	1																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	2																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																		
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Electronic Warfare																																				
Electronic Warfare	Northeast	0	0.05	15	SH-60B/F	2.1	32	100%	31.7	0%	0%	100%	0.00	0.00	31.71	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	238	244	21	15	160	38,052	5,436	114,450	4	3	115,668
	VACAPES	302	0.004	1	HH-60	2.1	3	100%	2.5	0%	0%	100%	0.00	0.00	2.54	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19	19	2	1	13	3,044	435	9,156	0	0	9,253
	Cherry Pt	2,620	0.04	12	P-3	2.0	24	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	115,968	16,567	348,799	11	10	352,513
	JAX	181	0.29	88	FA-18A/C	2.0	175	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	1,162,362	166,052	3,496,052	113	99	3,533,285
	Key West	0	0.29	88	FA-18E/F	2.0	175	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	1,810,804	258,686	5,446,381	177	154	5,504,385
	GOMEX	0	0.02	6	E-2C	2.0	12	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	1,100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	26,576	3,797	79,933	3	2	80,784
	Outside RCs	0	0.11	33	EA-6B	2.0	66	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,195	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	424,552	60,650	1,276,930	41	36	1,290,529
	Total	3,103	0.2	60	Learjet	2.0	121	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	532	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	128,531	18,362	386,585	13	11	390,702
Flare Exercise	Northeast	0	0.25	20	FA-18E/F	2.8	55	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	568,590	81,227	1,710,156	55	48	1,728,369
	VACAPES	80	0.25	20	EA-18G	2.8	55	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	568,590	81,227	1,710,156	55	48	1,728,369
	Cherry Pt	107	0.25	20	EP-3	2.8	55	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,053	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	231,660	33,094	696,767	23	20	704,188
	JAX	94	0	0	EA-6B	2.8	0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,195	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	Key West	900	0	0	P-3	2.8	0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	368	0.25	20	Learjet	2.0	40	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	532	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	42,560	6,080	128,008	4	4	129,372
	Outside RCs	0	0.25	20	SH-60B/F	2.8	55	100%	55.0	0%	0%	100%	0.00	0.00	55.00	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	413	422	36	26	277	66,000	9,429	198,509	6	6	200,623
	Total	1,549																																			
Chaff Exercise - Ship	Northeast	0																																			
	VACAPES	28																																			
	Cherry Pt	74																																			
	JAX	74																																			
	Key West	0																																			
	GOMEX	14																																			
	Outside RCs	0																																			
	Total	190																																			
Chaff Exercise - Aircraft	Northeast	0	0.25	495	FA-18E/F	2.8	1,362	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	14,079,710	2,011,387	42,347,745	1,374	1197	42,798,748
	VACAPES	1,981	0.25	495	EA-18G	2.8	1,362	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	14,079,710	2,011,387	42,347,745	1,374	1197	42,798,748
	Cherry Pt	572	0.25	495	EP-3	2.8	1,362	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,053	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	5,736,481	819,497	17,253,695	560	488	17,437,447
	JAX	424	0	0	EA-6B	2.8	0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,195	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	Key West	3,000	0	0	P-3	2.8	0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	GOMEX	368	0.25	495	Learjet	2.0	991	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	532	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	1,053,892	150,556	3,169,806	103	90	3,203,564
	Outside RCs	0	0.25	495	SH-60B/F	2.8	1,362	100%	1361.9	0%	0%	100%	0.00	0.00	1361.94	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,215	10,460	899	654	6,864	1,634,325	233,475	4,915,583	159	139	4,967,934
	Total	6,345																																			
Mine Warfare																																				
Mine Countermeasure Exercise - Ship Sonar	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Mine Neutralization - EOD	Northeast	0			vessel emissions																																
	VACAPES	24																																			
	Cherry Pt	20																																			
	JAX	12																																			
	Key West	0																																			
	GOMEX	12																																			
	Outside RCs	0																																			
	Total	68																																			
Underwater Mine Countermeasure (UMCM) Raise, Tow, Beach, and Exploitation Operations	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Airborne Mine Countermeasures (AMCM) Towed Mine Neutralization	Northeast	0	1	980	SH-60B	2.1	2,058	100%	2058.0	100%	0%	0%	2058.00	0.00	0.00	2	600	15435.00	15805.44	1358.28	987.84	10372.32	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	2,469,600	352,800	7,427,851	241	210	7,506,958
	VACAPES	980																																			
	Cherry Pt	183																																			
	JAX	134																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	1,297																																			
Airborne Mine Countermeasures (AMCM) - Mine Detection	Northeast	0	1	1,232	SH-60B	2.1	2,587	100%	2587.2	100%	0%	0%	2587.20	0.00	0.00	2	600	19404.00	19869.70	1707.55	1241.86	13039.49	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	3,104,640	443,520	9,337,870	303	264	9,437,318
	VACAPES	1,232																																			
	Cherry Pt	393																																			
	JAX	322																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	1,947																																			
Mine Countermeasures (MCM) - Mine Neutralization Small- and Medium-Caliber	Northeast	0	1	110	SH-60B	2.1	231	100%	231.0	25%	75%	0%	57.75	173.25	0.00	2	600	433.13	443.52	38.12	27.72	291.06	1299.38	1330.56	114.35	83.16	873.18	0	0	0	0	0	277,200	39,600	833,738	27	24	842,618
	VACAPES	110																																			
	Cherry Pt	27																																			
	JAX	27																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	164																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

TRAINING OPS INFORMATION - AIRCRAFT															Training Platform		EMISSIONS (lb./yr)																		
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Mine Countermeasures - Mine Neutralization - ROV	Northeast	0	1	210	SH-60B	2.1	441	100%	441.0	100%	0%	0%	441.00	0.00	0.00	2	600	3307.50	3386.88	291.06	211.68	2222.64	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	529,200	75,600	1,591,682	52	45	1,608,634
	VACAPES	210																																			
	Cherry Pt	27																																			
	JAX	27																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	264																																			
Mine Laying	Northeast	0	0.19	0	P-3	0.9	0	67%	0.0	50%	40%	10%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.42	0	FA-18A/C	0.5	0	7%	0.0	50%	40%	10%	0.00	0.00	0.00	2	3,318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0	0.39	0	FA-18E/F	0.5	0	7%	0.0	50%	40%	10%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Coordinated Unit Level Helicopter AMCM Exercises	Northeast	0	4	0	SH-60B	4.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Major Training Events																																					
Composite Training Unit Exercise (COMPTUEX)	Northeast	0	3	4	SH-60B/F	36.0	135	100%	135.0	0%	0%	100%	0.00	0.00	135.00	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,013	1,037	89	65	680	162,000	23,143	487,250	16	14	492,439
	VACAPES	1	3	4	HH-60	36.0	135	100%	135.0	0%	0%	100%	0.00	0.00	135.00	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,013	1,037	89	65	680	162,000	23,143	487,250	16	14	492,439
	Cherry Pt	1	2	3	P-3	36.0	90	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	432,000	61,714	1,299,333	42	37	1,313,170
	JAX	1	20	25	FA-18A/C	36.0	900	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	5,972,400	853,200	17,963,273	583	508	18,154,582
	Key West	0	20	25	FA-18E/F	36.0	900	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	9,304,200	1,329,171	27,984,375	908	791	28,282,409
	GOMEX	1	6	8	E-2C	36.0	270	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	1,100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	594,000	84,857	1,786,582	58	50	1,805,609
	Outside RCs	0																																			
	Total	5																																			
Joint Task Force Exercise (JTFEX) /Sustainment Exercise (SUSTAINEX)	Northeast	0	3	2	SH-60B/F	36.0	71	100%	71.3	0%	0%	100%	0.00	0.00	71.28	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	535	547	47	34	359	85,536	12,219	257,268	8	7	260,008
	VACAPES	1	3	2	HH-60	36.0	71	100%	71.3	0%	0%	100%	0.00	0.00	71.28	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	535	547	47	34	359	85,536	12,219	257,268	8	7	260,008
	Cherry Pt	1	2	1	P-3	36.0	48	0%	0.0	0%	0%	100%	0.00	0.00	0.00	4	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	228,096	32,585	686,048	22	19	693,354
	JAX	1	20	13	FA-18A/C	36.0	475	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	3,318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	3,153,427	450,490	9,484,608	308	268	9,585,619
	Key West	0	20	13	FA-18E/F	36.0	475	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	5,169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	4,912,618	701,803	14,775,750	479	418	14,933,112
	GOMEX	0	6	4	E-2C	36.0	143	0%	0.0	0%	0%	100%	0.00	0.00	0.00	2	1,100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	313,632	44,805	943,315	31	27	953,362
	Outside RCs	0																																			
	Total	2																																			
Other Training																																					
Search and Rescue (SAR)	Northeast	0	1	0	SH-60B	2.0	0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	2	600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	42																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	42																																			
Precision Anchoring	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	168																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	168																																			
Elevated Causeway System (ELCAS)	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Submarine Navigational (SUBNAV)	Northeast	165		SSN	No emissions																																
	VACAPES	78																																			
	Cherry Pt	0																																			
	JAX	57																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	300																																			
Submarine Under Ice Certification	Northeast	0		SSN	No emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT														Training Platform		EMISSIONS (lb./yr)																					
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Surface Ship Object Detection	Northeast	0			vessel emissions																																
	VACAPES	68																																			
	Cherry Pt	0																																			
	JAX	40																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	108																																			
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	Northeast	0			vessel emissions																																
	VACAPES	61																																			
	Cherry Pt	82																																			
	JAX	263																																			
	Key West	0																																			
	GOMEX	4																																			
	Outside RCs	0																																			
	Total	410																																			
Submarine Sonar Maintenance (in OPAREAs and Ports)	Northeast	66		SSN	No emissions																																
	VACAPES	34																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	100																																			
Civilian Port Defense	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Testing - New Ship Construction																																					
Surface Combatant Sea Trials-Propulsion Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Aicraft Carrier Sea Trials	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Sea Basing Ship Sea Trial	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Amphibious Ship Sea Trial	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Submarine Sea Trial	Northeast	0			SSN-no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Other Class Ship Sea Trials	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT														Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
LCS Sea Trials and Mission Package Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Post-Homeporting Test (all Classes)	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Testing - Shock Trials																																					
Aircraft Carrier Full Ship Shock Trial	Northeast	0			CVN-no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Littoral Combat Ship Full Ship Shock Trial	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Testing - Lifecycle Activities																																					
Ship Signature Test	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Shipboard Protection Systems and																																					
Shipboard Protection Systems Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Chemical / Biological Simulant Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Unmanned Vehicle Testing																																					
Underwater Deployed UAV Testing	Northeast	0		SSN	No emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Unmanned Vehicle Development and Payload Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT														Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Other Testing																																					
Test and Evaluation Catapult Launch	Northeast	0		CVN	no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Air Platform Shipboard Integrate Test	Northeast	0		CVN	no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Shipboard Electronic Systems Evaluation	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Maritime Security	Northeast	0	0.74	0	SH-60B	4.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VACAPES	0	0.25	0	SH-60F	4.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Countermeasure Testing: Acoustic System Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Special Warfare Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Radio-Frequency Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
Hydrodynamic Testing	Northeast	0		SSN	no emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
At-Sea Explosives Testing	Northeast	0			vessel emissions																																
	VACAPES	0																																			
	Cherry Pt	0																																			
	JAX	0																																			
	Key West	0																																			
	GOMEX	0																																			
	Outside RCs	0																																			
	Total	0																																			
RANGE COMPLEX TOTAL (lb)																			38,653.66	39,848.47	3,411.69	2,485.37	26,087.01	3,355.87	3,553.09	300.43	219.59	2,305.17	31,625	95,679	3,425	3,666	47,753	141,398,987.30	20,219,759	425,706,815	13,797	12,018.91	429,817,066.65
RANGE COMPLEX TOTAL (TPY)																			19.33	19.92	1.71	1.24	13.04	1.68	1.78	0.15	0.11	1.15	16	48	2	2	24	70,699.49	10,110	212,853	7	6.01	214,908.53

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																				
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Testing: NSWC Panama City Division (part of GOMEX Range Complex)																																					
AUV Demo		0			vessel emissions																																
		0																																			
Mine Detect		0	0	0	SH-60B	1.6	0	100%	0.0	25%	50%	25%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0																																			
MCM Testing		0	0	0	SH-60B	1.6	0	100%	0.0	25%	50%	25%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0																																			
Stationary Test		0			No emissions																																
		0																																			
Spec War Test		0			SDV no emissions																																
		0																																			
UUV Test		0			vessel emissions																																
		0																																			
Ord Test		0	0	0	SH-60B	1.0	0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	2	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0																																			
CM Test		0			vessel emissions																																
		0																																			
Total		0																																			
Testing: NUWC Division Newport, RI																																					
Launcher Test		0																																			
		0																																			
Torpedo Test		0																																			
		0																																			
Towed Equip Test		0																																			
		0																																			
UUV Test		0																																			
		0																																			
USV Test		0																																			
		0																																			
UAV Test		0																																			
		0																																			
Semi-Stationary Equip Test		0																																			
		0																																			
AUV Demo		0																																			
		0																																			
Pierside Int Swimmer Defense		0																																			
		0																																			
Total	Total	0																																			
South Florida Ocean Measurement Facility Testing																																					
Signature Analysis Ops		0																																			
		0																																			
Mine RDT&E		0																																			
		0																																			
Surface Testing		0																																			
		0																																			
Subsurface Testing		0																																			
		0																																			
UUV Demos		0																																			
		0																																			
Total		0																																			

Table D-3: Virginia Capes Range Complex - Training Related - Aircraft Air Emissions—No-Action Alternative (Continued)

			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform		EMISSIONS (lb./yr)																			
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr.)					State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use (total)		Greenhouse Gas Emissions (lb)			
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr.)	Total Time on Range (hr.)	Time < 3,000 ft (%)	Time < 3,000 ft (hr.)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engines (#)	Fuel Flow (lb/hr)	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Pierside Events																																					
Surface Combatant Sea Trials: Pierside Sonar Testing	Pierside, Bath ME	0																																			
	Pierside, Groton CT	0																																			
	Pierside , RI	0																																			
	Pierside, Norfolk Little Creek or Newport News	0																																			
	Pierside Kings Bay GA	0																																			
	Pierside, Mayport FL	0																																			
	Pierside, Port Canaveral FL	0																																			
	Pierside, Pascagoula MS	0																																			
	Total	0																																			
Submarine Sea Trials- Pierside Sonar Testing	Pierside, Bath ME	0																																			
	Pierside, Groton CT	0																																			
	Pierside , RI	0																																			
	Pierside, Norfolk Little Creek or Newport News	0																																			
	Pierside Kings Bay GA	0																																			
	Pierside, Mayport FL	0																																			
	Pierside, Port Canaveral FL	0																																			
	Pierside, Pascagoula MS	0																																			
	Total	0																																			
Pierside Integrated Swimmer Defense	Pierside, Bath ME	0																																			
	Pierside, Groton CT	0																																			
	Pierside , RI	0																																			
	Pierside, Norfolk Little Creek or Newport News	0																																			
	Pierside Kings Bay GA	0																																			
	Pierside, Mayport FL	0																																			
	Pierside, Port Canaveral FL	0																																			
	Pierside, Pascagoula MS	0																																			
	Total	0																																			

A/C: aircraft; AFTT: Atlantic Fleet Training and Testing; ASW: anti-submarine warfare; AUV: autonomous underwater vehicle; BOMBEX: bombing exercise; CH4: methane; Cherry Pt: Navy Cherry Point Range Complex; CM: countermeasures; CO: carbon monoxide; CO2: carbon dioxide; CO2e: carbon dioxide equivalent; EOD: explosive ordnance disposal; gal: gallon; GHG: greenhouse gas; GOMEX: Gulf of Mexico Range Complex; GPH: gallons per hour; hr: hour; JAX: Jacksonville Range Complex; Key West: Key West Range Complex; lb: pound; MCM: mine countermeasures; MPA: maritime patrol aircraft; N2O: nitrous oxide; nm: nautical mile; Northeast: Northeast Range Complexes; NOx: nitrogen oxides; NSWC: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC: Naval Undersea Warfare Center Division, Newport Testing Range; Ord: ordnance; Outside RCs: Other AFTT Areas; PM: particulate matter; RDT&E: research, development, test, and evaluation; ROV: remotely operated vehicle; SEASWITI: southeast anti-submarine warfare integration training initiative; SFOMF: South Florida Ocean Measurement Facility; SOx: sulfur oxides; TORPEX: torpedo exercise; TRACKEX: tracking exercise; UAV: unmanned aerial vehicle; USV: unmanned surface vehicle; UUV: unmanned undersea vehicle; VACAPES: Virginia Capes Range Complex; VOC: volatile organic compounds

NOTE: A standardized calculation worksheet was developed for all training and testing locations; for each alternative; and for each training and testing activity listed in Chapter 2 (Description of Proposed Action and Alternatives). Emissions estimates for the VACAPES Range Complex example are based on the VACAPES Range Complex activities (Annual Operations #) presented in Column C. Applied emission factors not shown.

Table D-4: Ordnance Emissions Estimates - No Action Alternative

ORDNANCE EMISSIONS ESTIMATES - NO ACTION ALTERNATIVE

MEM Category	Location – Range Complex	Number of MEM Items (Annual) for Training Activities	Number of MEM Items (Annual) for Testing Activities	Emission Factors (lb./item)						Emissions (lb./year) Training						Emissions (TPY) Training						Emissions (lb./year) Testing						Emissions (TPY) Testing					
		No Action Alternative	No Action Alternative	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5
Bombs																																	
Bombs (High Explosive)	Northeast / NUWC Newport	0	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	20	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1220.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	0	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	0	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	4	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	244.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1220	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	61.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	24	0																														
Bombs (Non-Explosive Practice Munition)	Northeast / NUWC Newport	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	555	655	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	811	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	696	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	292	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	2,354	655																														
Projectiles																																	
Small-Caliber	Northeast / NUWC Newport	0	0	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	1,299,600	800	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	2989.0800	126.0612	0.0000	0.0000	66.2796	49.3848	1.4945	0.0630	0.0000	0.0000	0.0331	0.0247	1.8400	0.0776	0.0000	0.0000	0.0408	0.0304	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	199,240	0	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	458.2520	19.3263	0.0000	0.0000	10.1612	7.5711	0.2291	0.0097	0.0000	0.0000	0.0051	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	502,140	0	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	1154.9220	48.7076	0.0000	0.0000	25.6091	19.0813	0.5775	0.0244	0.0000	0.0000	0.0128	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	39,600	8,000	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	91.0800	3.8412	0.0000	0.0000	2.0196	1.5048	0.0455	0.0019	0.0000	0.0000	0.0010	0.0008	18.4000	0.7760	0.0000	0.0000	0.4080	0.3040	0.0092	0.0004	0.0000	0.0000	0.0002	0.0002
	Other AFTT	0	0	0.0023	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	2,040,580	8,800																														
Medium-Caliber (High-Explosive)	Northeast / NUWC Newport	0	0	0.033	0.00043	0.0000	0.0000	0.00066	0.00046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	0	15,210	0.033	0.00043	0.0000	0.0000	0.00066	0.00046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	501.9300	6.5403	0.0000	0.0000	10.0386	6.9966	0.2510	0.0033	0.0000	0.0000	0.0050	0.0035
	Navy Cherry Pt.	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	0	6,000	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	198.0000	2.5800	0.0000	0.0000	3.9600	2.7600	0.0990	0.0013	0.0000	0.0000	0.0020	0.0014
	Key West	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Any OPAREA	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	0	21,210																														

Table D-4: Ordnance Emissions Estimates - No Action Alternative (Continued)

ORDNANCE EMISSIONS ESTIMATES - NO ACTION ALTERNATIVE

MEM Category	Location – Range Complex	Number of MEM Items (Annual) for Training Activities	Number of MEM Items (Annual) for Testing Activities	Emission Factors (lb./item)						Emissions (lb./year) Training						Emissions (TPY) Training						Emissions (lb./year) Testing						Emissions (TPY) Testing					
		No Action Alternative	No Action Alternative	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5
Medium-Caliber (Non-Explosive Practice Munitions)	Northeast / NUWC Newport	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	226,750	42,210	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	7482.7500	97.5025	0.0000	0.0000	149.6550	104.3050	3.7414	0.0488	0.0000	0.0000	0.0748	0.0522	1392.9300	18.1503	0.0000	0.0000	27.8586	19.4166	0.6965	0.0091	0.0000	0.0000	0.0139	0.0097
	Navy Cherry Pt.	39,075	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	1289.4750	16.8023	0.0000	0.0000	25.7895	17.9745	0.6447	0.0084	0.0000	0.0000	0.0129	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	68,825	16,000	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	2271.2250	29.5948	0.0000	0.0000	45.4245	31.6595	1.1356	0.0148	0.0000	0.0000	0.0227	0.0158	528.0000	6.8800	0.0000	0.0000	10.5600	7.3600	0.2640	0.0034	0.0000	0.0000	0.0053	0.0037
	Key West	36,000	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	1188.0000	15.4800	0.0000	0.0000	23.7600	16.5600	0.5940	0.0077	0.0000	0.0000	0.0119	0.0083	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	34,880	5,272	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	1151.0400	14.9984	0.0000	0.0000	23.0208	16.0448	0.5755	0.0075	0.0000	0.0000	0.0115	0.0080	173.9760	2.2670	0.0000	0.0000	3.4795	2.4251	0.0870	0.0011	0.0000	0.0000	0.0017	0.0012
	Any OPAREA	0	0	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	4,572	0.0330	0.0004	0.0000	0.0000	0.0007	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	150.8760	1.9660	0.0000	0.0000	3.0175	2.1031	0.0754	0.0010	0.0000	0.0000	0.0015	0.0011
	Total	405,530	68,054																														
Large-Caliber (High-Explosive)	Northeast / NUWC Newport	0	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	858	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	109.8240	137.2800	0.0000	0.0000	8.2368	6.3835	0.0549	0.0686	0.0000	0.0000	0.0041	0.0032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	78	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	9.9840	12.4800	0.0000	0.0000	0.7488	0.5803	0.0050	0.0062	0.0000	0.0000	0.0004	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	390	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	49.9200	62.4000	0.0000	0.0000	3.7440	2.9016	0.0250	0.0312	0.0000	0.0000	0.0019	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	0	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	700	0	0.1280	0.1600	0.0000	0.0000	0.0096	0.0074	89.6000	112.0000	0.0000	0.0000	6.7200	5.2080	0.0448	0.0560	0.0000	0.0000	0.0034	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	2,026	0																														
Large-Caliber (Non-Explosive Practice Munition)	Northeast / NUWC Newport	0	148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	3,844	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	1,392	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	2,372	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	1,240	448	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	8,848	596																														
Missiles (High-Explosive)	Northeast / NUWC Newport	0	0																														
	Virginia Capes	178	5																														
	Navy Cherry Pt.	44	0																														
	Jacksonville	88	5																														
	Key West	0	0																														
	GOMEX / NSWC Panama City	0	0																														
	Other AFTT	11	0																														
	Total	321	10																														
Missiles (Non-Explosive Practice Munition)	Northeast / NUWC Newport	0	4																														
	Virginia Capes	112	128																														
	Navy Cherry Pt.	8	0																														
	Jacksonville	15	5																														
	Key West	0	0																														
	GOMEX / NSWC Panama City	0	4																														
	Any AFTT	0	0																														
	Total	135	141																														

Table D-4: Ordnance Emissions Estimates - No Action Alternative (Continued)

ORDNANCE EMISSIONS ESTIMATES - NO ACTION ALTERNATIVE

MEM Category	Location – Range Complex	Number of MEM Items (Annual) for Training Activities	Number of MEM Items (Annual) for Testing Activities	Emission Factors (lb./item)						Emissions (lb./year) Training						Emissions (TPY) Training						Emissions (lb./year) Testing						Emissions (TPY) Testing					
		No Action Alternative	No Action Alternative	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5
Rockets (High-Explosive)	Northeast / NUWC Newport	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	0	150	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	139.5000	0.8400	0.0000	0.0000	60.0000	43.5000	0.0698	0.0004	0.0000	0.0000	0.0300	0.0218
	Navy Cherry Pt.	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	0	110	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	102.3000	0.6160	0.0000	0.0000	44.0000	31.9000	0.0512	0.0003	0.0000	0.0000	0.0220	0.0160
	Key West	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / Panama City	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	0	260																														
Rockets (Non-Explosive)	Northeast / NUWC Newport	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Virginia Capes	3,700	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	3441.0000	20.7200	0.0000	0.0000	1480.0000	1073.0000	1.7205	0.0104	0.0000	0.0000	0.7400	0.5365	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Navy Cherry Pt.	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Jacksonville	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Key West	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / Panama City	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Other AFTT	0	0	0.9300	0.0056	0.0000	0.0000	0.4000	0.2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	3,700	0																														
Pyrotechnic Buoys (e.g. MK 58 Marine Marker)	Northeast / NUWC Newport	238	10	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	10.9480	0.2380	0.0000	0.0286	161.8400	26.1800	0.0055	0.0001	0.0000	0.0000	0.0809	0.0131	0.4600	0.0100	0.0000	0.0012	6.8000	1.1000	0.0002	0.0000	0.0000	0.0000	0.0034	0.0006
	Virginia Capes	345	158	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	15.8700	0.3450	0.0000	0.0414	234.6000	37.9500	0.0079	0.0002	0.0000	0.0000	0.1173	0.0190	7.2680	0.1580	0.0000	0.0190	107.4400	17.3800	0.0036	0.0001	0.0000	0.0000	0.0537	0.0087
	Navy Cherry Pt.	199	5	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	9.1540	0.1990	0.0000	0.0239	135.3200	21.8900	0.0046	0.0001	0.0000	0.0000	0.0677	0.0109	0.2300	0.0050	0.0000	0.0006	3.4000	0.5500	0.0001	0.0000	0.0000	0.0000	0.0017	0.0003
	Jacksonville	511	7	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	23.5060	0.5110	0.0000	0.0613	347.4800	56.2100	0.0118	0.0003	0.0000	0.0000	0.1737	0.0281	0.3220	0.0070	0.0000	0.0008	4.7600	0.7700	0.0002	0.0000	0.0000	0.0000	0.0024	0.0004
	Key West	0	0	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / Panama City	56	5	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	2.5760	0.0560	0.0000	0.0067	38.0800	6.1600	0.0013	0.0000	0.0000	0.0000	0.0190	0.0031	0.2300	0.0050	0.0000	0.0006	3.4000	0.5500	0.0001	0.0000	0.0000	0.0000	0.0017	0.0003
	Other AFTT	0	5	0.0460	0.0010	0.0000	0.0001	0.6800	0.1100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2300	0.0050	0.0000	0.0006	3.4000	0.5500	0.0001	0.0000	0.0000	0.0000	0.0017	0.0003
	Total	1,349	190																														

		CO	NOx	VOC	SOx	PM10	PM2.5
TOTALS BY COMPLEX (TPY)	Northeast / NUWC Newport	0.0055	0.0001	0.0000	0.0000	0.0809	0.0131
	Virginia Capes	7.6293	0.1910	0.0000	0.0000	0.9694	0.6355
	Navy Cherry Pt.	0.8834	0.0244	0.0000	0.0000	0.0860	0.0240
	Jacksonville	1.7498	0.0706	0.0000	0.0000	0.2111	0.0549
	Key West	0.5940	0.0077	0.0000	0.0000	0.0119	0.0083
	GOMEX / NSWC Panama City	0.7443	0.0094	0.0000	0.0000	0.0316	0.0119
	Other AFTT	0.0448	0.0560	0.0000	0.0000	0.0034	0.0026
	Study Area Training Total	**11.6511**	**0.3593**	**0.0000**	**0.0001**	**1.3942**	**0.7503**

		CO	NOx	VOC	SOx	PM10	PM2.5
TOTALS BY COMPLEX (TPY)	Northeast / NUWC Newport	0.0002	0.0000	0.0000	0.0000	0.0034	0.0006
	Virginia Capes	1.0217	0.0129	0.0000	0.0000	0.1027	0.0437
	Navy Cherry Pt.	0.0001	0.0000	0.0000	0.0000	0.0017	0.0003
	Jacksonville	0.4143	0.0050	0.0000	0.0000	0.0316	0.0214
	Key West	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GOMEX / NSWC Panama City	0.0963	0.0015	0.0000	0.0000	0.0036	0.0016
	Other AFTT	0.0756	0.0010	0.0000	0.0000	0.0032	0.0013
	Study Area Testing Total	**1.6082**	**0.0204**	**0.0000**	**0.0000**	**0.1463**	**0.0688**

Table D-4: Ordnance Emissions Estimates - No Action Alternative (Continued)

ORDNANCE EMISSIONS ESTIMATES - NO ACTION ALTERNATIVE																																			
MEM Category	Location – Range Complex	Number of MEM Items (Annual) for Training Activities	Number of MEM Items (Annual) for Testing Activities	Emission Factors (lb./item)						Emissions (lb./year) Training						Emissions (TPY) Training						Emissions (lb./year) Testing						Emissions (TPY) Testing							
		No Action Alternative	No Action Alternative	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5	CO	NOx	VOC	SOx	PM10	PM2.5		

		CO	NOx	VOC	SOx	PM10	PM2.5
TOTALS BY COMPLEX for Training and Testing Combined (TPY)	Northeast / NUWC Newport	0.0057	0.0001	0.0000	0.0000	0.0843	0.0136
	Virginia Capes	8.6510	0.2038	0.0000	0.0000	1.0721	0.6792
	Navy Cherry Pt.	0.8835	0.0244	0.0000	0.0000	0.0877	0.0243
	Jacksonville	2.1641	0.0756	0.0000	0.0000	0.2428	0.0763
	Key West	0.5940	0.0077	0.0000	0.0000	0.0119	0.0083
	GOMEX / NSWC Panama City	0.8407	0.0110	0.0000	0.0000	0.0352	0.0135
	Other AFTT	0.1204	0.0570	0.0000	0.0000	0.0066	0.0039
	Grand Total for NAA	**13.2593**	**0.3797**	**0.0000**	**0.0001**	**1.5405**	**0.8191**

AFTT: Atlantic Fleet Training and Testing; Cherry Point: Navy Cherry Point Range Complex; CO: carbon monoxide; GOMEX: Gulf of Mexico Range Complex; Jacksonville: Jacksonville Range Complex; Key West: Key West Range Complex; lb: pound; MEM: military expended material; Northeast: Northeast Range Complexes; NOx: nitrogen oxides; NSWC Panama City: Naval Surface Warfare Center, Panama City Division Testing Range; NUWC Newport: Naval Undersea Warfare Center Division, Newport Testing Range; Other AFTT: Other AFTT Areas PM10: particulate matter less than less than 10 micrometers in diameter; PM2.5: particulate matter less than 2.5 micrometers in diameter; SFOMF: South Florida Ocean Measurement Facility; SOx: sulfur oxides; TPY: tons per year; Virginia Capes: Virginia Capes Range Complex; VOC: volatile organic compounds

NOTE: The VACAPES Range Complex example is shown in bold in comparison to other range complex data.

D.2 EXAMPLE RECORD OF NON-APPLICABILITY

This appendix shows an example of the documentation that will be prepared for each air quality control region in nonattainment or maintenance of the National Ambient Air Quality Standards potentially impacted by the Proposed Action. The example documentation (shown for Rhode Island) includes: a record of non-applicability memorandum (Figure D.2-1), a standard example form to show Clean Air Act conformity (Figure D.2-2), and sample conformity analyses (Figure D.2-3a and Figure D.2-3b).

MEMORANDUM FOR THE RECORD

From: _____

Subj: Conformity Analyses for Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement/Overseas Environmental Impact Statement – Activities in Rhode Island Waters

Ref: 40 CFR, 51.853(b)

Encl: (1) Record of Non-Applicability for Atlantic Fleet Training and Testing in Rhode Island State Waters;

(2) Conformity Analyses for Preferred Alternative Operating Scenario in Rhode Island State Waters

1. Enclosure (1) is a Record of Non-Applicability for those activities associated with Atlantic Fleet Training and Testing activities which are expected to occur in Rhode Island waters annually. The total NOx and VOC emissions for the Preferred Alternative are included in enclosure (2). Comparison of the calculated values in enclosure (2) with those in reference (b) show this project is significantly below the *de minimis* levels.

2. If there are any questions or if additional information is needed, please call _____ at _____.

_____

Name

Title

Figure D.2-1: Sample Record of Non-Applicability Memorandum for Rhode Island

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The Proposed Action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Proposed Action:

Action Proponents: United States Fleet Forces Command

Naval Sea Systems Command

Naval Air Systems Command

Office of Naval Research

Proposed Action Name: Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Proposed Action and Emissions Summary:

Affected Air Basin: Metropolitan Providence Air Quality Control Region

Date RONA prepared: _____

RONA prepared by: Naval Facilities Engineering Command, Atlantic

Attainment Area Status and Emissions Evaluation Conclusion:

To the best of my knowledge and belief, the information contained within this General Conformity Applicability Analysis is correct and accurate. By signing this statement, I am in agreement with the finding that the total of all reasonably foreseeable direct and indirect emissions that will result from this action is below the *de minimis* threshold set forth in 40 CFR 51.853(b). Accordingly, it is my determination that this action conforms to the applicable State Implementation Plan (SIP).

RONA Approval:

Signature: _____

Name/Rank: _____ Date: _____

Position: _____Commanding Officer: _____ Activity: _____

Figure D.2-2: Sample Record of Non-Applicability Form

Subject: Conformity Analysis for Navy Training and Testing in Rhode Island Waters

The AFTT EIS/OEIS has been prepared to assess current and future activities in the AFTT EIS/OEIS Study Area. The Study Area includes the state waters of Rhode Island wherein Naval Undersea Warfare Center Division, Newport Testing Range conducts testing activities. These training and testing activities generally involve a variety of boats and other watercraft which are used to support and also perform on-water testing activities. Portions of other Navy training and testing events are also conducted within and above Rhode Island waters. Aircraft overflights and vessel activities during portions of anti-submarine warfare and anti-surface warfare training and testing events would occur above Rhode Island waters.

Table 1 contains the list of on-water sources, engines, and their fuels, with the exception of the TWR-841 which also includes diesel-electric generators which can operate independently of the boat engines. This and other engine information was needed to calculate the potential emissions of nitrogen oxides (NOx) and volatile organic compounds (VOCs) resulting from testing activities conducted at the Naval Undersea Warfare Center Division, Newport Testing Range.

Table 1: List of On-Water Sources, Engines and Fuels

Boat or Source	Fuel	Number of Engines and Engine Size
WB825 (small boat)	Gasoline	One - 225 hp
UB-8906 (small boat)	Gasoline	One - 130 hp
RHIB 54 Boat (small boat)	Gasoline	Two - 40 hp
RHIB 687 Boat (small boat)	Gasoline	One – 90 hp
RHIB 85 Boat (small boat)	Gasoline	One -25 hp
WB-30	Diesel fuel oil	Two – 225 hp
TWR-841	Diesel fuel oil	Two – 2350 hp
Spartan 1 (Unmanned Surface Vehicle)	Diesel fuel oil	Two – 315 hp
Spartan 2 (Unmanned Surface Vehicle)	Diesel fuel oil	Two – 400 hp
Spartan 3 (Unmanned Surface Vehicle)	Diesel fuel oil	Two -440 hp
Spartan 4 (Unmanned Surface Vehicle)	Diesel fuel oil	Two – 500 hp
High Speed Ferry	Diesel fuel oil	Four – 1300 hp
Electric Generator Set 841	Diesel fuel oil	Two – 200 hp

Figure D.2-3a: Sample Conformity Analysis for Rhode Island

In addition to the engine information for each boat, the annual hours of operation for each boat was needed to estimate the emissions of NOx and VOCs. Using the engine and fuel information and proposed boat activities, the appropriate emission factors were identified from various Environmental Protection Agency documents for marine engines. These documents included, but were not limited to:

1. Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder, EPA420-D-007-001, March 2007.
2. USEPA Memorandum, "Emission Factors for Recreational Marine Diesel Engines," EPA Doc No. EPA420-F-02-044, dated 09 September 2002.
3. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition EPA 420-P-04-009. April 2004.
4. "Conversion Factors for Hydrocarbon Emission Components" EPA420-R-05-015. December 2005, NR-002c.

For each source, the appropriate emission factor is multiplied by the time of use and engine size to estimate emissions. A similar methodology was applied to calculate aircraft emissions. The emissions of criteria air pollutants from all sources were added and converted to tons per year. Appendix D of the EIS/OEIS contains all the information from which these emissions estimates were calculated. The emissions estimates for CO, NOx, and VOC for each alternative are given in Table 2 below.

Table 2: Rhode Island Emissions Estimates for the Preferred Alternative

Estimated Annual Air Pollutant Emissions in Rhode Island State Waters (within 3 nautical miles), Alternative 2			
Emissions by Air Pollutant (TPY)			
	CO	**NOx**	**VOC**
No Action Alternative	**42.78**	**38.56**	**2.02**
Alternative 2			
Aircraft	0.04	0.20	0.01
Vessels	64.47	60.64	3.11
Alternative 2 Total	**64.51**	**60.84**	**3.12**
Change	**21.73**	**22.28**	**1.10**
de Minimis Threshold	100	100	50
Exceeds Threshold	NO	NO	NO

TPY=tons per year; CO = carbon monoxide; NOx = nitrogen oxides; VOC = volatile organic compounds

Figure D.2-3b: Sample Conformity Analysis for Rhode Island

REFERENCES

Aircraft Environmental Support Office. (1999). AESO memoradum report no. 9929. Aircraft emission estimates: H-60 landing and takeoff cycle and in-frame, maintenance testing using JP-5. Draft.

Aircraft Environmental Support Office. (2000a). AESO memoradum report No. 9915, revision A. Aircraft emission estimates: S-3 landing and takeoff cycle and in-frame, maintenance testing using JP-5.

Aircraft Environmental Support Office. (2000b). AESO memorandum report no. 9943, revision B. Aircraft emission estimates: E-2 mission operations using JP-5.

Aircraft Environmental Support Office. (2000c). AESO memorandum report no. 9960, revision B. Aircraft emission estimates: H-53 mission operations using JP-5.

Aircraft Environmental Support Office. (2001a). AESO memoradum report no. 9963, revision B. Aircraft emission estimates: AV-8B mission operations using JP-5 fuel.

Aircraft Environmental Support Office. (2001b). AESO memorandum report no. 2000-10, revision B. Aircraft emission estimates: C-130 mission operations using JP-5.

Aircraft Environmental Support Office. (2001c). AESO memorandum report no. 9959, revision B. Aircraft emission estimates: H-46 mission operations using JP-5.

Aircraft Environmental Support Office. (2002). AESO memoradum report no. 9933, revision B. Aircraft emission estimates: F/A-18 mission operations using JP-5.

Aircraft Environmental Support Office. (2009a). AESO memoraddum report no. 9824, revision B. Aircraft emission estimates:AH-1W landing and takeoff cycleand maintenance testing using JP-5.

Aircraft Environmental Support Office. (2009b). AESO memoradum report no. 9962, revision A. Aircraft emission estimates: UH-1 and HH-1 mission operations using JP-5. .

Aircraft Environmental Support Office. (2009c). AESO memorandum report no. 9929, revision A. Aircraft emission estimates: H-60 landing and takeoff cycle and in-frame, maintenance testing using JP-5.

Aircraft Environmental Support Office. (2009d). AESO memorandum report no. 9941, revision B. Aircraft emission estimates: EA-6B mission operations using JP-5.

Aircraft Environmental Support Office. (2009e). AESO memorandum report no. 9961, revision A. Aircraft emission estimates: AH-1 mission operations using JP-5.

Aircraft Environmental Support Office. (2010). AESO memoradum report no. 9948, revision C. Aircraft emission estimates: P-3 mission operations using JP-5.

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John J. McMullen Associates. (2001). Emission factors for Navy ships.

U.S. Air Force. (2002). Air Force Institute for Environment: Safety and occupational health risk analysis. Aircraft/auxiliary power units/aerospace ground support equipment emission factors.

U.S. Department of the Navy. (2008). Final environmental impact statement for the introduction of the P-8A multi-mission maritime aircraft into the U.S. Navy Fleet.

U.S. Environmental Protection Agency. (1978). Air pollutant emission factors for military and civil aircraft.

U.S. Environmental Protection Agency. (1999). Exhaust emission factors for nonroad engine modeling - spark ignition.

APPENDIX E

PUBLIC COMMENTS AND RESPONSES

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APPENDIX E PUBLIC COMMENTS AND RESPONSES

This appendix includes information about the public's participation in the development of the Atlantic Fleet Training and Testing (AFTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS).

E.1 SCOPING PERIOD

The public scoping period began with the issuance of the Notice of Intent in the Federal Register on 15 July 2010 (Appendix B; Federal Register Notices). This notice included a project description and scoping meeting dates and locations. The scoping period lasted 60 days, concluding on 14 September 2010. The scoping period allowed a variety of opportunities for the public to comment on the scope of the EIS/OEIS. The Navy made significant efforts to notify the public to ensure maximum public participation during the scoping process using stakeholder notification letters, postcard mailers, press releases, and newspaper display advertisements (Chapter 8, Public Involvement and Distribution). The meetings were structured in an open house format, presenting informational posters and written information, with Navy staff and project experts available to answer participants' questions.

The Navy received comments from 69 individuals and groups. Because many of the comments addressed more than one issue, 107 total comments resulted. The following provides a synopsis of the comments received.

Biological Resources–Marine Mammals. A significant number of participants expressed concern about impacts on marine mammals, in particular the North Atlantic right whale. Concerns were associated with use of Navy sonar; ship strikes; impacts of Navy training and testing on habitat, breeding grounds, and migration corridors; and the efficacy of mitigation measures.

Sonar and Underwater Detonations. Many comments mentioned concerns about the effect of Navy sonar on marine life, such as marine mammals, fish, sea turtles, and marine invertebrates. Some comments requested that the EIS/OEIS consider alternative technologies to mid-frequency active sonar.

Threatened and Endangered Species. Numerous comments discussed potential impacts on the North Atlantic right whale habitat and migration routes and on sea turtle nesting areas, nesting seasons, and habitat. Safety issues associated with ship strikes and entanglement were also raised, as were requests for identification of additional mitigation measures.

Water Quality. Water quality comments included general concerns about potential contaminants in the water, potential water quality impacts to fisheries, and habitat associated with Navy training, and adherence to federal and state regulations, including state coastal management programs.

Other. This category includes a range of comments with numerous submissions discussing the importance of offshore alternative energy interests and the need for Navy coordination with those interests and activities, including interaction with federal, regional, and state agencies. Related to that topic was a comment requesting review of wind turbine encroachment on Navy training areas. Other comments stated that new or broadened activities should be performed elsewhere, that previous Navy EIS documents have been inadequate, and that existing National Marine Fisheries Service (NMFS) and other regulatory permits should not be reissued. A comment related to potential effects on cultural and historical resources associated with the Alabama-Coushatta Tribe of Texas in the Gulf of Mexico was also submitted.

Biological Resources—Fish and Marine Habitat. A significant number of participants expressed concerns about impacts on fish and marine habitat, with specific mention of the red drum, striped bass, and effects on bottom habitat supporting snapper and grouper. Two commenters also requested evaluation of Navy activities on potential oil spill residue remaining in the Gulf of Mexico and associated impacts on habitat.

Meetings/National Environmental Policy Act Process. Comments on the National Environmental Policy Act (NEPA) process and scoping meetings included support of the scoping meetings held, the request for a public forum to be held in Texas, and a question about whether the Navy coordinates with local environmental groups as part of the NEPA process. Other comments stated that the EIS process under NEPA was Navy-driven and should include more independent, third-party review and involvement.

Public Health and Safety. Comments were submitted regarding the perceived safety challenges posed to people and the environment from military training and activities. Other comments discussed the importance of Navy training to U.S. defense.

Alternatives. A range of comments discussed alternatives, with some stating that alternatives were inadequate and lacked specificity, others providing suggested modifications to the list of alternatives, and others supporting the alternatives provided and the evaluation of adjoining and overlapping range complexes within one EIS document. Specific comments were submitted regarding the need for additional study of the Outer Continental Shelf resources and a request that the EIS include individual planning areas such as were included in the Atlantic Fleet Active Sonar Testing EIS.

Recreation. Requests were made that the EIS analyze the effects of training and testing on the nearshore environment and recreational resources.

Air Quality. Commenters requested complete characterizations and descriptions of the environmental resources and physical conditions in the area of potential impact, including air quality.

Terrestrial/Birds. In addition to comments about impacts on wildlife and birds in general, a specific request was made for the EIS to consider the impact of Navy training and testing on nesting waterbirds, including those found in the southern Chesapeake Bay.

Depleted Uranium. The concern with depleted uranium involved its effect on U.S. military personnel specifically and on people and the environment in general.

Noise. It was specifically requested that the EIS identify and evaluate potential noise impacts and disturbances from training and testing activities.

Proposed Action. The comment pertaining to the Proposed Action supported the proposal and alternatives.

Regional Economy. One comment noted the importance of the growing offshore alternative energy industry to the state economy and requested consideration of the impact of training and testing sites and activities on potential alternative energy interests.

E.2 PUBLIC COMMENT PERIOD FOR THE DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The 60-day public comment period on the Draft EIS/OEIS began with the issuance of the Notice of Availability and a Notice of Public Meetings in the Federal Register on 11 May 2012 (Appendix B; Federal Register Notices). The public comment period began on 11 May 2012 and concluded on 10 July 2012. The Navy made significant efforts to notify the public to ensure maximum public participation during the public comment period using postcards, press releases, and newspaper display advertisements (Chapter 8, Public Involvement and Distribution).

The Notice of Public Meetings included a project description and dates and locations of the five public meetings. The public comment period allowed a variety of opportunities for the public to comment on the Draft EIS/OEIS (Appendix B; Federal Register Notices). Copies of the Draft EIS/OEIS were provided to 28 libraries along the east and Gulf coasts and the document was available on the project web site for review. Navy representatives were available during the open house public meetings to provide information and answer questions one-on-one. Comment sheets were made available to attendees.

Commenters provided their input on the Draft EIS/OEIS in letters submitted through mail, written or oral comments received at the public meetings, and via the project web site. The Navy also received form letters from one non-governmental organization and a petition from another non-governmental organization. Approximately 76,000 form letters were received, and there were approximately 477,000 signatures on the petition (Sections E.3.2.1 and E.3.2.2, respectively).

E.2.1 COMMENTERS, COMMENTS, AND RESPONSES

This section contains a list of the agencies and private entities that elected to comment on the Draft EIS/OEIS (Tables E-1 and E-2) and a comment matrix with Navy responses associated with each comment (Tables E-3, E-4, and E-5). Scanned copies of comment letters (with comment numbers assigned by the Navy in yellow) are available on the project web site (www.AFTTEIS.com).

E.2.1.1 Commenters

During the 60-day public comment period, comments were received from 8 federal agencies, 16 state/local/regional agencies, 14 non-governmental organizations, and approximately 500 private individuals (approximation due to duplicate comments received). The following table lists the agencies and organizations that submitted comments during the comment period (Table E-1). The Commenter Identifier is used to identify the comments and responses in the comment response matrix (Tables E-3 and E-4). For example, a comment letter from a federal agency could have 10 comments within it. To organize responses, each commenter received a Commenter Identifier and each comment within the letter was numbered (e.g., F01-01 is the first comment in the letter from the Marine Mammal Commission).

Table E-1: Agencies and Organizations Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

Commenter Identifier	Commenting Agency/Organization
Federal Agencies (F)	
F01	Marine Mammal Commission
F02	U.S. Army Corps of Engineers, Norfolk District
F03	Gulf of Mexico Fishery Management Council
F04	U.S. Army Corps of Engineers, Galveston District
F05	National Aeronautics and Space Administration, John F. Kennedy Space Center
F06	Federal Aviation Administration, New England Region
F07	Department of the Interior, Office of Environmental Policy and Compliance
F08	U.S. Environmental Protection Agency
F09	U.S. Army Corps of Engineers, Wilmington District
State Agencies (S)	
S01	Florida Department of Environmental Protection (includes comments from the Outer Continental Shelf Program, Bureau of Beaches and Coastal Systems, Fish and Wildlife Conservation Commission)
S02	Virginia Department of Environmental Quality
S03	State of Rhode Island Coastal Resources Management Council
S04	Texas Commission on Environmental Quality
S05	Virginia Marine Resources Commission
S06	North Carolina Department of Cultural Resources, State Historic Preservation Office
S07	Connecticut Department of Energy and Environmental Protection
S08	Delaware Department of Natural Resources and Environmental Control
S09	North Carolina Division of Marine Fisheries (also submitted under S11)
S10	Georgia Department of Natural Resources Wildlife Resources Division
S11	North Carolina Department of Administration on behalf of the Department of Environment and Natural Resources (Division of Marine Fisheries, Division of Parks and Recreation, Division of Coastal Management, and the North Carolina Wildlife Resources Commission)
S12	New Jersey Department of Environmental Protection
S13	Port of Virginia, Virginia Port Authority
S14	Maryland Department of Planning, Maryland Department of Natural Resources

Table E-1: Agencies and Organizations Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

Commenter Identifier	Commenting Agency/Organization
Local/Regional Government Agencies (L)	
L01	City of Norfolk, Virginia
L02	City of Virginia Beach, Virginia
L03	County of Monroe, Florida
Organizations (O)	
O01	Maryland Environmental Services
O02	Ocean Conservation Research
O03	Hampton Roads Military and Federal Facilities Alliance
O04	Sierra Club
O05	Wildseas.org
O06	Sierra Club Ocean County Group (New Jersey)
O07	Last Stand (Protect Key West & the Florida Keys)
O08	Ocean Defender
O09	Natural Resources Defense Council
O10	Humane Society Veterinary Medical Association
O11	Savannah Airport Commission
O12	Natural Resources Defense Council (Form Letter)
O13	Moveon.org (Petition)

As stated above, comments were received from approximately 500 private individuals (approximation due to duplicate comments received). The following list contains the private individuals (P) who submitted oral or written comments during the comment period (Table E-2). The Comment Identifier is used to identify the comments and responses in the comment response matrix (Table E-5). Names of individuals appear as they were provided to the Navy.

Table E-2: Private Individuals Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

P001	A Klick
P002	Aaron Joslin
P003	Aaron Dressin
P004	Abbey Sutherland
P005	Alexander Baggett
P006	Alexi Curington
P007	Alisha Arita
P008	Amanda Evans
P009	Amanda Stovall
P010	Amanda Beard-White
P011	Darlene Moak
P012	David Dow
P013	Dawn Royster
P014	Dawn Kirch
P015	Dawn Nelson
P016	Dawn Lauer
P017	Debbie Carter
P018	Debbie Kozin
P019	Deborah Fletcher
P020	Deborah Seemayer-Iannotti
P021	Amber Tisue
P022	Deborah Salonek
P023	Deborah & Thomas Taylor
P024	Deborah S Van Damme
P025	Debra Scott
P026	Denise Boulet
P027	Denise Wilson
P028	Desiree Herrera
P029	Diana Marmorstein
P030	Diana George
P031	Diane Kastel
P032	Amy Wheeler
P033	Diane Wacker
P034	Dianne Patterson
P035	DiDi Hendley
P036	Donna Beck
P037	Donya Ayers-Bell
P038	Dorene Szeker
P039	Dorene Schutz
P040	Doris Maat
P041	Doug Maesk
P042	Douglas Morrison
P043	Amy Donovan
P044	Ed Madej
P045	Edith Wilson
P046	Edith Maxey
P047	Eileen Schendel
P048	Elaine Smythe
P049	Eleanor White
P050	Eleanor White
P051	Elisse De Sio
P052	Elizabeth Abrams
P053	Elizabeth Gray
P054	Amy Evans
P055	Elizabeth Hall
P056	Elizabeth Hale
P057	Emilia Wronski
P058	Eric Mallin
P059	Erica Cranden
P060	Erika Chotai
P061	Eugene OKeeffe
P062	Evelyn Vollmer
P063	Evi Seidman
P064	Fabiana Fiesmann
P065	Amy Pollman
P066	Flo Flowing
P067	Florence Eaise
P068	Fonda Dichiara
P069	Fonda Feingold
P070	Francine Guokas
P071	Francisco Santos
P072	Francisco de Tavira
P073	Frank Mangione
P074	Frederick Rose
P075	Gary Barton
P076	Ana Koopmans
P077	Gary Pitcock
P078	Geisa Teixeira
P079	George Lyter
P080	Gerrit Blom
P081	Gertrude Wallis
P082	Gina Brown
P083	Ginger Carter
P084	Guillermo Garcia
P085	Gunta Kaza
P086	Gwen Anderson
P087	Andrew Weinstein
P088	Hanna Chitrik
P089	Harriet Shalat
P090	Heather Hintz
P091	Heather Carpenter
P092	Heather Mohan
P093	Heidi Johnson
P094	Heidi Lett
P095	Henry DiPasquale
P096	Holland VanDieren
P097	Holly Gallo
P098	Angela Kemper
P099	Howard Lubel
P100	Igor Khomyakov
P101	Ina Sparka
P102	J Behrens
P103	J Ward
P104	Jack Foreman
P105	Jahn Dussich
P106	James Ruhle

Table E-2: Private Individuals Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

P107	Jan Johnson
P108	Jan McCreary
P109	Angelika Davis
P110	Janet Weeks
P111	Janet Arendacs
P112	Janet Mercer
P113	Janette Kuhn
P114	Janette Reever
P115	Janice Chalifoux
P116	Janna Kruse
P117	Janna de Braal
P118	Jared Sombat
P119	Jarrett Gable
P120	Angie Winterbottom
P121	Jean Public
P122	Jeanette Owen
P123	Jean-François Van den Broeck
P124	Jedde Regante
P125	Jeff Reynolds
P126	Jenni James
P127	Jennifer Pechenik
P128	Jennifer Dowdle
P129	Jennifer Vuillermet
P130	Jennifer Bruns
P131	Anita Herrmann
P132	Jennifer Ford
P133	Jennifer Brown
P134	Jennifer Wiseman
P135	Jenny Jackman
P136	Jessica Woodward
P137	Jessica Woodward
P138	Jill Olson
P139	Jill Ray
P140	Jill Nelson
P141	Joan Lorenz
P142	Anita French
P143	Joanna Randazzo
P144	Joanna Lewis
P145	Joanna Lewis
P146	Jodi Jubran
P147	Jodi Bauter
P148	Jody Gibney
P149	John Webb
P150	John Hotvedt
P151	John Abbott
P152	John Abbott
P153	Anita Welych
P154	John Abbott
P155	John Abbott
P156	John Shippey
P157	Jonathan Ley
P158	Joshua Normandin
P159	Joy Mitchem
P160	Joyce Heid
P161	Judith Fairly
P162	Julaine Nichols
P163	Julia Hume
P164	Anke Groeber
P165	Julia Becker
P166	Julie Goldman
P167	Julie Rosenwinkel
P168	Julie McDaniel
P169	June Polasek
P170	Justin Holt
P171	Kara Linsenmeiwr
P172	Kara Vlach-Lasher
P173	Karen Valerio
P174	Karen Maish
P175	Ann Malone
P176	Karen Swistak
P177	Karla Koebernick
P178	Karli Duran
P179	Kasia Muzyka
P180	Kate Coyle
P181	Kate Freeman
P182	Katherine McRory
P183	Katherine Carrus
P184	Katherine Dorothy
P185	Kathleen Howard
P186	Anna Mason
P187	Kathleen Summers
P188	Kathleen Smith
P189	Kathleen Reier
P190	Kathryn Chalmers
P191	Kathy Patterson
P192	Kathy Braidhill
P193	Katie Jones
P194	Katy Albright
P195	Keith Kocsis
P196	Keith Chaisson
P197	Anna Mason
P198	Kelli Hall
P199	Kelly Grudziecki
P200	Kelly Micklo
P201	Ken K
P202	Kevin Tierney
P203	Kevin Mcmillen
P204	Kevon Storie
P205	Kezia Snyder
P206	Kim Daly
P207	Kim Springer
P208	Anna Sillanpaa
P209	Kim Cox
P210	Kim Davis
P211	Kim Howell
P212	Kimberly Kelly
P213	Kirsi Hepworth

Table E-2: Private Individuals Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

P214	Kris Murphy
P215	Krista Gard
P216	Kristal Basanta
P217	Kristin Callis
P218	L Makely
P219	Anne Byers
P220	Lance Groth
P221	Lance Fanguy
P222	Larry Hirsch
P223	Laura Pereira
P224	Lauren Williams
P225	Lauren Garner
P226	Lawrence Baskett
P227	Leanne Williams
P228	Leanne Redmon
P229	Lee Channing
P230	Anneke Loggie
P231	Leinaala Kalama-Dutro
P232	Leslie Porter
P233	LI Southerland
P234	Libby Stortz
P235	Linda Churchwell
P236	Linda Kocsis
P237	Lisa Reff
P238	Lisa Bigger
P239	Lisa Wilkerson
P240	Lise Guillet
P241	Annette Cole
P242	Liz Marshall
P243	Loraine Miscavage
P244	Lori Girshick
P245	Louise Lilja
P246	Louise River
P247	Luanne Cullen
P248	Luke Gardner
P249	Lynn Anderson
P250	Lynn O'Dowd
P251	Lynn Garman
P252	Annette vd Berg
P253	Lynn Olson-Tuma
P254	Madeline Graham, DVM
P255	Magda Novak
P256	Magda Novak
P257	Magda Novak
P258	Marc Lemiere
P259	Margherite DeSanto
P260	Marguerite Strobel
P261	Maria Turchek
P262	Maria Schultz
P263	Anthony Stuckey
P264	Maria Vint
P265	Marica Mueller
P266	Marina Barry
P267	Marjorie Laird
P268	Markus Scherer
P269	Martha Roberts
P270	Maru Angarita
P271	Mary de Mars
P272	Mary Lotts
P273	Mary Barnich
P274	Arturo Lopez
P275	Mary Garrett
P276	Mary Anne O'Sullivan
P277	Mary P. Daoust
P278	Marylou Schmidt
P279	Matthew Reynolds
P280	Maureen Newton
P281	Maureen Engh
P282	Megan Haug
P283	Melanie Barnet
P284	Melinda McComb
P285	Barbara Haddad
P286	Melinda MacInnis
P287	Melissa Minton
P288	Meredith Loughlin
P289	Micah Loggie
P290	Michael Chapman
P291	Miguel Angel Tejada
P292	Mimi Nguyen
P293	Mindy Sweeny
P294	Monika Thelen
P295	Morgan Riley
P296	Barbara Fleming
P297	Naila Costa
P298	Nan Towle
P299	Nancy Jenkins
P300	Natalie Boydstun
P301	Natasha Keogh
P302	Nicholas Read
P303	Nick Scholtes
P304	Nick Scholtes
P305	Nicole Silva
P306	Noah Craddock
P307	Barbara Fitzpatrick
P308	Olivia Withington
P309	Olof Minto
P310	Paige Lewandowski
P311	Pam Thompson
P312	Parry Lopez
P313	Pasha Yushin
P314	Pat Rasmussen
P315	Patricia Bourland
P316	Patricia Yager Delagrange
P317	Paul Kelley
P318	Barbara Holtz

Table E-2: Private Individuals Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

P319	Paula Avila
P320	Paulette Kaplan
P321	Perdita Holtz
P322	Rachel Feldman
P323	Randy Herz
P324	Rebecca Portman
P325	Rebecca Siegmund
P326	Rebecca Lunardi
P327	Rebekah Maish
P328	Renate Riffe
P329	Barbara Holt
P330	Rhonda Rance
P331	Richard Pendarvis
P332	Rick Monroe
P333	Risa Mandell
P334	Rita Lemkuil
P335	Robert Seat
P336	Robert Seat
P337	Robin Sullivan
P338	Robin Brown
P339	Ron Cole
P340	Barbara Wallace
P341	Rosalind Peterson
P342	Rosemary Packard
P343	Ruth Cooper
P344	Ruth Pennington
P345	Rutily Vincent
P346	Sabrina Roth
P347	Sam Jomes
P348	Samantha Abadinsky
P349	Samantha Novak
P350	Sandra Taylor
P351	Barbara Kann
P352	Sandra Moreland
P353	Sandy Dvorsky
P354	Sarah Swingle
P355	Sarah Hays
P356	Sean Wise
P357	Serena Burnett
P358	Shane McKibben
P359	Sharlene Harrison-Hinds
P360	Sharon Cohen
P361	Sharon Silva
P362	Barbara B. Ruge
P363	Sharon Riley
P364	Shayna Weinstein
P365	Sheila Wells
P366	Sherry Ramsey
P367	Shevy Singh
P368	Simran Kaur
P369	Sonia Hurt
P370	Sophie Ebert
P371	Sophie Ebert
P372	Stacy Wagner
P373	Ben McKinley
P374	Stephanie Small
P375	Stephanie Terry
P376	Stephen Augustine
P377	Stephen Smith
P378	Steve Disch
P379	Steve Armstrong
P380	Sue Murphy
P381	Sujatha Ramakrishna
P382	Susan Menconi
P383	Susan Clapp
P384	Bill Baker
P385	Susan Snowball
P386	Susan Siragusa-Ortman
P387	Susan Woodward
P388	Swamp Deville
P389	Sydney VerVynck
P390	Sylvia Hlynsdottir
P391	Tamara Santelli
P392	Tamarleigh Grenfell
P393	Tara Bionaz
P394	Tara Selbo
P395	Blake Andrews
P396	Ted Lewis
P397	Teresa Keller
P398	Terri Canavan
P399	Terry Baresh
P400	Terry Thompson
P401	Terry Thompson
P402	Terry Thompson
P403	Theresa Sheridan
P404	Thomas Wright
P405	Thomas Brown
P406	Blythe Bostock
P407	Thomas Mazorlig
P408	Thomas Monforte
P409	Tina Drobilek
P410	Tommy Van Gampelaere
P411	Traci Hunt
P412	Tracy Purcell
P413	Tracy Korhonen
P414	Tricia Wyse
P415	Tricia Rizzi
P416	Trina Lopatka
P417	Bonnie Bennett
P418	Valerie Loe
P419	Valerie Retter
P420	Valerie Haak
P421	Vicki Cooper
P422	Vicki Mccallister
P423	Victoria Anderson
P424	Victoria Chamara

Table E-2: Private Individuals Who Commented on the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (Continued)

P425	Victoria Martin
P426	Victoria Strang
P427	Virginia Perry
P428	Bonnie Duncan
P429	Warren Senders
P430	Wendy Vogelgesang
P431	Wendy Alward
P432	Will Jobbins
P433	William Knight
P434	William and Martha Cherry
P435	Yolanda Ochoa
P436	Yzetta Smith
P437	Joseph Steel
P438	Bonnie Card
P439	Brenda Lee
P440	Brian Wauer
P441	Brittany Herz
P442	Bruno Felix
P443	C. Smith
P444	Camille Rousseau
P445	Candice McConnell
P446	Carey Cherivtch
P447	Carmen McIntyre
P448	Carol Stewart
P449	Carol Boyse
P450	Carol Brighton
P451	Caroline Power
P452	Caroline Verde
P453	Carolyn Eck
P454	Carolyn O'Brien
P455	Casey Lewis
P456	Catherine Blystone
P457	Catherine Daligga
P458	Cathy Ritacco
P459	Cathy Pupo
P460	Cayetana Johnson
P461	Cecelia Theis
P462	Charlene Ozell
P463	Charles Swanson
P464	Charlotte Rivas
P466	Charlotte A. Shockley
P467	Cherry Lee
P468	Cheryl Huvard
P469	Chisa Hidaka
P470	Christina Engert
P471	Christina Tallman
P472	Christine Roth
P473	Christine Cina
P474	Christine Coniglio
P475	Christopher Law
P476	Cindy Wargo
P477	Cindy Yang
P478	Claudia Cerio
P479	Cleia Zinser
P480	Colleen Johnson
P481	Colleen Crinion
P482	Cristina Stoyle
P483	Curt Albright
P484	Cyndi Nelson
P485	Cynthia Weller
P486	Cynthia Greb
P487	D. Weinstein
P488	Daria Gyedu
P489	James Ruhle
P490	Beverly Bernice Hatley Wilhite
P491	Eric Bernthal
P492	Chris Capozziello
P493	Brian Hurley
P494	Heather Tallent
P495	Melody Halligan
P496	Richard Barry
P497	F&N
P498	Marisa Landsberg
P499	Pat Ginsbach
P500	J. Capozzelli
P501	Linn Barrett
P502	Don Timmerman
P503	Jean Marie Naples
P504	Beverly Bernice Hatley Wilhite
P505	B. Holden
P506	Suzanne Rivell

E.2.2 COMMENTS AND RESPONSES

Tables E-3, E-4, and E-5 provide a listing of all comments received on the Draft EIS/OEIS and the Navy's responses. Responses to these comments were prepared and reviewed for scientific and technical accuracy and completeness. Comments appear as they were submitted and have not been altered with the exception that expletives, addresses, and phone numbers were removed, as necessary. Table E-3 contains comments from federal (F), state (S), and local (L) agencies received during the public comment period and the Navy's response.

Table E-3: Responses to Comments from Agencies

Comment Identifier	Comment	Navy Response
F01-01	The Marine Mammal Commission recommends that the Navy revise the DEIS by expanding the range of alternatives under consideration to include at least one with lower levels of training and testing activities. Doing so is particularly important at this time when decision-makers may be faced with the choice of reducing the Navy's budget and, if they do so, they should be well informed about the environmental consequences of the various decisions that they might make;	The Navy developed the alternatives considered in this EIS/OEIS after careful assessment by subject matter experts, including military units and commands that utilize the ranges, military range management professionals, and Navy environmental managers and scientists. The environmental consequences of individual activities (e.g., torpedo exercises, mine countermeasures exercises, tracking exercises, etc.) have been analyzed in the EIS/OEIS with sufficient detail to inform the decision maker of the environmental consequences of making a budget-related reduction in training or testing activity if needed. Furthermore, Alternative 1 contains lower levels of training and testing than Alternative 2.
F01-02	The Marine Mammal Commission recommends that the Navy either (1) append to the DEIS any environmental analyses of AUTEC activities or (2) complete such analyses to ensure that activities conducted at AUTEC have been duly evaluated under Executive Order 12114;	Activities at the Atlantic Undersea Test and Evaluation Center (AUTEC) are not part of this Proposed Action. See Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) of the EIS/OEIS (also see Figure 2.1-1) for ranges that are included in the AFTT Study Area.
F01-03	The Marine Mammal Commission recommends that the Navy adjust all acoustic and explosive thresholds for low-, mid-, and high-frequency cetaceans by the appropriate amplitude factor (e.g., 16.5 or 19.4 dB) if it intends to use the type II weighting functions as depicted in Figure 6 of Finneran and Jenkins (2012);	The thresholds were adjusted based on weighting the exposures from the original research from which the thresholds were derived with the Type II weighing functions. The weighted threshold is not derived by a simple amplitude shift.
F01-04	The Marine Mammal Commission recommends that the Navy explain why Kastak et al (2005) data were used as the basis for explosive thresholds in pinnipeds and specify the extrapolation process and factors used as the basis for associated TTS thresholds;	The same offset between impulsive and non-impulsive TTS found for the only species where both types of sound were tested (beluga) was used to convert the Kastak data (which used non-impulsive tones) to an impulsive threshold. This method is explained in Finneran and Jenkins (2012) and Southall et al. (2007).
F01-05	Some of the Navy's activities involve the simultaneous use of multiple source types (i.e., acoustic, explosive, non-explosive impulsive) that generate sound within various frequency bands (i.e., low, mid, and high). To account for activities involving those sources, the Navy has proposed to sum all sound exposure levels received by an animal in each frequency band. However, the DEIS did not describe how the Navy would sum the sound exposure levels from multiple source types (e.g., acoustic vs. explosive).	Events involving multiple source types (e.g., acoustic vs. explosive) are treated as separate events and the sound exposure levels are not summed. In most cases, explosives and sonar are not used within the same activities and therefore are unlikely to affect the same animals over the same time period. Furthermore, two received sounds with different frequency content may not sum physiologically to produce an effect on the animal's hearing. Please see *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Naval Undersea Warfare Center 2012) which is on the project web site (www.AFTTEIS.com) for additional explanation.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F01-06	It also did not explain how the various thresholds for those different source types would be prioritized and applied. In such cases with multiple source types, a simple summation of sound exposure levels may not necessarily estimate takes accurately.	Events involving multiple source types (e.g., acoustic vs. explosive) are treated as separate events and the sound exposure levels are not summed. Furthermore, in most cases, explosives and sonar are not used within the same activities and therefore are unlikely to affect the same animals over the same time period. Energy is summed for multiple exposures of similar source types. For sonars, including use of multiple systems within any scenario, energy is accumulated within the following four frequency bands: low-frequency, mid-frequency, high-frequency, and very high-frequency. After the energy has been summed within each frequency band, the band with the greatest amount of energy is used to evaluate the onset of PTS or TTS. For explosives, including use of multiple explosives in a single scenario, energy is summed across the entire frequency band. Please see the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Naval Undersea Warfare Center 2012) which is on the project web site (www.AFTTEIS.com) for additional explanation.
F01-07	In addition, the Navy used three different types of propagation models: the Comprehensive Acoustic System Simulation/ Gaussian Ray Bundle model for acoustic sources, Reflection and Refraction in Multilayered Ocean/Ocean Bottoms with Shear Wave Effects model for explosive sources, and the Range-Dependent Acoustic Model for non-explosive impulsive sources. The DEIS and supporting technical documents did not provide (1) information regarding how the Navy integrated propagation of sound from those three models into its effects model and (2) details regarding how sound exposure levels would be summed.	Events involving multiple source types (e.g., acoustic vs. explosive) are treated as separate events and the sound exposure levels are not summed. Furthermore, in most cases, explosives and sonar are not used within the same activities and therefore are unlikely to affect the same animals over the same time period. Energy is summed for multiple exposures of similar source types. For sonars, including use of multiple systems within any scenario, energy is accumulated within the following four frequency bands: low-frequency, mid-frequency, high-frequency, and very high-frequency. After the energy has been summed within each frequency band, the band with the greatest amount of energy is used to evaluate the onset of PTS or TTS. For explosives, including use of multiple explosives in a single scenario, energy is summed across the entire frequency band. Please see the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Naval Undersea Warfare Center 2012) which is on the project web site (www.AFTTEIS.com) for additional explanation.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F01-08	The Marine Mammal Commission recommends that the Navy provide detailed information regarding how it determined marine mammal takes that occur when multiple types (i.e., acoustic, explosive, and non-explosive impulsive) of sound producing sources of varying frequencies (i.e., low, mid, and high) are used simultaneously;	Events involving multiple source types (e.g., acoustic vs. explosive) are treated as separate events and the sound exposure levels are not summed. Furthermore, in most cases, explosives and sonar are not used within the same activities and therefore are unlikely to affect the same animals over the same time period. Energy is summed for multiple exposures of similar source types. For sonars, including use of multiple systems within any scenario, energy is accumulated within the following four frequency bands: low-frequency, mid-frequency, high-frequency, and very high-frequency. After the energy has been summed within each frequency band, the band with the greatest amount of energy is used to evaluate the onset of PTS or TTS. For explosives, including use of multiple explosives in a single scenario, energy is summed across the entire frequency band. Please see *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Naval Undersea Warfare Center 2012) which is on the project web site (www.AFTTEIS.com) for additional explanation.
F01-09	The Navy's method for determining those strike probabilities was based on simple probability calculations. For example, it used a Poisson model to estimate the probability of ship strikes based on the historical rate of ship strikes. Although the use of the Poisson model is not unreasonable for modeling the occurrence of rare events, such as a ship striking a marine mammal, the assumption that the encounter rate will remain the same is questionable if the Navy increases the number of training and testing activities or if the abundance and distribution of marine mammals change. Such an approach may be appropriate for the no action alternative but is clearly deficient for assessing impacts of alternatives 1 and 2.	While the number of training and testing activities is likely to increase, it is not expected to result in an appreciable increase in vessel use or transits since multiple activities usually occur from the same vessel. The Navy is not proposing substantive changes in the locations where vessels have been used over the last decade. The rate at which strikes are expected to occur should remain the same.
F01-10	The Marine Mammal Commission recommends that the Navy use its spatially and temporally dynamic simulation models to estimate strike probabilities for specific activities (i.e., movements of vessels, torpedoes, unmanned underwater vehicles and expended munitions, ordnance, and other devices) rather than using simple probability calculations;	The recommendation of the Marine Mammal Commission to use a dynamic simulation model to estimate strike probability was considered, but the Navy found that use of historical data was more appropriate for the analysis. The strike probability analysis completed in this EIS/OEIS is based upon actual data collected from historical use of vessels, in-water devices, and military expended materials and the likelihood that these items may even have the potential to strike an animal. These data account for real world variables over the course of many years and any model would be expected to be less accurate than the use of actual data.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F01-11	The Marine Mammal Commission recommends that the Navy provide the predicted average and maximum ranges for all criteria (i.e., behavioral response, TTS, PTS, onset slight lung injury, onset slight gastrointestinal injury, and onset mortality), for all activities (i.e., based on the activity category and representative source bins), and all functional hearing groups of marine mammals;	Ranges to effects for all criteria and functional hearing groups are provided for representative active sonars (Section 3.4.3.1.8.1, Range to Effects) and explosives (Section 3.4.3.1.9.1, Range to Effects). The representative sources include the most powerful active sonar source and the largest proposed charge weight analyzed. The Navy needs to conduct training and testing in a variety of environments having variable acoustic propagation conditions. These variations in acoustic propagation conditions are considered in the Navy's acoustic modeling and the quantitative analysis of acoustic impacts; average ranges to effect are provided in the EIS/OEIS to show the reader typical zones of impact around representative sources.
F01-12	In contrast, the Navy uses visual, passive acoustic, and active acoustic monitoring during Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar activities to augment its mitigation efforts over large areas. It is not clear why the Navy is not proposing to use those same monitoring methods for the other activities described in the DEIS.	Mitigation measures were developed on a case-by-case basis based on predicted potential impacts; therefore, the use of acoustic monitoring is not always warranted, nor practicable from an operational standpoint (Section 5.3.2.1, Acoustic Stressors). Some events do use passive acoustic monitoring as part of the mitigation when practicable, including improved extended echo ranging sonobuoys, explosive sonobuoys using 0.6–2.5 pound net explosive weight, explosive torpedo testing, and sinking exercises. The active sonar system used by SURTASS LFA is built into the system’s vertical array and can only be employed in this fashion from a slow-moving platform. It is not possible to employ this system on the types of platforms analyzed in the AFTT EIS/OEIS because it cannot be installed on other ship classes.
F01-13	The Marine Mammal Commission recommends that the Navy use passive and active acoustics, whenever practicable, to supplement visual monitoring during the implementation of its mitigation measures for all activities that generate sound;	Passive acoustic monitoring is already and will continue to be implemented with several activities (e.g., Improved Extended Echo Ranging sonobuoys and torpedo [explosive] testing). Information on mitigation measures can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS. The mitigation measures listed in the Final EIS/OEIS are the result of the consultation with NMFS.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F01-14	In addition, the Navy proposes that, if feasible, it will cease acoustic activities (i.e., active sonar transmissions) and explosive activities (i.e., detonations that do not use time-delay firing devices) when a marine mammal is detected within the mitigation zone. Those activities would resume when the animal is "thought to have exited" the mitigation zone. The meaning of "thought to have exited" is not clear, and a more definitive criterion is needed to clarify when activities might be resumed.	Clarification of what is meant by "thought to have exited" (based on animal course and speed) as well as information on post-sighting activity recommencement criteria has been added to Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) for each activity.
F01-15	The Marine Mammal Commission recommends that the Navy cease the use of its sound sources (including explosive activities that do not use time-delay firing devices) and not reinitiate them for periods at least as long as the maximum dive times of the species observed (if identified to species) or likely to be encountered (if species identification is uncertain), after the sighting of one or more marine mammals within or about to enter a mitigation zone;	Dive behavior varies across species. As described in the *Dive Distribution and Group Size Parameters for Marine Species Occurring in Navy Training and Testing Areas in the North Atlantic and North Pacific Oceans* technical report, a 30-min. waiting period accounts for the dive capabilities typical of most species. Recommencement wait periods longer than 30 min. after sighting an animal would be impracticable to implement and would decrease realism of activities. For activities involving platforms restricted by fuel or other constraints (e.g., helicopters), the wait times have been adjusted based on operational need and practicability of implementation. Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) discusses effectiveness of each wait time for each activity. Lastly, species-specific identification of marine mammals is not a Lookout requirement; therefore, a single activity-specific waiting time is needed for all species.
F01-16	The Marine Mammal Commission recommends that the Navy adjust the size of the mitigation zone for mine neutralization events using the average swim speed of the fastest swimming marine mammal occurring in the area where time-delay firing devices would be used to detonate explosives;	The principles of AFTT time delay firing device mitigation are similar to those contained within the 2011 VACAPES Letter of Authorization. For time delay activities, the mitigation zone is 1,000 yd. for all charge sizes (5, 10, and 20 lb. charges) and for a maximum time-delay of 10 min. The mitigation zone takes into account a portion of the distance that a marine mammal could potentially travel during the time delay. However, the mitigation zone was set at 1,000 yd. because that is the maximum distance that Lookouts in two small boats can realistically observe. The use of more than two boats for observation during this activity presents an unacceptable impact to readiness due to limited personnel resources. If a swim speed of 3 knots (102 yd./min.) (a nominal average for a delphinid in this area) is considered, the 1,000-yd. mitigation zone results in coverage of the potential range to mortality for all charges, including up to a 9-min. time-delay. Furthermore, the mitigation zone covers the potential range to injury for 5 lb. charges, including up to a 6-min. time-

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
		delay, and for 10 lb. and 20 lb. charges, including up to a 5-min. time-delay. The 3 knot swim speed, therefore, was a consideration, but not the only determining factor in development of the time delay mitigation zones; therefore, considering different swim speeds would not result in a change to or expansion of the mitigation zone size for time delay activities. The Navy asserts that the 1,000-yard time delay zone is both practical and protective. The proposed AFTT mitigation zone covers the entire predicted maximum range to PTS as well as a portion of the estimated swim speed distance.
F01-17	The Marine Mammal Commission recommends that the Navy revise its DEIS by (1) including in its cumulative impacts analysis all potential risk factors, whether they are deemed individually significant or negligible	As stated in Section 4.2.2 (Identify Appropriate Level of Analysis for Each Resource), in accordance with Council on Environmental Quality guidance, the cumulative impacts analysis focused on impacts that are "truly meaningful." This was accomplished by reviewing the direct and indirect impacts that could occur on each resource under each alternative. Key factors considered were the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts of each potential stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. Those impacts to a resource that were considered to be negligible were not considered further in the analysis. The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences).
F01-18	The Marine Mammal Commission recommends that the Navy revise its DEIS by... (2) describing the specific details needed for the reader to evaluate the utility of the Navy's conceptual framework for its cumulative impacts analysis.	As stated in Section 4.2.2 (Identify Appropriate Level of Analysis for Each Resource), in accordance with Council on Environmental Quality guidance, the cumulative impacts analysis focused on impacts that are "truly meaningful." This was accomplished by reviewing the direct and indirect impacts that could occur on each resource under each alternative. Key factors considered were the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts of each potential stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. Those impacts to a resource that were considered to be negligible were not considered further in the analysis. The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences).

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F02	We suggest that the final EIS contain the acknowledgement that Navy must comply with the Clean Water Act and Rivers and Harbors Act, as stated in the draft EIS. With that acknowledgement, we believe that our business line interests such as, but not limited to dredged material placement areas, sand borrow areas, navigational channel configuration and maintenance, activity on or connected to the Outer Continental Shelf (OCS) including wind energy and electrical transmission, danger zones, and similar operational or regulatory matters should be minimally affected by direct or indirect effects of the proposed action.	With respect to Navy's compliance with the Clean Water Act and Rivers and Harbors Act, text in the Final EIS/OEIS in Section 3.0.1.1 (Federal Statutes) is consistent with the Draft EIS/OEIS.
F03	The GMFMC proposes the establishment of a one kilometer buffer zone around all known hardbottom and artificial reef habitats when conducting any exercises during which explosive ordnance will be expended.	Mitigation measures related to hard bottom and artificial reef habitats can be found in Section 5.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks Within Entire AFTT Study Area), which includes a 350-yd. (320-m) radius mitigation zone around known locations. For activities where explosions may occur on or near the bottom, the impact area for the largest mine (650-lb. charge) is estimated to be 0.001375 km^2. This is more than two orders of magnitude smaller than the 0.321536-km^2 (conversion of the 320-m radius into a circular area) mitigation zone that is being avoided. Since the majority of activities where explosions may occur on or near the bottom would involve explosive charges much smaller than 650 lb. (for Preferred Alternative, see Tables 3.3-5 and 3.3-6), the current mitigation zone sufficiently reduces potential impacts on both the seafloor habitats and living resources that may occur there. These mitigation measures have been developed in coordination with NMFS through consultation on Essential Fish Habitat.
F04	We have reviewed your request and have concluded that your proposed action is located in navigable waters of the U.S. The U.S. Army Corps of Engineers regulates the placement of structures and/or work performed in/or affecting navigable waters of the U.S. under Section 10 of the Rivers and Harbors Act of 1899. The Corps also regulates the discharge of dredged and/or fill material into waters of the U.S., including navigable waters, under Section 404 of the Clean Water Act. Therefore, if your proposed action includes work and/or structures or the discharge of dredged and/or fill material into a navigable water of the U.S. a Department of the Army permit may be required.	The Navy will obtain appropriate permits as required.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
F05	NASA Kennedy Space Center has no comments for any of the proposed alternatives.	Thank you for your review.
F06	Because the study area affects several regions of the Federal Aviation Administration (FAA), we coordinated with the FAA Office of the Environment and Energy, located in Washington, DC. After reviewing the information, they determined that no reply was necessary. The FAA, New England Region, has no further comments.	Thank you for your review.
F07-01	As discussed in DEIS sections 2.2.2 (Amphibious Warfare) and 2.2.8 (Naval Special Warfare), training may include shore assaults and boat-to-shore gunnery activities. Depending on specific timing and location, these activities could adversely affect sea turtles (nesting behavior, nests, and hatchlings), shorebirds (including wintering populations of the threatened piping plover), manatees, and coastal habitat. However, the DEIS does not provide enough details about these activities for the Department to determine whether our concern is warranted, and we recommend addressing such potential impacts in the Final Environmental Impact Statement (FEIS). Although the Navy examined potential acoustic, electromagnetic, physical disturbance or strikes, entanglement, and ingestion impacts of the proposed activities, the analyses and criteria applied in the DEIS are primarily focused on in-water species and not those occurring above the mean high water line.	Additional descriptions of amphibious warfare and naval special warfare can be found in Appendix A (Navy Activities Descriptions). The Study Area only includes areas up to the mean high water line; areas landward of that are not a part of the Study Area (Section 2.1, Description of the Atlantic Fleet Training and Testing Study Area). The Navy consulted with U.S. Fish and Wildlife Service as appropriate.
F07-02	To avoid impacts to migratory shorebirds and seabirds, the Department recommends that the Navy avoid construction and training activities during their breeding/nesting season near known nesting sites.	The Navy consulted with U.S. Fish and Wildlife Service as appropriate and will comply with the mitigation measures resulting from consultation. Section 3.6 (Birds) analyzes birds. Section 5.3.3.4 (Birds) discusses specific measures implemented within defined mitigation areas for birds.
F07-03	Similarly, we recommend adjusting the timing of activities to avoid disturbances in the vicinity of historically significant onshore and offshore foraging sites for flocks of migrating birds and in the vicinity of winter onshore foraging sites for the piping plover.	The Navy consulted with U.S. Fish and Wildlife Service as appropriate and will comply with the mitigation measures resulting from consultation. Section 3.6 (Birds) analyzes birds. Section 5.3.3.4 (Birds) discusses specific measures implemented within defined mitigation areas for birds.
F07-04	As required under regulations for the Endangered Species Act (Act), the Navy will need to initiate formal consultation with the Department for the effects of the proposed action on the manatee. The Department's lead office for manatee consultations and recovery is the North Florida Ecological Services Field Office.	The Navy has coordinated with the North Florida Ecological Services Field Office. Based on the analysis in the EIS/OEIS and the implementation of mitigation measures, all "may affect" determinations are "not likely to adversely affect." Therefore, the Navy has completed an informal consultation with U.S. Fish and Wildlife Service for the manatee and will comply with the mitigation measures resulting from consultation.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
		Section 5.3.3.1.2 (West Indian Manatee) discusses specific measures implemented within defined mitigation areas for manatees.
F07-05	Sea Turtles: The Navy should initiate formal consultation with the NMFS; however, we request that the Navy include the Department on all consultation correspondence with NMFS.	The Navy has consulted with NMFS for sea turtles and will include the Department of Interior, Office of Environmental Policy and Compliance, on consultation correspondence related to sea turtles.
F07-06	As noted in our General Comments above, we do not anticipate adverse effects to resources under our jurisdiction from the proposed activities, but the description of Amphibious Warfare and Naval Special Warfare activities in the DEIS lacks sufficient detail to support specific concurrence with a determination that these are not likely to adversely affect nesting sea turtles or hatchlings. We request the Navy to provide further details to support the “not likely to adversely affect” and “no effect” findings relative to sea turtles on nesting beaches.	Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) describes the Study Area and states that "land-based portions of the range complexes are not a part of the Study Area.” The Study Area begins at the mean high-water line and extends seaward. Therefore, land based impacts on sea turtles were not addressed in this EIS/OEIS.
F07-07	Accordingly, the National Park Service (NPS) believes the AFTT EIS/OEIS should specifically reference national park units and other protected federal lands on all associated maps and to address potential impacts to park resources in Chapter 3 Affected Environment and Environmental Consequences.	Information on Marine Protected Areas can be found in Section 6.1.2 (Marine Protected Areas).
F07-08	EIS/OEIS describes all three alternatives as having the “same” impact on natural resources and other resource areas. Specifically, Table ES-1 “Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2” on pages ES-8 to ES-10 concludes that impacts on marine mammals, sea turtles, birds, vegetation, and other resources “would be the same as those described in the No Action Alternative.” However, the selection of Alternative 2 (i.e., the Preferred Alternative) “consists of all activities that would occur under Alternative 1 plus the establishment of new range capabilities, as well as modifications of existing capabilities; adjustments to type and tempo of training and testing; and establishment of additional locations to conduct activities within the Study Area. This alternative allows for additional range enhancements and infrastructure requirements...” (page 2-76). It would also “increase number of events conducted overall, with a 10 percent increase in the tempo of all proposed Naval Air Systems Command testing activities. Increase flexibility in conducting all at-sea explosive testing in either location identified.” (page 2-78). Specifically, Alternative 2 would allow	The language was revised to indicate that though the number of individual impacts may increase under Alternatives 1 and 2, the types of impacts would be the same as the No Action Alternative.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	for mine warfare testing and training. When combined with other activities authorized under Alternative 2, there may be a greater overall impact on endangered sea turtle populations than the No Action Alternative. As such, we encourage the Navy to consider including additional analysis to better address how the Alternative 2, the Preferred Alternative, and Alternative 1 will have the "same" impact as the No Action Alternative on sea turtles and other resource categories outlined on Table ES-1.	
F07-09	To reduce any confusion regarding the proposed action, we strongly encourage the clear identification of Alternative 2 as the Preferred Alternative.	The Preferred Alternative was identified in the Draft EIS/OEIS and is identified more prominently in the Final EIS/OEIS.
F07-10	We encourage the Navy to consider forming a monitoring partnership with specific NPS units to share information and to closely study the effects of the Navy's testing and training program.	The Navy's approach to monitoring can be found in Section 5.5 (Monitoring and Reporting).
F07-11	The Navy may wish to consider supporting (with funding or otherwise) NPS sea turtle monitoring programs as well as other ongoing scientific research underway by various university partners.	The Navy's approach to monitoring can be found in Section 5.5 (Monitoring and Reporting). Monitoring reports can be found on the NMFS Office of Protected Resources webpage (www.nmfs.noaa.gov/pr).
F07-12	In the wake of the Deepwater Horizon (DWH), Mississippi Canyon C252 oil spill incident, it may be necessary to re-evaluate the biological impacts of the proposed action on Gulf Islands National Seashore. What may have previously been a temporary disruption or short-term minor displacement of certain species may now be a more significant impact as a result of the oil spill. Unfortunately, it may be some time before the long-term biological effects of the spill are fully determined. In the case of benthic invertebrates, pelagic fish, mollusks, crustaceans, and other marine species, suitable stocks for recruitment and recolonization may have been jeopardized by the incident. Consequently, recovery times for species abundance, diversity, and biomass should be expected to increase substantially. At a minimum, the cumulative impacts evaluation section of the EIS/OEIS needs to now consider the collective impacts of any proposed operations to near or off shore areas in proximity to the barrier islands (1 mile or less) in conjunction with the DWH oil spill.	The Affected Environment section of each biological resource subchapter discusses general threats, which include oil spills. The *Deepwater Horizon* spill was considered as part of the current baseline of the Affected Environment where relevant. Section 4.3.10.4 (Major Pollution Events) describes the *Deepwater Horizon* spill in terms of cumulative impacts.
F07-13	Given the disruptions to many marine and coastal species such as shorebirds and sea turtles resulting from oil spill response activities, it is more important than ever to implement seasonal timing of project activities. As such, the park encourages caution for other marine	In consultation with NMFS and U.S. Fish and Wildlife Service, the Navy has developed a suite of mitigation measures that are practicable to implement and that allow training and testing activities to meet their readiness requirements. Through careful exploration of all mitigation

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	areas in close proximity (1 mile radius or greater) to the barrier islands during the sensitive wildlife nesting period of March – October.	measures to determine which were the most effective, the Navy chose the proposed measures, which are designed to avoid or reduce potential impacts on marine resources. Additional discussion of mitigation measures, including temporal restrictions specific to sea turtles and birds, can be found in Section 5.3.3.3 (Reptiles) and Section 5.3.3.4 (Birds).
F07-14	Finally, we wish to inform you that commercial ferries in Mississippi operate between Gulfport and Ship Island – East and West Ship Islands are included within the jurisdictional boundaries of the national park unit.	Analysis in Chapter 3.11 (Socioeconomic Resources) addresses the accessibility of ocean and airspace. Section 3.11.3.1 (Accessibility) concludes there would be no impacts on commercial and recreational activities, including commercial ferries, when Navy training and testing activities temporarily change access to the ocean or airspace in the Study Area.
F07-15	There appears to be no analysis of the frequency, duration, or intensity of piping plover exposure to aircraft noise for aircraft in transit to offshore training areas.	The Navy has consulted with the U.S. Fish and Wildlife Service and developed mitigation to address this issue. Section 5.3.3.4 (Birds) discusses specific measures implemented within defined mitigation areas for piping plovers.
F07-16	What data support the “may affect, not likely to adversely affect” determination for piping plovers under the No Action Alternative?	Please refer to Section 3.6.3.1.5 (Impacts from Aircraft and Vessel Noise), where the potential impacts of the No Action Alternative on the piping plover are described. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. Furthermore, Section 5.3.3.4 (Birds) discusses specific measures implemented within defined mitigation areas for piping plovers.
F07-17	In addition, the Draft EIS contains a limited discussion of the critical habitat for piping plover. Specifically, piping plover critical habitat is mentioned in one sentence: “Critical habitat for wintering piping plovers is designated in the Marquesas Keys.” However, there are many other locations with piping plover critical habitat (See second paragraph in section 3.6.2.1 beginning on page 3.6-13).	A full description of piping plover critical habitat can be found in Section 3.6.2.6 (Piping Plover). The critical habitat area in the Marquesas Keys is the only piping plover critical habitat with potential for overlap with aircraft noise originating from airfields. For all other piping plover critical habitat areas, aircraft noise would occur farther offshore.
F07-18	It is unclear what analysis supports the conclusion that “Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.” Is this a regulatory exemption from impacts under the MBTA, or were stressors analyzed for effects? If stressors were analyzed, where is this analysis? This should be	As discussed in Section 3.6.1.3 (Migratory Bird Treaty Act Species), Migratory Bird Treaty Act species are not analyzed individually, but rather are grouped by taxonomic or behavioral similarities based on the stressor being analyzed. The analysis conducted on groups of birds was then used to make a Migratory Bird Treaty Act determination for each stressor by alternative. Using the analysis for each individual stressor, the Navy determined training and testing activities would not result in an adverse effect on migratory bird populations (Section 3.6.4.3, Migratory Bird

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	provided in the Final EIS/OEIS.	Treaty Act Determinations).
F07-19	We would like to work with the Navy to identify measures such as increased aircraft operations buffers, flight operations rules, or other appropriate measures to avoid adverse effects to park resources, and we may seek other mitigation for adverse effects to park resources when impacts cannot be avoided.	The Navy does not anticipate adverse effects from the Proposed Action, including park resources. Information on Marine Protected Areas can be found in Section 6.1.2 (Marine Protected Areas) of the Draft and Final EIS/OEIS. Mitigation measures can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Draft and Final EIS/OEIS. The Navy welcomes opportunities to discuss studies of this nature.
F07-20	Because the Dry Tortugas National Park and the associated Research Natural Area are intended to preserve and protect the marine resources in these areas, we would like to work with the Navy to monitor the acoustic impacts to the Park to potentially identify measures that would avoid and minimize potential effects to marine fauna.	Information on Marine Protected Areas can be found in Section 6.1.2 (Marine Protected Areas). The Tortugas Military Operations Area is an air exclusion zone established to protect Fort Jefferson and Dry Tortugas National Park and is discussed in more detail in Section 3.10.2.3.2 (Tortugas Military Operations Area). Furthermore, the Navy's approach to monitoring can be found in Section 5.5 (Monitoring and Reporting). The Navy welcomes opportunities to discuss studies of this nature.
F07-21	The South Florida National Parks provide important stopover habitat for these migrating birds. The Department would like to work with the Navy and other interested parties to help identify practicable measures to minimize risk to migrating birds and bats such as seasonal flight restrictions, altitudinal restrictions, radar monitoring of bird aggregations, or other such measures.	The Navy welcomes opportunities to discuss studies of this nature.
F07-22	We are concerned about the use of chaff in areas frequented by migratory birds and bats. While the potential effects of chaff on birds and bats do not appear to be well-known, a Government Accountability Office (GAO) report regarding the use of chaff (GAO 1998) recommended an examination of the respirability of fibrous particles in avian species. We are not aware of results of any such studies, but would like to work with the Navy to develop improved understanding of the potential effects of chaff on fish and wildlife and their habitats in the parks, including marine species and migrant birds and bats.	Potential effects from chaff were analyzed in Section 3.6.3.4 (Ingestion Stressors – Birds) using the best available scientific literature and studies. The Navy welcomes potential opportunities to cooperate in a study of this nature.
F07-23	The GAO report also notes that, “Initiatives between DOD and DOI are helping to identify and minimize the effects of chaff on public lands. The Fish and Wildlife Service and the Bureau of Land Management have signed agreements with the individual military services to control chaff use over wildlife refuges, Native Americans’ reservations, and public lands.” NPS would like to explore the	Given how and where chaff is used (beyond 3 nm offshore), impacts to south Florida parks are not anticipated. Location of chaff use can be found in the activity tables at the end of Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions - A.1.6). Pursuit of a similar agreement as described in the

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	potential of developing a similar agreement for the south Florida parks.	comment would not be necessary for the Navy.
F07-24	While we do not have evidence of chaff resulting in degradation of parklands or waters, it is likely that chaff occurs on NPS lands and waters, potentially including designated Wilderness Areas. We would like to work with the Navy to assess potential impacts and identify measures that would minimize the occurrence of chaff in park property. Similarly, there appears to be potential for other military materials and debris resulting from training activities to occur in park waters, and we would like to work with the Navy to minimize the occurrence of military debris because it detracts from the near-pristine natural marine communities that Dry Tortugas National Park was intended to protect and maintain.	Potential impacts from chaff on sediment and water quality are discussed in Section 3.1.3.4 (Other Materials), which concludes there would be no chemical alteration of water and sediment from decomposing chaff fibers. A discussion on Navy activities in relation to Marine Protected Areas can be found in Section 6.1.2 (Marine Protected Areas). The Navy does not anticipate any increase in the amount of military materials expended in park waters.
F08	EPA believes that the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- "Lack of Objections." A summary of EPA's rating is enclosed.	Thank you for your comment.
F09	Specifically, this office is commenting about section 3.0.1, entitled Regulatory Framework. This section discloses the different regulatory laws, rules, and or policies which exist that may define environmental consequence. It appears that the EIS omits two potential regulatory procedures that may enumerate environmental consequences. The Army Corps of Engineers has responsibility under section 404 of the Clean Water Act (CWA) to regulate the discharge of fill material in jurisdictional waters and, in this case, out to three nautical miles as defined in 33 CFR 328.4. Secondly, the Corps has regulatory responsibility under Section 10 of the Rivers and Harbors Act (RHA) of 1899. This Act requires Corps permits for work or structures, including structures on the OCS seabed, in or affecting navigable waters. The Corps evaluates permits for OCS structures with respect to national security and navigational interest. The type of Department of Army (DA) authorization required (i.e., general or individual permit) will be determined by the location, type, and extent of jurisdictional area impacted by the project, and by the project design and construction limits. It is unclear at this point whether the described activities would be regulated by section 404 of the CWA or section 10 of the RHA.	Section 3.0.1 was meant to include only those regulatory laws, rules, and policies applicable to the Proposed Action. The Rivers and Harbors Act discussion was unintentionally omitted and has been added in the Final EIS/OEIS. The Proposed Action does not involve discharge of fill material into waters of the United States. If any regulated structures in navigable waters of the United States are necessary in association with any of the analyzed training or testing activities, the Navy will obtain appropriate permits as required by Section 10 of the Rivers and Harbors Act prior to commencement of the regulated activities.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S01-01	Florida understands the U.S. Department of the Navy's (Navy) reasoning for combining the six separate environmental impact statements to evaluate and assess the impacts of similar activities throughout the Atlantic Ocean and Gulf of Mexico, and the AFTT DEIS/OEIS provides a good description of the types and number of activities proposed for each operating area. The extremely large geographic area and diverse habitats and species covered by the document, however, often result in generic and superficial descriptions and analyses, especially of impacts to non-protected species and habitats. For example, it appears that site-specific information collected and analyzed in the JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Jacksonville, Florida – Final Cruise Report (December 31, 2010) was not used in the habitat descriptions provided in the AFTT DEIS/OEIS. The DEP, therefore, recommends that the Navy refrain from combining the analyses for such broad and diverse areas in the future or, at a minimum, tier individual area-specific NEPA analyses off a broader document, such as the AFTT DEIS/OEIS.	Sections 3.3.2.5 (Soft Bottoms) and 3.3.2.6 (Hard Bottoms) of the Draft and Final EIS/OEIS cite the *JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Florida. Final Cruise Report.* The Navy has taken a hard look at potential environmental consequences of the Proposed Action in the entire Study Area. Combining all the Navy activities into one document allows the Navy to assess all its activities in a more comprehensive manner. The rigorous analysis provides sufficient information for careful agency decision making. The conclusions presented in the EIS/OEIS are fully supported in the analysis. Furthermore, the JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Jacksonville, Florida – Final Cruise Report (December 31, 2010) data were used and cited within the document. Section 3.3.2.6 (Hard Bottoms) describes and compares the Navy data to the Southeast Area Monitoring and Assessment Program (SEAMAP)—South Atlantic data.
S01-02	Upon receipt of the AFTT DEIS/OEIS, DEP staff reviewed the project website and found that a benthic habitat survey had been performed and results were available in the JAX OPAREA USWTR Bottom Mapping and Habitat Characterization, Jacksonville, Florida – Final Cruise Report dated December 31, 2010. While staff would have preferred receiving the results of the study soon after its completion (thus allowing more time to review the detailed information), DEP appreciates the Navy's efforts to collect the necessary benthic data for the USWTR area. The DEP requests additional time within which to review all of the video and still photography collected during the study, as well as an opportunity to collaborate with the Navy to determine the best location for cable routes and sonar nodes in relation to benthic resources, artificial reefs, fisheries habitat, etc. before construction begins. This cooperative consultation with the Navy will also allow the state to better understand cable installation methodologies and the effects of laying an estimated 600 NM of cable.	This comment is outside of the scope of this EIS/OEIS, as the construction of the Undersea Warfare Training Range (USWTR) is not part of this Proposed Action. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project. Construction of the Undersea Warfare Training Range (USWTR) is not part of this Proposed Action. Furthermore, the Navy has provided the Florida Department of Environmental Protection raw data from the Undersea Warfare Training Range bottom mapping effort since this comment was made.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S01-03	Section 5 (MITIGATION MEASURES) of the Atlantic Fleet Training and Testing Essential Fish Habitat Assessment – Final Report dated April 2012 (on the project website) does not appear to recognize that the installation, use and removal of seafloor devices – as proposed in the USWTR project – can negatively impact corals and other live-bottom habitats. Florida continues to recommend avoidance of the North Florida Marine Protected Area offshore Jacksonville and all hard/livebottom habitats for any bottom-disturbing activities being conducted by the Navy, since the impacts on hard/live-bottom habitats are expected to be longterm (see AFTT DEIS/OEIS, Page 4-23).	This comment is outside the scope of this EIS/OEIS, as the construction of the Undersea Warfare Training Range (USWTR) is not part of this Proposed Action. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project. The AFTT Essential Fish Habitat Assessment analyzed the use of the range once it is built.
S01-04	The DEP Bureau of Beaches and Coastal Systems (BBCS) advises that its only concern with the proposed activities is the increased potential for ordnance (both exploded and unexploded) to remain in sand borrow areas identified for beach restoration and nourishment. Staff indicates that this situation occurred during the Eglin Air Force Base beach restoration project in 2010. There, the dredge contractor had to cease operations while the area was cleared of ordnance and modify its equipment to avoid recovering any exploded ordnance remnants, resulting in unexpected additional project costs. Other states along the Atlantic coast (e.g., New Jersey, Delaware, Virginia and Maryland) have experienced even more problematic situations, including placement of dredged ordnance on the beach at the risk of public safety.	As discussed in Section 3.11 (Socioeconomic Resources), the Navy would avoid conducting training and testing activities in designated areas of mineral extraction. This precautionary measure would minimize potential impacts on beach restoration and nourishment activities.
S01-05	Section 161.144, F.S., charges the DEP with carefully managing beach-quality sand for the system-wide benefit of the state's beaches. The BBCS requests that sand borrow areas be avoided for exercises involving expendable munitions testing and training. Borrow areas are located primarily within state waters, except for areas off Duval and Brevard Counties, where offshore areas provide sand for the beaches of those counties and Patrick Air Force Base. The BBCS offers its assistance to the Navy in identifying sand borrow areas, as plans are developed for future AFTT and beach restoration activities.	The Navy will forward this item to the appropriate compatible use point of contact. The activities the Navy conducts occur over a wide geographical area, and the impacts on these areas are negligible.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S01-06	The EIS/OEIS should reference any known monitoring data or monitoring plans that may exist for the project areas. To ensure consistency with the Florida Coastal Management Program, staff recommends that the EIS/OEIS also include an analysis of environmental consequences to state-protected species, as well as plans for minimizing and mitigating impacts to the species and their habitats.	The Navy has taken a hard look at potential environmental consequences of the Proposed Action to all resources in the Study Area. The analysis in this EIS/OEIS is supported by the best available science, as described in Section 3.0.5 (Overall Approach to Analysis). State-protected species are not required to be called out individually within the analysis, and instead are included in the overall analysis of groups of species, characterized by distribution, body type, or behavior relevant to the stressor being evaluated. However, species listed under the ESA are analyzed individually and are consulted on under Section 7 of the ESA with NMFS or U.S. Fish and Wildlife Service, as appropriate. Federally listed birds have been addressed in the EIS/OEIS (Table 3.6-1) and are part of the consultation with U.S. Fish and Wildlife Service.
S01-07	Although mitigation measures proposed by the Navy should decrease the probability of lethal encounters with North Atlantic right whales, concerns remain that the proposed activities may result in an increased risk of vessel related injury or mortality. To address the issue, the Navy intends to submit applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act authorizations on a five-year basis. The data and information submitted with each application should include cumulative impacts analyses based on information available at that time. The FWC recommends that the Navy collaborate with the NMFS to develop an adaptive management approach for addressing increased risks – based on specific whale population metrics – to detect and understand risk trends and support effective mitigation.	The Navy has consulted with NMFS under the MMPA and ESA with respect to impacts on federally listed species. The MMPA and ESA allow for adaptive management and are part of the consultation process. Information on monitoring can be found in Section 5.5 (Monitoring and Reporting) of this EIS/OEIS.
S01-08	While the West Indian manatee mitigation measures referenced on Page 5-57 of the AFTT DEIS/OEIS appear to apply only to the basin and channels at Naval Station Mayport, a wide variety of training and testing activities in inshore and nearshore environments may potentially result in adverse impacts to manatees. The FWC, therefore, recommends the EIS/OEIS include all potential mitigation areas/activities and their offsetting measures for manatees. Please note that boat speed zones, such as boating safety zones, exist in many other areas of Florida and in ports other than the Naval Station Mayport vicinity. Such boating speed and safety zones may compliment Manatee Protection Zones, but may also occur in areas where manatee-specific zones do not exist but that are highly utilized by manatees. FWC staff requests that the Navy comply with all	Naval Station Mayport basin and channel are the only locations where manatee protection zones and speed restrictions have been designated within the AFTT Study Area. Within and outside of manatee protection zones, ships will maintain a Lookout and will avoid approaching manatees within a 200-yd. (183-m) mitigation zone, as described in Section 5.3.2.2.1.1, Vessels. Pursuant to the Mayport Integrated Natural Resources Management Plan, the Naval Station Mayport provides training to Harbor Ops personnel to report manatee observations to other vessels in the basin and post signs at select locations alerting personnel of the potential presence of manatees and how to report sightings. In addition, activity-specific mitigation measures outlined in Section 5.3.1 (Lookout Procedural Measures) and Section 5.3.2 (Mitigation Zone Procedural Measures), including those outlined for pierside sonar testing,

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	posted speed zones while traversing inshore and nearshore areas of Florida. In addition, the FWC recommends that: all offsetting measures for pier-side sonar testing, as suggested for Port Canaveral, be utilized at Mayport; manatee observer locations be specified for planned activities; the latest versions of the "Lookout Training Handbook" and "Marine Species Awareness Training" program be included as appendices in the EIS/OEIS; and lookouts also be utilized during vessel docking and departures, particularly at Mayport and Canaveral.	apply to all marine mammals and are implemented anywhere the activity takes place. After consultation with U.S Fish and Wildlife Service with respect to the manatee, and analysis presented in Section 3.4.3 (Environmental Consequences), no additional mitigation measures were recommended for the Mayport, Florida location. All recommended mitigation areas specific to manatees are described in Section 5.3.3.1.2, West Indian Manatee. Manatee observer locations are unique to each activity, and observers would be located in aircraft, on vessels, or on piers, depending on which assets are involved and where the activity is being conducted. The *Lookout Training Handbook* and the Marine Species Awareness Training can be downloaded from https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_environmental/documents/atlantic%20documents,pacific%20documents.
S01-09	The FWC also requests that a number of state-listed bird species and the Atlantic sturgeon and Gulf sturgeon, all of which potentially inhabit the project study areas, be addressed in the EIS/OEIS.	The Navy has addressed the Atlantic and Gulf sturgeon (Table 3.9-1) in the EIS/OEIS and has included these federally listed species in its consultation with NMFS. Federally listed birds have also been addressed in the EIS/OEIS (Table 3.6-1) and are part of the consultation with U.S. Fish and Wildlife Service.
S01-10	Page 3.3-31 – The first full paragraph states that: "The majority of military expended materials that settle on hard bottoms or artificial substrates, while covering the seafloor, will still serve the same habitat function as the substrate it is covering by providing a hard surface on which organisms can attach." For natural hard bottom substrate, expended materials may serve a similar, but not the same, habitat function. This comment is also applicable to the similar discussion found in the AFTT Essential Fish Habitat Assessment – Final Report (Page 4-50).	The Final EIS/OEIS has been updated with this information.
S01-11	Page 4-11 – The Programmatic Environmental Impact Statement for Geological and Geophysical Exploration on the Mid- and South Atlantic Outer Continental Shelf is now beyond the scoping stage. A draft EIS was released in March 2012.	This statement has been updated in the Final EIS/OEIS.
S02-01	The Navy must submit a JPA to VMRC for review and approval, to ensure project consistency with the subaqueous lands management enforceable policy of the VCP.	The Navy prepared a Coastal Zone Management Act consistency determination for Virginia to ensure consistency with the subaqueous lands management enforceable policy of Virginia's Coastal Zone Management Program and received concurrence from the Virginia

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
		Department of Environmental Quality on the consistency determination submitted. Effects on subaqueous lands in the coastal zone would be temporary, localized, and would not measurably affect the environment. The Navy would reduce potential impacts on coastal zone uses and resources through adherence to standard operating procedures and the implementation of environmental mitigation measures. In accordance with the consistency determination submitted to the Virginia Department of Environmental Quality, the Navy will be consistent to the maximum extent practicable with the Subaqueous Lands Management enforceable policy.
S02-02	The Navy should take all reasonable precautions to limit emissions of VOCs and NOx, principally by controlling or limiting the burning of fossil fuels.	Air emissions are addressed in Section 3.2 (Air Quality). All reasonably foreseeable direct and indirect emissions in nonattainment and maintenance areas do not equal or exceed applicable *de minimis* levels.
S02-03	VMRC recommends that time-of-year restrictions for activities, in near-shore waters, during known spawning migrations of any of the aforementioned species should receive careful consideration.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. After consultation with NMFS with respect to ESA-listed fish species, and analysis presented in Section 3.9.3 (Environmental Consequences), no time-of-year restrictions were recommended.
S02-04	Due to the legal status of species documented to be present in the project area, OCR recommends coordination with the Virginia Department of Game and Inland Fisheries (DGIF), the USFWS and the National Marine Fisheries Service (NMFS) for information regarding the possible impacts to these protected species and to ensure compliance with protected species legislation.	The Navy has consulted with U.S. Fish and Wildlife Service and the National Marine Fisheries Service with respect to impacts on federally listed species within the Study Area.
S02-05	The Navy must continue to consult directly with DHR, as necessary, pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations codified at 36 CFR Part 800	Consultation with the appropriate State Historic Preservation Offices, the Advisory Council on Historic Preservation, Native American tribes, and the public and state and federal agencies as required by Section 106 of the National Historic Preservation Act and by government-to-government consultation required by Executive Order (EO) 13007 has occurred.
S02-06	The DEQ Division of Land Protection and Revitalization (DLPR) recommends that, should any on-shore sites in Virginia be impacted, the Navy should conduct an environmental investigation to identify any solid or hazardous waste sites or issues related to related on-	Thank you for your comment. The Proposed Action does not involve solid or hazardous waste sites or issues related to on-shore activities.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	shore activities related to the training operations.	
S02-07	DEQ-DLPR recommends that the Navy access and analyze the data in DEQ's web-based databases to determine if Navy activities would affect or be affected by any sites identified in the databases. The databases include: Permitted Solid Waste Management Facilities; Virginia Environmental Geographic Information Systems (Solid Waste, Voluntary Remediation Program, and Petroleum Release sites); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Facilities; and Hazardous Waste Facilities.	None of these sites fall within the boundaries of this at-sea Study Area.
S02-08	DEQ encourages the implementation of pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.	Concur.
S02-09	Soil that is suspected of contamination or wastes that are generated as a result of training and testing activities in Virginia must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations.	The Proposed Action does not include training and testing activities that would result in contaminated soil or generation of wastes. The training and testing activities are described as "at-sea" since activities would not be conducted on land.
S03-01	As for specific applicable standards for the proposed federal testing and training activity, I would direct your attention to the following sections within Section 1160 of the Ocean SAMP that the EIS should address as part of any consistency determination to be filed with the RICRMC.	The Navy has prepared a Coastal Zone Management Act consistency determination to ensure consistency with the enforceable policies of the Rhode Island Coastal Zone Management Program. The Navy determined Section 1160 of the Ocean SAMP was not applicable to the Navy's Proposed Action because it does not include offshore development or significant long-term impacts to Rhode Island commercial or recreational fisheries. Rhode Island concurred with the Navy's coastal consistency determination.
S03-02	Accordingly, it's unclear as to whether the Navy has already prepared or will be preparing consistency determinations for the State of Rhode Island, or other states for that matter. In either case I would expect that the Navy will review the Ocean SAMP and address the sections noted above prior to filing a consistency determination with the RICRMC.	The text has been revised for the Final EIS/OEIS. The Navy reviewed Rhode Island's Ocean SAMP and included it under its federal consistency review. Coordination with all applicable states and territories, including Rhode Island, under the Coastal Zone Management Act occurred between the release of the Draft and Final EIS/OEIS. Rhode Island concurred with the Navy's coastal consistency determination.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S04	We do not anticipate significant long term environmental impacts from this project as long as construction and waste disposal activities associated with it are completed in accordance with applicable local, state, and federal environmental permits and regulations. We recommend that the applicant take necessary steps to insure that best management practices are utilized to control runoff from construction sites to prevent detrimental impact to surface and ground water.	Thank you for your comment. The Proposed Action does not involve construction or waste disposal.
S05-01	Furthermore, in accordance with §28.2-1203 of the Code, permits from the Habitat Management Division of the VMRC may be necessary for certain training or testing activities that are to occur over, or that may otherwise impact, the identified State-owned submerged bottomlands. Without identifying all of the potential training activities that could occur, specific activities that will result in the filling or encroachment over State-owned submerged bottomlands will require a VMRC permit.	The Navy prepared a Coastal Zone Management Act consistency determination for Virginia to detail consistency with the subaqueous lands management enforceable policy of Virginia's Coastal Zone Management Program. Effects on subaqueous lands in the coastal zone would be temporary, localized, and would not measurably affect the environment. The Navy will obtain appropriate permits as required.
S05-02	In addition, activities that will result in the disturbance to identified areas of submerged aquatic vegetation (SAV) or the abandonment of vessels, structures, or materials out over the State's submerged bottomlands will also require a VMRC permit.	The Navy will obtain appropriate permits as required.
S06	We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.	Thank you for your review.
S07	"In conjunction with the AFTT EIS/OIS process, the Navy will complete a consistency determination or negative determination for each state and territory under the federal consistency review process." That process, as required under 15 CFR Part 930.39, presents an appropriate opportunity to furnish us with additional information concerning proposed actions that will affect or take place in Long Island Sound. We look forward to reviewing your consistency determination.	The Navy has prepared a Coastal Zone Management Act consistency determination to ensure consistency with the enforceable policies of the Coastal Zone Management Program. On 26 February 2013, Connecticut provided its concurrence with the Navy's determination that the Proposed Action is consistent with Connecticut's Coastal Management Program.
S08	The Delaware Department of Natural Resource and Environmental Control (DNREC) previously offered comments for consideration during the 2010 scoping process. The comments focused primarily on the need for baseline assessments of benthic and biological resources in order to determine potential impacts; the importance of	The Navy used the best available science in determining the baseline conditions. As found in Section 3.11.2.2 (Mineral Extraction), sand resources have been considered in the analysis and have addressed the concerns raised during the scoping period. The large marine ecosystem classification system used in this EIS/OEIS was advocated by the

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	not interfering with offshore sand resources potentially available to coastal states; and the need for regional marine spatial planning in order to avoid negatively impacting the renewable resource potential of the Mid-Atlantic.	Council on Environmental Quality's Interagency Ocean Policy Task Force as a marine spatial framework for regional coordination and planning in the United States.
S09	*Duplicate to comments S11-01, S11-02, and S11-03.*	*See responses to comments S11-01, S11-02, and S11-03.*
S10-01	We urge the Navy to incorporate the revised Southeast U.S. right whale critical calving habitat boundaries into the AFTT mitigation plan and final EIS. Expanding the Mitigation Area to encompass the entire NMFS designated calving habitat is the most effective way to reduce adverse impacts to right whales.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS, the Navy evaluated a larger mitigation area to address North Atlantic right whale calving habitat concerns; however, an expanded mitigation area is not being recommended due to the unacceptable impacts it would have with regard to personnel safety, practicality of implementation, and impact on effectiveness of the military readiness activities that occur in that area, Section 5.3.3.1.1.1 (North Atlantic Right Whale Southeast Calving Habitat) describes the recommended measures.
S10-02	The Navy is currently funding right whale surveys and passive acoustic monitoring in the proposed Undersea Warfare Training Range (USWTR) offshore of Jacksonville, FL to address this question. We applaud the Navy for supporting this important research. While a brief summary of aerial survey results is provided in the AFTT DEIS, results of passive acoustic monitoring are not provided. We request that the Navy make this information available. If this or other research demonstrates that right whales frequently inhabit waters greater than 30 nmi from shore, protective measures should be implemented in those areas also.	All monitoring reports are available on the Navy's marine species monitoring web site (http://www.navymarinespeciesmonitoring.us/). Outside of mitigation areas, the mitigation measures identified throughout Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) will apply to marine mammals (including the North Atlantic right whale) year round and will be applied regardless of the location of the activity.
S10-03	We request the Navy provide estimates of vessel abundance and distribution that are expected to occur within the revised NMFS critical habitat boundaries from November 15 to April 15 under each Alternative. Such information is required to assess whether this risk of vessel collisions would increase under Alternatives 1 and 2.	Vessel abundance and distribution is not expected to appreciably change, as discussed in Chapter 3 (Affected Environment and Environmental Consequences). For additional detail on ship strikes and right whales, refer to Section 3.4.3.3.1 (Impacts from Vessels) and Section 3.4.3.3.2 (Impacts from In-Water Devices). Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS provides mitigation measures for the North Atlantic right whale. These measures were developed in coordination with NMFS.
S10-04	While these measures reduce the probability of collisions, the measures are not sufficient to minimize adverse impacts for the	The mitigation measures listed in the Final EIS/OEIS and the Biological Opinion are the result of the consultation with NMFS and U.S. Fish and

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	following reasons: 1) Most of the proposed vessel mitigation measures would only apply within the Mitigation Area, which as stated above, does not encompass the actual area frequently used by right whales. 2) Visual detection methods, while prudent, cannot be relied upon to reliably detect right whales. Right whales are often below the surface of the water and undetectable by visual means. The probability of detecting whales is further reduced in rough seas, inclement weather and at night. 3) "Slowest speed" and "speed reductions" are not defined in the DEIS. Previous studies have indicated that the probability of whale mortality and serious injury are increased at speeds of 10 knots or greater (Laist et al. 2001, Pace and Silber 2007, Vanderlaan and Taggart 2007). The DEIS states that large Navy vessels generally travel at speeds greater than 10 knots. We cannot assess the effectiveness of proposed speed reduction measures because the DEIS does not quantify the amount or distribution of traffic that will occur at speeds less than or greater than 10 knots under each alternative. To minimize adverse vessel impacts to right whales we recommend that Navy vessels 65 feet or greater in length travel at speeds of 10 knots or less when transiting through revised NMFS critical habitat zone from November 15 to April 15. We also recommend that training and testing activities requiring higher vessel speeds should be conducted outside of the NMFS critical habitat when feasible. If Navy vessels are unable to operate at speeds 10 knots or less in the NMFS critical calving grounds, we recommend that the Navy change its assessment of vessel operations to read "may affect and is likely to adversely affect" right whales for each Alternative, as is stated for other species of baleen whales examined in the DEIS.	Wildlife Service. Information on mitigation measures considered but eliminated can be found in Section 5.3.4 (Mitigation Measures Considered but Eliminated) of the Draft and Final EIS/OEIS. Mitigation measures are proposed for vessels in all areas where vessels may operate during training or testing activities. For example, as described in Section 5.3.1.2.3.1 (Vessels), while underway, surface ships will have a minimum of one Lookout.
S10-05	Despite these measures, the Navy acknowledges that the increased explosive ordnance training proposed in Alternatives 1 and 2 "may affect and is likely to adversely affect" right whales. This assessment seems reasonable given the large increase in proposed ordnance detonations. However, the DEIS does not quantify the amount and distribution of proposed ordnance detonations that will likely occur within the calving habitat. We request that the Navy estimate the types, amounts and distribution of ordnance detonations that will occur within 30 nmi of the Southeast U.S. coast from November 15 to April 15 under each Alternative. Such information is required to assess impacts to right whales and the calving habitat under	Mitigation measures for the North Atlantic right whale mitigation area are described in Section 5.3.3.1 (Marine Mammal Habitats) of the Draft and Final EIS/OEIS. As stated, the Navy will not conduct the following activities between 15 November and 15 April within the mitigation area: Low-frequency active sonar High-frequency and non-hull-mounted mid-frequency active sonar (excluding helicopter dipping) Missile activities (explosive and non-explosive) Bombing exercises (explosive and non-explosive) Underwater detonations

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	Alternatives 1 and 2.	Improved extended echo ranging sonobuoy exercises Torpedo exercises (explosive) Small-, medium-, and large-caliber gunnery exercises These mitigation measures were developed in coordination with NMFS during the MMPA permitting and ESA consultation processes.
S10-06	We support the Navy's proposal to restrict ordnance detonations within the Mitigation Area. This approach is the simplest way to avoid adverse impacts to right whales and the calving habitat. However, as stated above, the proposed Mitigation Area does not encompass the actual area frequently used by right whales. We recommend that the Navy increase the size of the Mitigation Area to encompass the NMFS critical calving habitat and avoid testing and training with explosive ordnance within the calving habitat from November 15 to April15.	The mitigation measures listed in the Final EIS/OEIS and the Biological Opinion are the result of the consultation with NMFS and U.S. Fish and Wildlife Service. Outside of mitigation areas (which encompasses the established North Atlantic right whale critical habitat), the mitigation measures identified throughout Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) will apply to marine mammals (including the North Atlantic right whale) year round and will be applied regardless of the location of the activity.
S10-07	We support the Navy's use of Mitigation Zones in locations where densities of right whales and other marine mammals are expected to be low. However, we do not support Mitigation Zones as the primary means of mitigating adverse impacts within the calving habitat.	Thank you for your comment.
S10-08	Accordingly the Navy acknowledges that active sonar training and testing "may affect and is likely to adversely affect" right whales. The Navy's assessment seems reasonable. However, we are unable to fully assess the impacts of the Alternatives because the DEIS does not quantify the extent to which active sonar will be used within the right whale calving habitat. Accordingly, we request that the Navy provide estimates of the following under each Alternative: 1) The type, amount and distribution of active sonar training and testing that will occur within the NMFS critical calving habitat from November 15 to April15 annually 2) The extent to which active sonar noise will likely propagate into/throughout the NMFS critical habitat, and 3) The extent to which active sonar sound may raise ambient noise levels within the NMFS critical habitat.	The timing of training cycles and testing needs varies based on deployment requirements to meet current and emerging threats. Due to the variability, the EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their location. In addition, information regarding the exact location of sonar usage is classified. Moreover, the Navy has already implemented restrictions in the mitigation zone, which encompasses the critical habitat, including the following: Low-frequency active sonar High-frequency and non-hull-mounted mid-frequency active sonar (excluding helicopter dipping) Missile activities (explosive and non-explosive) Bombing exercises (explosive and non-explosive) Underwater detonations Improved extended echo ranging sonobuoy exercises Torpedo exercises (explosive)

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
		Small-, medium-, and large-caliber gunnery exercises These mitigation measures were developed in coordination with NMFS during the MMPA permitting and ESA consultation processes.
S10-09	Given the potential cumulative impacts of active sonar noise on right whales and the calving habitat, we recommend that the Navy proceed conservatively and limit active sonar testing and training in all coastal waters within the NMFS critical habitat of Georgia, South Carolina and northeast Florida from November 15 to April 15.	Cumulative impacts have been assessed in Chapter 4. Information on mitigation measures can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Draft and Final EIS/OEIS. The mitigation measures listed in the Final EIS/OEIS are the result of the consultation with NMFS.
S10-10	However, the portion of training and testing activities that will occur in relation to the USWTR is not stated in the DEIS. We remain concerned that training and testing in the USWTR will have cumulative adverse impacts on right whales and their habitat for the following reasons: 1) The USWTR is located in close proximity to the NMFS critical calving habitat (approximately 20 nmi eastward), 2) The USWTR would concentrate vessel operations and active sonar in close proximity to the calving habitat, 3) Sound from the most powerful active sonar systems is predicted to travel great distances (up to 100 nmi), and 4) Right whales residing in the calving habitat would be exposed to active sonar noise for months at a time. Accordingly, we request that the Navy provide estimates of the following under each Alternative: 1) The type, amount and distribution of vessel traffic predicted to occur within the USWTR from November 15 to April15 annually, 2) The number of vessel transits that will likely occur between the USWTR and Southeast U.S. Navy ports (i.e., Port Canaveral, FL; Mayport, FL; Kings Bay, GA; Charleston, SC) from November 15 to April15 annually, 3) The amount of active sonar training and testing that will occur within the USWTR from November 15 to April15, 4) The extent to which active sonar will likely propagate from the USWTR and into the adjacent NMFS right whale calving habitat, and 5) Whether active sonar emitted from the USWTR will raise ambient noise levels within the adjacent calving habitat.	See page A-77 for details regarding activities in the Undersea Warfare Training Range (USWTR). Activities on USWTR will occur year-round and are estimated to be evenly distributed throughout the year. The Navy vessel traffic in and out of the listed ports will not change from current levels as activities occurring on the USWTR range already take place in this area, just not currently on an instrumented range. Acoustic modeling accounted for the levels that would propagate into the adjacent right whale critical habitat. Active sonar activity is relatively short in duration and is not shown to measurably increase ambient noise levels.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S10-11	As we have stated previously, we also recommend that the Navy conduct a study to validate the Acoustic Effects Model in-situ in Southeast U.S. littoral waters. In such a study, representative sonar systems should be operated within the USWTR and other areas where active sonar training and testing will be concentrated. Received levels should be measured simultaneously at various ranges and locations within the right whale calving habitat. Results of such a model verification study, combined with improved marine mammal density estimates, should be used to corroborate the Acoustic Effect Model results. Long-term passive acoustic monitoring should also be implemented within and adjacent to the USWTR to determine what, if any, impacts active sonar may have on the acoustic characteristics of the calving habitat. Adaptive management triggers (e.g., reductions in active sonar duty cycle, cessation of training when whales are present) should be incorporated into the mitigation plan, thereby allowing impacts from active sonar to be mitigated in the event that adverse impacts are documented after project implementation.	The acoustic propagation models have been validated and approved by the Oceanographic and Atmospheric Master Library. These models are the same used for Navy's tactical decision aids. Long-term passive acoustic monitoring has been occurring in the JAX OPAREA, and the results of the monitoring are presented on the NMFS Office of Protected Resources web site and the Navy's Marine Species Monitoring web site (http://www.navymarinespeciesmonitoring.us/). Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS includes information on the Navy's approach to monitoring (Section 5.5.1). As described in Chapter 5, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
S11-01	The 2010 North Carolina Coastal Habitat Protection Plan (CHPP) defines hard bottom habitat as "exposed areas of rock or consolidated sediments, distinguished from surrounding unconsolidated sediments, which may or may not be characterized by a thin veneer of live or dead biota, generally located in the ocean rather than in the estuarine system". The CHPP explains that live hard bottom does not require "stoney bottom, bedrock, or rubble" as described in section 3.3.2.6 but instead low-relief hard bottom can occur on compacted mud bottom and be intermittently covered with a thin layer of sand (Deaton et al. 2010). This could explain why it appears that mapped live hard bottom may be confused with soft sediment. Please update section 3.3.2.6 accordingly.	The Navy concurs that hard bottom does not have to be composed of stony bottom, bedrock, or rubble, but may instead be made up of compacted sediments such as clay. The text has been updated accordingly. However, the issue of hard bottom being overestimated in the SEAMAP data remains. During the Navy's mapping of the Undersea Warfare Training Range (USWTR) off the coast of northeast Florida, the backscatter from the multibeam sonar and a sub-bottom profiler were used to determine sediment composition and thickness, and followed up with video transects and benthic cores to validate the results. Accordingly, many of the areas denoted as hard bottom in the SEAMAP data actually turned out to be unconsolidated sediments, as noted in the EIS/OEIS.
S11-02	The CHPP also describes the efforts of Moser and Taylor {1995) to collect near-shore hard bottom locations and provides maps that include this data and SEAMAP data. Please add this data to the other mentioned data sources as a part of the mapped live hardbottom in the Protective Measures Assessment Protocol (section 5.3.3.3) which will provide a buffer around hard bottom for certain activities.	These data were added as part of the data sources included in the Navy's Protective Measures Assessment Protocol.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S11-03	Research on impacts of acoustic stressors to hearing specialists and the impacts of electromagnetic devices on the fish identified that can detect electromagnetic properties would be very valuable to the decision making process regarding these activities in the future. DMF encourages increased research and monitoring for impacts to fish species.	Thank you for your comment.
S11-04	Specifically, DPR is concerned about the Endangered Species Act determinations of "may effect, likely to affect" for the loggerhead (*Caretta caretta*) and green sea turtles (*Chelonia mydas*), which are designated as 'Threatened' by the U.S. Fish and Wildlife Service. These species are known to nest along Bear Island, and Hammocks Beach State Park has an ongoing monitoring program in place. DPR respectfully requests the implementation of mitigation measures (i.e., spotter planes) to help avoid or reduce potential impacts to these rare species.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. In addition to activity-specific mitigation measures outlined in Section 5.3.1 (Lookout Procedural Measures) and Section 5.3.2 (Mitigation Zone Procedural Measures), Section 5.3.3.3.1.2 (Sea Turtle Habitat off North Carolina) includes information on Navy's mitigation areas specific to sea turtles in this region.
S11-05	We also respectfully request the implementation of noise mitigation measures to minimize adverse impacts to Park staff and visitors.	Socioeconomic issues associated with the Proposed Action in the Key West Range Complex are addressed Sections 3.11.3 (Environmental Consequences). Section 3.11.3.2 (Acoustic Stressors) states the public might intermittently hear noise from ships or aircraft overflights if they are in the general vicinity of a training or testing activity. Because activities producing airborne noise are normally short-term and temporary, the EIS/OEIS concludes that airborne noise impacts on tourism and recreational activity would be negligible.
S11-06	To limit unintended impacts to nesting sea turtles on North Carolina beaches, we request near shore, in-water activities adhere to the May l - November 15 sea turtle nesting moratorium.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. In addition to activity-specific mitigation measures outlined in Section 5.3.1 (Lookout Procedural Measures) and Section 5.3.2 (Mitigation Zone Procedural Measures), Section 5.3.3.3.1.2 (Sea Turtle Habitat off North Carolina) includes information on Navy's mitigation areas specific to sea turtles in this region.
S11-07	Section 3.11.3.1.14 (Environmental Consequences for Commercial and Recreational Fishing) briefly concludes that naval operations would not lead to a noticeable change from historic use. Therefore,	As stated in Section 3.11.3.1.1.4 (Commercial and Recreational Fishing), the Navy strives to conduct its operations in a manner compatible with commercial and recreational ocean users by minimizing temporary

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	the Navy concluded that commercial and recreational fishing would not be noticeably affected by Navy activities requiring area restrictions. However, the DEIS/OEIS is apparently silent on whether existing Naval operations have had explicit instances of adverse effects on commercial and recreational fishing activities. DCM encourages the Navy to include an affirmative statement on whether existing naval operations have or have not had adverse effects on commercial and recreational fishing activities.	access restrictions. Because the Navy uses Notices to Mariners to allow commercial and recreational fishing boats to adjust their routes to avoid temporary restricted areas and given the size of the Study Area, opportunities for Navy activities to interfere with commercial and recreational fishing are minimal.
S11-08	DCM also encourages the Navy to incorporate a mitigation measure(s) to conduct its training and testing activities in such a manner that adverse effects to commercial and recreational fishing would be avoided.	As stated in Section 3.11.3.1.1.4 (Commercial and Recreational Fishing), the Navy strives to conduct its operations in a manner compatible with commercial and recreational ocean users by minimizing temporary access restrictions. Because the Navy uses Notices to Mariners to allow commercial and recreational fishing boats to adjust their routes to avoid temporary restricted areas and given the size of the Study Area, opportunities for Navy activities to interfere with commercial and recreational fishing are minimal.
S11-09	Nevertheless, we encourage the Navy to condition training and testing activities to avoid the discharge of any hazardous debris or toxic substances that could adversely affect sand and gravel burrow sites.	The Proposed Action does not involve the discharge of hazardous debris or toxic substances that could adversely affect sand and gravel borrow sites. Impacts on sediments and water quality were discussed in Section 3.1 (Sediments and Water Quality) of the EIS/OEIS. As discussed in Section 3.11 (Socioeconomic Resources), the Navy would avoid conducting training and testing activities in designated areas of mineral extraction. This precautionary measure would minimize potential impacts on sand and gravel borrow sites.
S12-01	Historic Preservation Office (SHPO): HPO has reviewed the DEIS concerning its potential to affect historic and archaeological resources. Based on the information submitted, it appears that the proposed undertaking will require consultation under Section 106 of the National Historic Preservation Act for the identification, evaluation and treatment of historic properties within the project's area of potential effects. As a result, the HPO looks forward to further consultation with the United States Department of the Navy pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and it's implementing regulations, 36 CFR §800.	The Navy consulted with the New Jersey State Historic Preservation Office pursuant to Section 106 of the National Historic Preservation Act and New Jersey concurred with the finding that the project will not adversely affect historic properties.
S12-02	If the Department of the Navy is ultimately granted permission to utilize active sonar in New Jersey waters or nearby waters, it is strongly recommended that a minimum of two dedicated, and three	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	non-dedicated, marine mammal lookouts be posted at all times when active sonar is being used, and that such lookouts be provided with binoculars, night vision goggles, and infrared sensors; a 35 minute time period be used to scan the area for cetaceans, due to the long periods of time during which some cetaceans can remain submerged, before engaging active sonar; and the use of active sonar should be terminated when marine mammals are spotted within 2,000 meters. In addition, the use of passive sonar to listen for whales and ensure that they are not within the testing area prior to switching on active sonar is recommended as well as aerial monitoring for at least sixty minutes before sonar use if such use occurs during periods when North Atlantic right whales may be migrating through the area. We highly recommend that the use of active sonar be minimized during February-April and September-December, when endangered marine mammals (including the critically endangered North Atlantic right whale) transit through the area during their migration. We also recommend minimizing active sonar use during June-August when bottlenose dolphins are known to give birth and nurse their young in NJ waters. The Department of the Navy must also accept responsibility for responding to any strandings and/or rescues of marine species which may be associated with use of active sonar.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, or other wildlife given that these same activities have been conducted for decades in other range complexes with no indications of broad-scale impacts that are either injurious to or of significant biological impact on marine mammals, fish, or other wildlife at those locations. Please see the recent results supporting this as presented in training range monitoring reports available at NMFS Office of Protected Resources web site and the Navy's Marine Species Monitoring web site (http://www.navymarinespeciesmonitoring.us/). Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report*, which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are potential impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
S12-03	Other impacts to marine mammals from testing and training activities include injury or mortality from vessel strikes, the use of electromagnetic devices, entanglement in training/testing equipment, and ingestion of munitions and other military expended material. It is highly recommended that vessel speeds are reduced to 10 knots within the mid-Atlantic management area, and that speeds are reduced even further when marine mammals are observed.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The analysis of reduced vessel speeds can be found in Section 5.3.4.1.5 (Reducing Vessel Speeds). There is no evidence that injury or mortality has occurred as a result of electromagnetic devices, entanglement in training/testing equipment, or ingestion of munitions and other military expended material, and no references were provided to support this claim.
S12-04	We highly recommend minimizing testing and training activities, including the use of active sonar, explosives, pile driving, air guns, and weapons firing, during the months of May through September, when sea turtles are known to be present in these locations and along the coast.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. After consultation with NMFS with respect to ESA-listed sea turtles, and analysis presented in Section 3.5.3 (Environmental Consequences), no time-of-year restrictions were recommended off the coast of New Jersey. Section 5.3.3.3.1 (Sea Turtles) describes the recommended measures.
S12-05	Other impacts from testing and training activities on sea turtles include injury or mortality from vessel strikes, the use of electromagnetic devices, entanglement in training/testing equipment, and ingestion of munitions and other military expended material. It is highly recommended that vessel speeds are reduced to 10 knots within the mid-Atlantic management area, and that speeds are reduced even further when sea turtles are observed.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The analysis of reduced vessel speeds can be found in Section 5.3.4.1.5 (Reducing Vessel Speeds). There is no evidence that injury or mortality has occurred as a result of electromagnetic devices, entanglement in training/testing equipment, or ingestion of munitions and other military expended material, and no references were provided to support this claim.
S12-06	It is possible that increased traffic coupled with behavioral changes due to training and testing activities may place Atlantic sturgeon at increased risk from ship strikes. Activities such as equipment/structures on the sea floor could also potentially impact	A thorough analysis of impacts on Atlantic sturgeon by vessels and seafloor devices is in Sections 3.9.3.3.1 (Impacts from Vessel and In-Water Device Strikes) and 3.9.3.3.3 (Impacts from Seafloor Devices) of the EIS/OEIS. The Navy's may affect, not likely to adversely affect

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	this demersal species, along with Shortnose sturgeon (Federally Endangered) that on occasion migrates into ocean waters.	conclusions are fully supported in the analysis. The Navy has consulted with NMFS.
S12-07	We also recommend that the Department of Navy review and take into consideration bird hotspots as identified in the state baseline study: http//www.nj.gov/dep/dsr/oceanwindlindex.htm when conducting training and testing activities off NJ waters.	Species-specific analysis for birds was not possible due to the number of species present in the Study Area. Instead, species were grouped by taxonomic or behavioral similarities based on the stressor being analyzed. Therefore, all birds were already taken into consideration in the analysis. The New Jersey state baseline study didn't really identify hotspots but rather showed modeled density within the Study Area. These densities proved to be extremely variable from year to year, so it was difficult to take any particular areas into account in the analysis in a meaningful way. In addition, very few activities would occur within 20 nm from New Jersey's shore. Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations. After consultation with U.S. Fish and Wildlife Service with respect to ESA-listed birds, and analysis presented in Section 3.6.3 (Environmental Consequences), no mitigation areas were recommended off the coast of New Jersey.
S12-08	Any activity that could lead to a "take" of a State or federally listed endangered or threatened species is discouraged, and the use of alternative technologies to midfrequency active sonar should be strongly considered.	Thank you for your comment.
S13-01	Accordingly, the VPA supports the No Action Alternative and Alternatives 1 and 2 currently presented by the U.S. Navy, provided the proposed boundary, activity and infrastructure expansions discussed in these alternatives will not impact or restrict maritime commerce or commercial navigation within the federal channels into the Chesapeake Bay, Hampton Roads, and the Port of Virginia.	Analysis of the impacts on commercial and recreational activities is in Section 3.11 (Socioeconomic Resources). The Navy is not proposing to add any new restricted areas and proposes to continue the same type of temporary area closures that have occurred for decades.
S13-02	We respectfully recommend that the project team coordinate with and seek comments the U. S. Department of Interior, Bureau of Ocean Energy Management with regard to the proposed Wind Energy Areas slated for lease along the Atlantic Coast, if this has not already occurred.	The Draft EIS/OEIS was submitted to the Department of the Interior, Bureau of Ocean Energy Management for review and comment.
S13-03	In addition, we recommend that the project team also coordinate and solicit input from the U.S. Coast Guard and consider the findings of the USCG Port Route Access Study into its selection of the preferred	As an important stakeholder, the U.S. Coast Guard was notified of the availability of the Draft EIS/OEIS. As noted in Section 3.11.3.1.1.3 (Commercial Transportation and Shipping), the Navy concludes that the

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	alternative.	impacts would be negligible due to advance public notification (Notices to Airmen and Notices to Mariners) and the short-term duration of military activities.
S14-01	The Maryland Department of the Environment commented: Any solid waste including construction, demolition and land clearing debris, generated from the subject project, must be properly disposed of at a permitted solid waste acceptance facility, or recycled if possible.	Thank you for your comment. The Proposed Action does not include generation of solid waste. Please see Chapter 2 (Description of Proposed Action and Alternatives) of the EIS/OEIS for a clear definition of the scope of this project.
S14-02	This Department, Planning, commented that the Navy should coordinate with the Maryland Historical Trust regarding protection of undersea or underwater historic or archeological resources. The Maryland Historical Trust commented, as noted in the EA, the Nary will work with the Maryland Historical Trust/MDSHPO to complete the Section 106 of proposed actions that could affect historic and archeological properties in Maryland.	The Navy consulted with the Maryland State Historic Preservation Office pursuant to Section 106 of the National Historic Preservation Act which concurred with the finding of no historic properties affected for Maryland waters.
S14-03	The No Action Alternative is preferred for the following reasons: As noted throughout the Draft EIS/OEIS, marine mammals and turtles are particularly vulnerable to the proposed Navy activities, especially the use of active sonar and explosives. Some of these creatures are already rare, threatened or endangered. The scope of the proposed activities, especially the alternatives that expand the number of events, intensity and areas of impact, will likely cause unacceptable impacts since the migration, foraging and mating patterns of marine mammals and turtles may be disrupted.	The conclusions reached in the EIS/OEIS are fully supported by the science and the analysis, which has been refined through the ESA and MMPA consultations with NMFS. The Proposed Action was also the subject of an Essential Fish Habitat Assessment and associated consultation with NMFS. The Navy used the best available data (including data on animal density, distribution, and occurrence) to support its impact analyses in the Draft and Final EIS/OEIS. The analysis supports that the proposed training and testing will not pose a significant risk to habitats, whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious to or of significant biological impact on habitats, marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this, as presented in training ranges monitoring reports available at the NMFS Office of Protected Resources web site (www.nmfs.noaa.gov/pr). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy to fulfill its mission.
S14-04	The No Action Alternative is preferred for the following reasons: There are significant data and information gaps regarding marine mammal, turtle and benthic habitat density and distribution in the Mid-Atlantic region. This lack of information precludes an accurate analysis of the	The conclusions reached in the EIS/OEIS are fully supported by the science and the analysis, which has been refined through the ESA and MMPA consultations with NMFS. The Proposed Action was also the subject of an Essential Fish Habitat Assessment and associated

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	potential impacts of the proposed training and testing.	consultation with NMFS. The Navy used the best available data (including data on animal density, distribution, and occurrence) to support its impact analyses in the Draft and Final EIS/OEIS. The analysis supports that the proposed training and testing will not pose a significant risk to habitats, whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on habitats, marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at the NMFS Office of Protected Resources web site (www.nmfs.noaa.gov/pr). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy to fulfill its mission.
S14-05	The No Action Alternative is preferred for the following reasons: The proposed Navy training and testing activities pose additional restrictions to an already busy Mid-Atlantic region and are likely not compatible with existing coastal uses. The proposed activities will add to potential coastal use conflicts and potentially diminish the value of key regional assets, such as the Ports of Baltimore and Norfolk, ocean-related tourism, commercial fishing and recreation, arid the Wallops Flight Facility. Additional constraints due to expanded Navy training and testing may drive up shipping times and costs thereby reducing commercial competitiveness.	While the number of training and testing activities is likely to increase, since multiple activities usually occur from the same vessel, the increased number of activities is not expected to result in an increase in vessel use or transits. The Navy is not proposing appreciable changes in the locations and frequency at which vessels have been used over the last decade, and increased activities will not result in any impacts on commercial shipping. The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
S14-06	The No Action Alternative is preferred for the following reasons: We encourage the U.S. Navy to actively engage in the regional ocean planning process as called for in the President's National Ocean Policy Executive Order.	The Department of Defense has been, and will continue to be, actively involved in the National Ocean Policy process. The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy to fulfill its mission.
S14-07	The proposed activities are subject to Federal Consistency under the Coastal Zone Management Act. Please consider measures that will make the proposed training and testing activities consistent to the maximum extent practical with relevant enforceable policies.	The Navy has prepared a Coastal Zone Management Act consistency determination to ensure consistency with the enforceable policies of the Coastal Zone Management Program. Maryland provided concurrence with the Navy's coastal consistency determination.
L01	The City of Norfolk is fully supportive of the Navy's proposed action as described in the draft EIS.	Thank you for your comment.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
L02	The City of Virginia Beach is fully supportive of the Navy's proposed action as described in the draft EIS.	Thank you for your comment.
L03-01	Number of Takeoffs and Landings at NAS-KW: According to page 2-79 of the Draft EIS/OEIS, the number of Air Combat Maneuver (ACM) events in the Key West Range Complex ranges from 5,700 events for No Action to 6,840 events for Alternative 2. According to page 3.0-27, the number of events including aircraft movement in the Key West Range Complex (including but not limited to ACM, FLAREX, and CHAFFEX events) ranges from 9,646 events for No Action to 10,881 events for Alternative 2. Given that multiple aircraft may be involved in one event, and that multiple events may be completed during a single flight, and that the takeoffs and landings may occur at NAS-KW, aircraft carriers, or other locations; it is not clear how the number of events translates into the number of takeoffs and landings at NAS-KW. Provide the number of takeoffs and landings at NAS-KW under each alternative, including the current NAS-KW baseline.	Take-offs and landings from Naval Air Station Key West are outside the scope of this EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Take-offs and landings from Naval Air Station Key West will be addressed under the Naval Air Station Key West Airfield Operations EIS (currently in draft). Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their locations.
L03-02	Effect of F-35 and F/A-18E/F Super Hornet on Socioeconomic Resources: At the Key West Range Complex, the difference in Air Combat Maneuver (ACM) events between the No Action and Preferred Alternative is described as an increase in the number of events (20% increase). But the EIS/OEIS does not appear to evaluate the change in the types of aircraft used. According to page A-2, Air Combat Maneuver (ACM) events will be conducted using F-35, F/A-18, and F-5 aircraft. Provide an analysis of the effects of the introduction of F-35 takeoffs and landings at NAS-KW on local socioeconomic resources including but not limited to noise effects on the surrounding community and tourism. Also, in the Navy's 2003 Final Environmental Impact Statement for the Introduction of the F/A-18E/F Super Hornet Airport to the East Coast of the United States, the impacts resulting from F/A-18E/F Super Hornet operations at NAS-KW were not discussed. Therefore, the No Action baseline in the AFTT Draft EIS/OEIS should not include the F/A-18E/F Super Hornet. Provide an analysis of the effects of F/A-18E/F Super Hornet takeoffs and landings at NAS-KW on local socioeconomic resources including but not limited to noise effects on the surrounding community and tourism.	Take-offs and landings from Naval Air Station Key West are outside the scope of this EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Take-offs and landings from Naval Air Station Key West will be addressed under the Naval Air Station Key West Airfield Operations EIS (currently in draft). Socioeconomic issues associated with the Proposed Action in the Key West Range Complex have been addressed in Section 3.11.3 (Socioeconomic Resources – Environmental Consequences).

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
L03-03	Number of F-35 Takeoffs and Landings at NAS-KW: According to page 2-71, the F-35 is projected to make up about one-third of the Navy's strike fighter inventory by 2020. According to page A-2, Air Combat Maneuver (ACM) events would be conducted using F-35 and other aircraft. According to page 3.0-27, the number of events including aircraft movement in the Key West Range Complex (including but not limited to ACM, FLAREX, and CHAFFEX events) ranges from 9,646 for No Action to 10,881 events for Alternative 2. In the Key West Range Complex for each alternative, how many of the events involving aircraft would include F-35 aircraft, and how many F-35 takeoffs and landings would occur at NAS-KW.	Take-offs and landings from Naval Air Station Key West are outside the scope of this EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Take-offs and landings from Naval Air Station Key West will be addressed under the Naval Air Station Key West Airfield Operations EIS (currently in draft). Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the AFTT EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their locations.
L03-04	Timing of increases at NAS-KW: According to pages 2-76, 2-79, and 3.5-93, the number of Air Combat Maneuver (ACM) events in the Key West Range Complex under the Preferred Alternative would increase from 5,700 to 6,840 events/yr, a 20% increase, in support of proposed increase in utilization of NAS-KW. Describe when the increase in takeoffs and landings would occur, including the time of day that the increased flights would occur (morning, day, evening, night), the days of the week that the increased flights would occur (weekdays, weekends), and the seasons that the increased flights would occur.	Take-offs and landings from Naval Air Station Key West are outside the scope of this EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Take-offs and landings from Naval Air Station Key West will be addressed under the Naval Air Station Key West Airfield Operations EIS (currently in draft stage). Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the AFTT EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their location.
L03-05	Amount of Activity Perceptible to Public: In the Key West Range Complex for each alternative, quantify how much activity (including but not limited to aircraft overflights, ACMs, flares, chaff, air to air missile explosions, CSSQT gunnery, sonobuoy explosions, mine neutralization EOD explosions, etc.) would be visible or audible to the public on the land, and how much activity would be visible or audible to the public offshore (including recreational and commercial mariners). This should include, but not be limited to, any nighttime use of flares, mine neutralization EOD activities on Demolition Key, and whether Navy activities could affect navigational aides such as GPS used by the public. It should also include an estimate of the greatest distance at which explosions (air to air missile explosions, CSSQT high explosive large caliber rounds, sonobuoy explosions, mine neutralization EOD explosions) and gunnery firing (medium-caliber and high-caliber rounds) can be seen or heard.	Socioeconomic issues associated with the Proposed Action in the Key West Range Complex are addressed Sections 3.11.3 (Socioeconomic Resources – Environmental Consequences). Section 3.11.3.2 (Acoustic Stressors) states that the public might intermittently hear noise from ships or aircraft overflights if they are in the general vicinity of a training or testing event. Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
L03-06	Quantify Restrictions to the Public: In the Key West Range Complex for each alternative, quantify any additional restrictions (areal extent, frequency of closure, type of access) to the public including commercial or recreational fishermen, aviators, divers, boaters, etc, due to the increase in ACMs, GUNEX A-A, MISSILEX A-A, mine neutralization EOD, sonobuoy lot acceptance tests, CSSQT events, special warfare, or other proposed activities.	Many Navy at-sea training and testing ranges are accessible to the public for recreational and commercial purposes. The Navy acknowledges that during specific exercises, its training and testing could briefly limit (usually for a matter of hours) public access to a very limited portion of coastal and ocean areas to ensure public safety. Socioeconomic Resources (Section 3.11) addresses the availability of access on the ocean and in the air, specifically; Section 3.11.3.1 (Accessibility) concludes there would be no impacts on commercial and recreational activities when Navy training and testing activities temporarily change access to the ocean or airspace in the Study Area. Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations.
L03-07	Public Health and Safety: Page 3.12-12 (for Alternative 1 and page 3.12-13 for Alternative 2) states there will be an "increase" in active sonar testing activities and an "increase" in testing activities involving underwater explosions in the Key West OPAREA and other places, and states that Alternatives 1 and 2 would "adjust locations and tempo" of the testing. But the term "increase" is an understatement for the Key West Range Complex because there would be entirely new activities including exploding sonobuoy lot acceptance tests, CSSQT large caliber high explosive projectiles, mine neutralization EOD charges, high explosive air-to-air missiles, etc. Provide a public health and safety analysis specifically for these completely new activities in the Key West Range Complex. In addition to explosives and projectiles, include an assessment of unexploded ordnance.	See the Alternative Development section (Section 2.5). All activities listed in Tables 2.8-1, 2.8-2, and 2.8-3 have been thoroughly analyzed in Chapter 3 (Affected Environment and Environmental Consequences) including an analysis of those activities with respect to Public Health and Safety (Section 3.12). The analysis of Public Health and Safety addresses all activities for all three alternatives and includes explosives, projectiles, and unexploded ordnance. Standard operating procedures specified in Section 3.12 would be implemented to ensure public safety.
L03-08	Other Branches of the Military: The Draft EIS/OEIS refers to Navy activities, but does not mention other branches of the military. This is in contrast to the 2009 Final EA/OEA for the Key West Range Complex, which quantifies activities not just by the Navy, but also by the Air Force and Air National Guard. Clarify whether the numbers of events in the AFTT Draft EIS/OEIS are for the Navy only, or if they also include other branches of the military. Provide total numbers for the Key West Range Complex regardless of the branch of military.	The Proposed Action involves only Department of the Navy activities and is described in Chapter 2 (Description of Proposed Action and Alternatives). Section 4.3.4 (Other Military Actions) provides an analysis of the other military activities in terms of cumulative impacts. Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their locations.
L03-09	Avoidance Analysis for Explosions: The Preferred Alternative proposes explosions in the Key West Range Complex. Explosions are	Explosions in the Key West Range Complex are addressed in Sections 3.3 (Marine Habitats) and 3.8 (Marine Invertebrates) for impacts

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	not in the current baseline, so this would be a completely new type of activity in the area. The explosions would be associated with air to air missile exercises, mine neutralization EOD, sonobuoy lot acceptance tests, and CSSQT events. Given the environmentally sensitive nature of the area (particularly the only living coral reef tract in the continental United States), it is not appropriate to initiate a new activity such as explosions without a site-specific analysis of the environmental consequences. Please provide that site-specific analysis. Further, provide an avoidance analysis to evaluate if the environmental impacts can be avoided or minimized by performing the explosions in a different range complex.	on coral reefs. Mitigation measures related to the use of explosives can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). Specifically, mitigation zones for coral reefs and other seafloor habitats are presented in Section 5.3.3 (Mitigation Areas). Measures specific to the Florida Keys National Marine Sanctuary are discussed in Section 6.1.2 (Marine Protected Areas).
L03-10	Avoidance Analysis for Military Expended Materials: The Preferred Alternative proposes a new type of military expended material in the Key West Range Complex: debris from 1,512 explosive sonobuoys and 3,120 non-explosive sonobuoys per year. Given the environmentally sensitive nature of the Keys (particularly the only living coral reef tract in the continental United States), it is not appropriate to dispose of a new type of debris without a site-specific analysis of the environmental consequences. Please provide that site-specific analysis. Further, provide an avoidance analysis to evaluate if the environmental impacts can be avoided or minimized by performing the sonobuoy testing in a different range complex.	Potential impacts on marine habitats and marine invertebrates from military expended materials are addressed in Sections 3.3.3.2 (Physical Disturbance and Strike Stressors – Marine Habitats) and 3.8.3.3 (Physical Disturbance and Strike Stressors – Marine Invertebrates) respectively. This analysis takes into consideration the current status of the resource. Alternative training and testing locations (Section 2.5.1.1 Alternative Training and Testing Locations) were eliminated from further consideration because they failed to meet the Navy's Purpose and Need (Section 1.4).
L03-11	Expansion of Areas within the Key West Range Complex: Page 2-67 states that the Preferred Alternative will "Expand areas within the VACAPES, Navy Cherry Point, JAX, and Key West Range Complexes where anti-air warfare events, such as air combat maneuvers and gunnery and missile exercises, would be conducted in order to allow for greater operational flexibility." Describe how areas within the Key West Range Complex would be expanded and provide associated maps showing baseline and proposed areas.	The extent of the Key West Range Complex and OPAREA has not changed. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations within or across range complexes. Training cycles and testing needs are expected to vary due to current and emerging threats. See Tables 2.8-1, 2.8-2, and 2.8-3 for information on the number of proposed activities and their locations.
L03-12	Shift Operations Farther Offshore: Some parts of the Key West OPAREA and Special Use Airspace are close to the islands of the Florida Keys, and parts of the Special Use Airspace are above areas frequently used by the public (e.g., W-174 is above the route often taken between Key West and the Dry Tortugas). Provide an avoidance and minimization analysis for shifting Navy activities farther offshore to offset the proposed increase in activities in the Key West Range Complex.	The use and control of airspace is dictated by the Federal Aviation Administration National Airspace System and seeks to ensure the safe, orderly, and efficient flow of commercial, private, and military aircraft. Special Use Airspace has defined dimensions where activities must be confined because of their nature or where limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration Order 7400.8). Shifting this airspace would have impacts to the other segments of the aviation community, such as

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
		commercial jet routes. Moving the airspace farther offshore would also reduce the amount of training that could be accomplished during a single take-off and landing due to increased fuel consumption. Air combat maneuvers in the Key West Range Complex have been revised and are no longer proposed to increase. Section 2.5.1.1 (Alternative Training and Testing Locations) of the EIS/OEIS discusses how and why the Navy developed the geographic locations of its activities.
L03-13	FKNMS Prohibitions: Florida Keys National Marine Sanctuary (FKNMS) general prohibitions include, but are not limited to, removal or injury of coral or live rock, alteration of the seabed, and discharge or deposit of most materials. Page 6-12 states that prohibitions (for the FKNMS) do not apply to existing classes of DoD military activities conducted prior to the effective date of Sanctuary regulations as identified in the EIS and Management Plan for the Sanctuary (15 C.F.R. § 922.163(d)(l)), and that new military activities in the Sanctuary are allowed and may be exempted from the prohibitions summarized after consultation between the Director and the Navy. Further clarify what activities would occur within the FKNMS, and specifically identify those activities that would violate FKNMS general prohibitions if the Navy were not exempt.	The Proposed Action will not violate the prohibitions of the Florida Keys National Marine Sanctuary. Section 6.1.2.5.4 (Florida Keys National Marine Sanctuary) has been revised to more clearly specify the following: (1) platforms, sources, or items that are part of Navy activities may be used within the Florida Keys National Marine Sanctuary because they were specifically exempted, (2) platforms, sources, or items that are part of Navy activities may be used within the Florida Keys National Marine Sanctuary because they are not likely to destroy, cause the loss of, or injure sanctuary resources, and (3) platforms, sources, or items that are part of Navy activities, but that are not planned to be used within the Florida Keys National Marine Sanctuary (including a 2.7 nm buffer) as part of the Proposed Action.
L03-14	Sonar Within FKNMS: Page A-200 indicates Special Warfare, which may include Submarine sonars, Doppler sonar, and underwater communications, will be conducted in the Key West Range Complex. Page 5-72 states the Navy will not conduct low-frequency, hull-mounted or non-hull mounted mid-frequency, or high-frequency active sonar within FKNMS. For each alternative, quantify the amount, if any, of sonar that would be used within the FKNMS, including but not limited to sonar associated with Special Warfare.	Chapter 6 (Additional Regulatory Considerations) was updated to more clearly reflect which activities occur in the Florida Keys National Marine Sanctuary (Section 6.1.2.5.4). Those activities that could occur do not result in impacts on sanctuary resources. Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 in the EIS/OEIS for information the number of proposed activities and their locations. Specific information about sonar usage is classified for national security purposes.
L03-15	Activities Outside the OPAREA and SUAs: In the vicinity of the Key West Range Complex, quantify and describe any activities that may occur outside W-174 A/B/C/E/F/G, W-465 A/B, Bonefish ATCAA, or the Key West OPAREA. This should include activities that will occur between NAS-KW and the Key West OPAREA, special use airspace W-174 A/B/C/E/F/G, W-465 A/B, and Bonefish A TCAA. This should include, but not be limited to, number of overflights by each aircraft type, types and amount of exercises, amount of any supersonic	Take-offs and landings from Naval Air Station Key West are outside the scope of this EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Take-offs and landings from Naval Air Station Key West will be addressed under the Naval Air Station Key West Airfield Operations EIS. Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	overflights, and number and type of vessel movements.	structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 in the EIS/OEIS for information on the number of proposed activities and their locations.
L03-16	Exploding Sonobuoy Lot Acceptance Tests: For the Key West Range Complex, page 2-91 states that sonobuoy lot acceptance tests will increase from 0 (0 events) under No Action to 1,512/yr (39 events/yr) under the Preferred Alternative, and 1,512 sonobuoys will use high explosives. But in Appendix A.2.4.3 page A-101 it states that the assumption used for the analysis is an average of 80 non-explosive sonobuoys per event. If the analysis was based on nonexplosive sonobuoys, but many sonobuoys in the Key West Range Complex will be explosive, provide a separate analysis for environmental effects of explosive sonobuoys in the Key West Range Complex.	The sonobuoy lot acceptance test includes the use of both explosive and non-explosive sonobuoys. The number of explosive sonobuoys is listed in Table 2.8-2 of the EIS/OEIS. The number of both non-explosive and explosive sonobuoys is detailed in Appendix A (Navy Activities Descriptions, specifically, Section A.2.4.3). Both are included in the analysis.
L03-17	Events Including Vessel Movement: Clarify the number of Events Including Vessel Movement in the Key West Target Range. Page 3.0-97 indicates that the number of events including vessel movement (training+ testing) is 12+52=64 events for the Preferred Alternative. On Tables 2.8-1 to 2.8-3, the total appears to be 58 events, so 6 events are unaccounted for. Identify those 6 events and/or reconcile the totals.	Numbers have been reviewed and updated based on changes to the activities. See Tables 2.8-1, 2.8-2, and 2.8-3 and Section 3.0.5.3.3.1 (Vessels) for updated numbers.
L03-18	Bird Nesting Areas: On page 3.6-52 for Alternative 2, it states "Although noise due to aircraft and vessels would increase over Alternative 1, the types of impacts on Bermuda petrels, piping plovers, and roseate terns, as well as to piping plover critical habitat, would not differ substantially from those under Alternative !." 1." The text states the "types" of impacts would not increase, but quantify the amount of increase (in the Preferred Alternative compared to No Action), in particular for the Florida Keys including but not limited to the Dry Tortugas and Marquesas Keys. For example, quantify the increased number of sonic booms and explosions that would be audible at bird nesting areas in the Florida Keys.	Training cycles and testing needs are expected to vary due to current and emerging threats. Due to changing needs, the EIS/OEIS is structured to provide flexibility in training and testing locations. See Tables 2.8-1, 2.8-2, and 2.8-3 for information the number of proposed activities and their locations.
L03-19	Annual Events: Page 2-79, Tables 2.8-1 through -3 and many other places in the Draft EIS/OEIS indicate the number of testing and training activities per year. Clarify if this is a yearly maximum or a yearly average. Also, Page 3.0-67, page 3.0-97, page 3.0-112, and many other tables identify the number of explosions, events, missiles, etc., but do not indicate whether this is the yearly total or a total	Tables 2.8-1, 2.8-2, and 2.8-3 represent the number of annual events the Navy anticipates it will conduct, unless otherwise noted. The language was added to the titles of tables in Section 3.0, Introduction (to clarify that the totals represent annual numbers).

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	number.	
L03-20	Comparative Analysis: Table ES-1 states that impacts for Alternatives 1 and 2 are "the same" as the No Action Alternative. Explain how impacts can be "the same" when the data in the tables in Chapter 3 show more impacts for Alternatives 1 and 2.	The language was revised to indicate that the types of impacts would be the same but the numbers would increase.
L03-21	Other Waste Disposal: The EIS/OEIS describes the amount of military expended materials (projectiles, sonobuoys, parachutes, flares, chaff, etc.). Given the increase in aircraft and vessel activities, will the Preferred Alternative result in other waste disposal at sea such as garbage and waste water? If so, explain the types and amount in the Key West Range Complex.	The Proposed Action does not include any waste disposal at sea. Please see Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project.
L03-22	Ballast Water and Invasive Species: Page 3.0-97 indicates the Preferred Alternative for the Key West Range Complex would include an increase in Events Including Vessel Movement from 2 per year to 64 per year. Given the increase in vessel events, will the Preferred Alternative result in additional ballast water being disposed? If so, explain the precautions the Navy will take in the Key West Range Complex to reduce the likelihood of spreading invasive, exotic, or nuisance species through ballast water.	Please see Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project. Best management practices and Navy policy dictate how ballast water is handled. Ballast water discharge is not a component of the training and testing activities analyzed under this EIS/OEIS. Analysis presented in the EIS/OEIS is limited to the training and testing activities and reasonable outcomes of such activities. Ballast water discharge is not a component of the training and testing activities analyzed under this EIS/OEIS. The spread of invasive, exotic, or nuisance species is neither reasonably foreseeable nor anticipated. While the number of training and testing activities is likely to increase, since multiple activities usually occur from the same vessel, the increased number of activities is not expected to result in an increase in ballast water discharge.
L03-23	Contamination Potential: Will the Preferred Alternative result in additional risk of fuel leaks, waste water leaks, or other accidents that could release contamination? If so, explain the precautions the Navy will take in the Key West Range Complex to minimize that risk.	The analysis presented in the EIS/OEIS is limited to the activities and reasonable outcomes of such activities. Accidents involving fuel leaks, waste water leaks, and other contaminant releases are not reasonably foreseeable, nor anticipated. The impact of such occurrences is not addressed or analyzed. The Navy has plans and procedures for preventing, reporting, and responding to contaminant releases. While the number of training and testing activities is likely to increase, since multiple activities usually occur from the same vessel, the increased number of activities is not expected to result in an increase in vessel use or transits.
L03-24	Sediment and Water Quality: Section 3.1.4 (pages 3.1-80 to -81) states that chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards,	The EIS/OEIS presents a thorough description and analysis in Section 3.1 (Sediments and Water Quality) of amounts and types of specific training materials as well as chemical composition and

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
	regulations, and guidelines, and would be within existing conditions or designated uses. This conclusion appears to be drawn from qualitative statements such as the volume of materials is relatively small, dilution in the oceans is a substantial factor, most expended components are subject to a variety of processes that render them benign, etc. Sediment and water quality are very important issues in the fragile marine environment of the Florida Keys. For the Key West Range Complex, provide supporting data for the conclusion and identify what mitigation measures the Navy will implement to minimize degradation of sediment and water quality.	breakdown processes of expended materials. Based on the best available science, no individual expended materials would result in water or sediment toxicity surrounding expended items. Please see Section 3.1.3.3 (Chemicals Other than Explosives) which provides this information. The Navy has taken a hard look through its analysis and has considered the best available data in supporting its conclusions.
L03-25	Maritime Security Operations: Page A-18 indicates that Anti-Surface Warfare Maritime Security Operations (including but not limited to small-arms fire and anti-swimmer grenades) may occur in all OPAREAs and littoral areas proximate to homeports. Page 2-81 does not indicate that any MSO activities will occur in the Key West OPAREA. Clarify that no MSO will occur in the Key West Range Complex, or define the amount and locations of MSO in the Key West Range Complex.	Locations identified within Tables 2.8-1 through 2.8-3 represent areas where events are typically scheduled to be conducted. Events could occur outside of the specifically identified areas if environmental conditions are not favorable on a range, the range is unavailable due to other units training or testing, it poses a risk to civilian or commercial users, or to meet fleet readiness requirements. However, Key West is not considered a home port in this context.
L03-26	Intelligence, Surveillance, and Reconnaissance Test: Page A -84 indicates that Intelligence, Surveillance, and Reconnaissance Test is proposed in the AFTT Study Area. Describe the amount of this activity that is proposed within or proximal the Key West Range Complex.	Testing needs are expected to vary due to current and emerging threats and the locations of the tests are expected to vary based on availability of air and sea space. Due to changing needs, the EIS/OEIS is structured to provide flexibility in testing locations. The actual amount of activity anticipated to occur in the Key West Range Complex, if any, is uncertain at this time.
L03-27	Other Class Ship Sea Trials- Propulsion Testing: Page 2-94 and A-131 indicates that Other Class Ship Sea Trials- Propulsion Testing (including full power and endurance runs) is proposed in the AFTT Study Area. Describe the amount of this activity that is proposed within or proximal the Key West Range Complex.	Testing needs are expected to vary due to current and emerging threats and the locations of the tests are expected to vary based on availability of air and sea space. Due to changing needs, the EIS/OEIS is structured to provide flexibility in testing locations. The actual amount of activity anticipated to occur in the Key West Range Complex, if any, is uncertain at this time.
L03-28	Surface Warfare Mission Package Testing: Pages A-134 through A-136 indicate that Surface Warfare Mission Package Testing- Gun Testing Small-Caliber, Medium-Caliber, and Large Caliber is proposed in the AFTT Study Area. Describe the amount of this activity that is proposed within or proximal the Key West Range Complex.	Testing needs are expected to vary due to current and emerging threats and the locations of the tests are expected to vary based on availability of air and sea space. Due to changing needs, the EIS/OEIS is structured to provide flexibility in testing locations. The actual amount of activity anticipated to occur in the Key West Range Complex, if any, is uncertain at this time.

Table E-3: Responses to Comments from Agencies (Continued)

Comment Identifier	Comment	Navy Response
L03-29	Anti-Surface Warfare (ASUW) I Anti-Submarine Warfare (ASW) Testing: Page 2-98 indicates that Anti-Surface Warfare (ASUW) I Anti-Submarine Warfare (ASW) Testing, including Missile Testing, Kinetic Energy Weapons Testing, Torpedo (Explosive) Testing, and Countermeasure Testing - Acoustic System Testing, is proposed in the AFTT Study Area. Describe the amount of this activity that is proposed within or proximal the Key West Range Complex.	Testing needs are expected to vary due to current and emerging threats and the locations of the tests are expected to vary based on the availability of air and sea space. Due to changing needs, the EIS/OEIS is structured to provide flexibility in testing locations. The actual amount of activity anticipated to occur in the Key West Range Complex, if any, is uncertain at this time.
L03-30	Hydrodynamic Testing: Page 2-99 indicates that Hydrodynamic Testing is proposed in the AFTT Study Area. Describe the amount of this activity that is proposed within or proximal the Key West Range Complex.	Testing needs are expected to vary due to current and emerging threats and the locations of the tests are expected to vary based on the availability of air and sea space. Due to changing needs, the EIS/OEIS is structured to provide flexibility testing locations. The actual amount of activity anticipated to occur in the Key West Range Complex, if any, is uncertain at this time.
L03-31	Number of Missiles: On page 3.0-115, Table 3.0-71, the number of missiles for Key West under the Testing columns are blank. Provide a completed table.	Table 3.0-71 has been revised and completed.
L03-32	Number of Flares and Chaff: The Draft EIS/OEIS for the AFTT indicates that the baseline number of flares in the Key West Range Complex is 4,500 and the baseline number of chaff canisters is 30,000. These numbers differ substantially from the 2009 EA/OEA for the Key West Range Complex, which states the baseline number of flares in the Key West Range Complex is 23,642 and the baseline number of chaff canisters is 48,243. For each alternative, clarify number of flares and chaff canisters proposed for the Key West Range Complex.	The numbers of chaff and flares used in the Key West Range Complex annually can be found in Tables 3.0-92 and 3.0-93. The EIS/OEIS only includes training and testing activities as described in Section 2.4 (Proposed Activities) and Tables 2.8-1, 2.8-2, and 2.8-3. Other activities originating at Naval Air Station Key West are not included as part of this Proposed Action and are being addressed in the Naval Air Station Key West Airfield Operations EIS.
L03-33	Hurricane Evacuation: Our citizens are under a State mandate to evacuate the Florida Keys within 24 hours in the event of an approaching hurricane. Our ability to do so requires Monroe County and its municipalities to limit growth and development each year. The State's traffic models include the evacuation of military personnel. Therefore, to the extent, Alternative I or Alternative 2 of the Draft EIS/OEIS would increase personnel in the Keys, the ability to evacuate our citizens and military personnel in a safe and timely manner will be affected. The Draft EIS/OEIS does not indicate the anticipated increase in local military personnel associated with Alternative 1 or 2. Assess the impact of the alternatives on this critical public safety issue.	The Proposed Action does not involve an increase in personnel, and therefore personnel increases were not analyzed in the EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project.

Table E-4 contains comments from non-governmental organizations (O) received during the public comment period and the Navy's response. Responses to these comments were prepared and reviewed for scientific and technical accuracy and completeness. Comments appear as they were submitted and have not been altered.

Table E-4: Responses to Comments from Organizations

Comment Identifier	Comment	Navy Response
O01-01	The study area does not geographically overlap any current dredging operations, dredged material containment facilities, or mitigation projects that MES/MPA may be involved with. Please note that MPA is currently permitted to place dredged material in the Norfolk Ocean Disposal Site (NODS), located in the Virginia Capes Range Complex. Although MPA is not actively conducting dredged material placement at this site at this time, MPA should be made aware of any activities that would impact their ability to safely complete dredged material placement at this site.	Thank you for your comment.
O01-02	MES recommends that the Navy consult with the Maryland Pilots Association regarding whether the project will affect Maryland Pilots association's activities in the study area, if applicable. Based on the contents of this DEIS/OEIS, it is unclear whether this correspondence has occurred.	The Navy made significant efforts to notify the public to ensure maximum public participation as noted in Chapter 8 (Public Involvement and Distribution) but did not specifically notify the Maryland Pilots Association. As noted in Section 3.11.3.1.1.3 (Commercial Transportation and Shipping), the Navy concludes that the impacts would be negligible due to advance public notification (Notices to Mariners) and the primarily short-term duration of military activities.
O01-03	The map of the OPAREAS (Figure 3.11-3) shows several Range Complexes to overlap commercially used waterways in the Mid-Atlantic area. Section 3.11.2.3 of the DEIS/OEIS concludes that military and civilian uses of offshore areas are compatible as demonstrated by current conditions: "U.S. Navy vessels and aircraft that conduct activities not compatible with commercial or recreational transportation (e.g., weapons firing) typically occur in operating areas (OPAREAs) away from commercially used waterways and inside Special Use Airspace, as described in Section 3.11.2.3.2 (Air Transportation) as well as in transit and on testing ranges", and further, "Activities are communicated to vessel and aircraft operators by use of Notices to Mariners issued by the U.S. Coast Guard and Notices to Airmen issued by the Federal Aviation Administration." However, MES recommends coordination with MPA [Maryland Port Authority] on this issue to confirm that there will be no financial loss to the Port of Baltimore or associated industry due to circumstances in the study area.	The ship underway time is not expected to change appreciably from current activities. Socioeconomic impacts are addressed in Section 3.11.3.1 (Accessibility), which includes an analysis of impacts on commercial and recreational activities. The analysis concludes that there would be no impacts because the proposed activities would not be in the transit lanes or interfere with commercial shipping traffic. The Draft EIS/OEIS was submitted to each state adjacent to the Study Area for review and comment.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O02-01	We always appreciate the opportunity to review and comment on proposed activities of the US Navy, although we find that the concurrent issuance and simultaneous closure of the public comment period for the Hawaii-Southern California Testing and Training (HSTT) and the Atlantic Fleet Training and Testing (AFTT) DEIS places a significant and we believe unreasonable burden on the resources of those of us who have made it our work to review, comment, and inform the public about how their tax dollars are spent.	The Navy has complied with all NEPA notification requirements under 40 C.F.R. Part 1506. NEPA regulations require that agencies not allow less than 45 days for comments on a Draft EIS/OEIS. Please note that public comments are very important to the NEPA process. The Navy included an extra 15 days for review of this document for an extended comment period of 60 days total. The Navy made significant efforts to notify the public to ensure maximum public participation as noted in Chapter 8 (Public Involvement and Distribution).
O02-02	One of the arguments used in the DEIS to justify the high take levels is the comparison implied throughout the entire "Affected Environment" Sections 3 as well as in the executive summaries that commercial fisheries interactions through entanglements and by-catch exact much higher impacts on marine mammals, fish, invertebrates, and turtles than the proposed military actions as to render the military actions insignificant. This is a hollow argument; while the take numbers may indicate that the military actions are the "lesser of two evils," it does not justify any of the deliberate carnage of marine life by the Navy.	The discussion of interaction with commercial fisheries is included in the description of the baseline as an essential component used to inform a complete discussion on the status and threats to species. The Navy activities are compared against this baseline.
O02-03	While the evaluations reveal a new candor, the proposed alternatives don't express responsiveness to the estimated impacts.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes the chosen alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission. Further, the USEPA reviewed the EIS/OEIS and stated “the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- "Lack of Objections."”

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O02-04	While the evaluations reveal a new candor, the proposed alternatives don't ...reflect anthropogenic impacts that we know about, that are increasingly becoming evident, but are just recently entering into of the literature.	The EIS/OEIS uses best available science as described in Section 3.0.5 (Overall Approach to Analysis).
O02-05	For example: while the synergistic and cumulative impacts of human activities are beginning to make way into the Environmental Impact Statement discussions, so far there is no metric examining the intermediate and long term health effects induced by our ever increasing agonistic activities on marine life.	The Navy used the best available science and a comprehensive review of past, present and reasonably foreseeable actions to develop a robust Cumulative Impacts analysis (Chapter 4).
O02-06	In this context we should not be doing a comparative analysis on whether fishing, shipping, or Naval warfare training has a greater impact on marine habitat, rather we need to examine how the additional disruptions further compromise an already stressed environment.	The discussion of general threats to resources is included in the description of the baseline as an essential component used to inform a complete discussion on the status and threats to species. The Navy activities are compared against this baseline. The Navy used the best available science and a comprehensive review of past, present, and reasonably foreseeable actions to develop a robust Cumulative Impacts analysis (Chapter 4).
O02-07	If more "biological bandwidth" is required to assure our national security and health of our marine food supply, the Navy is in the best place to promote less impactful marine technologies, and enforce regulations that decrease unlawful commercial and industrial impacts on the habitat.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. Enforcing regulations that decrease unlawful commercial and industrial impacts on the habitat is not part of the Navy's mission as described in Title 10.
O02-08	What I find extremely troubling is that with all of the facts, models, and assumptions presented in the documents that the Navy is not paying heed to what they have concluded: that millions of marine mammals and countless fish and marine invertebrates will be maimed, poisoned, or killed by the proposed actions.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. Though the intensity of training and testing will increase, the events are of relatively short duration. Based on the analysis of potential impacts (Chapter 3, Affected Environment and Environmental Consequences) and associated mitigation measures (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), the Navy does not anticipate

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		long-term, population level impacts on marine animals.
O02-09	They have not considered that over the intermediate to long term the practices of the US Navy proposed in the HSTT and AFTT DEIS's will contribute significantly to the collapse of marine ecosystems.	The Navy used the best available and most applicable science to analyze potential environmental impacts on every resource. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. In addition, the Navy has been conducting these types of activities for decades, and there is no evidence to support this comment.
O02-10	And they have not conceded that these environmental compromises will have a significantly deeper negative impact on global security.	The Navy is committed to protecting the marine environment during the conduct of its training and testing activities. The EIS/OEIS reviewed potential environmental consequences (Chapter 3, Affected Environment and Environmental Consequences) of the Proposed Action and alternatives, and provides sufficient information for careful agency decision making.
O03	The Hampton Roads Military and Federal Facilities Alliance is fully supportive of the Navy's proposed action as described in the draft EIS.	Thank you for your comment.
O04-01	Unfortunately, we do not consider the mitigation measures described in this DEIS to be sufficiently strong or adequate….we concur with NRDC that the DEIS itself should identify such measures as alternatives to be considered.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and the permitting process with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of this Final EIS/OEIS. The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives.
O04-02	In addition to our own review, we have reviewed and endorsed the comments on this DEIS submitted by the National Resources Defense Fund (NRDC). We agree with their conclusion that this DEIS must be revised as necessary to comply with NEPA requirements, including development of alternatives that incorporate spatial and temporal measures.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission. Further, the USEPA reviewed the EIS/OEIS and stated "the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- 'Lack of Objections.'"
O04-03	Use coastal and marine spatial planning tools to develop and implement spatial and temporal mitigation measures to avoid or reduce impacts from the activities described in this DEIS.	Coastal and marine spatial planning tools are under development by NMFS under an executive order. The Department of Defense has been and will continue to be actively involved in the National Ocean Policy process. The mitigation measures listed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS are the result of consultation with NMFS and U.S. Fish and Wildlife Service. The Navy proposes to implement both area-specific mitigations and activity-specific mitigations. For a discussion of area-specific mitigations, please see Section 5.3.3 (Mitigation Areas) of the Draft and Final EIS/OEIS. To supplement the Navy's proposed mitigation areas, activity-specific procedural mitigation measures (Section 5.3.1, Lookout Procedural Measures and Section 5.3.2, Mitigation Zone Procedural Measures) will apply year round at each activity location. The balance between procedural measures and mitigation area measures provide a way for the Navy to mitigate potential impacts while maintaining its military readiness objectives. Refer to Chapter 4 (Cumulative Impacts) for a discussion of the additive effects of all projects in the Study Area.
O04-04	Although there are many species potentially impacted by the training and testing activities, a relatively small number of species account for the majority of potential "exposures," and implementing temporal or spatial measures based on seasonal population densities for key species may result in significant reductions in exposures.	In general, wide-scale spatial and temporal limitations would adversely impact the ability of the Navy to carry out the Proposed Action and may not significantly reduce modeled takes. The balance between procedural measures and mitigation area measures provide a way for the Navy to mitigate potential impacts while maintaining its military readiness objectives (Section 5.3.1, Lookout Procedural Measures; Section 5.3.2, Mitigation Zone Procedural Measures; and Section 5.3.3, Mitigation Areas discuss proposed mitigation in the Draft and Final EIS/OEIS). The procedural mitigation measures will apply year round at each activity location. Furthermore, marine mammals are patchily distributed within the ocean, including in the AFTT Study Area. Variability in animal presence within relatively small ocean sub-areas is often strongly correlated with daily, weekly, seasonal, and even decadal changes in prey availability, with prey availability being driven by changes in both local and basin-

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		wide oceanographic conditions. Any specific area of high animal density at a given time may have low animal density the following day, week, or year, depending on the biotic and abiotic factors affecting the prey distribution. Finally, it must be acknowledged that these activities have been conducted without incident for decades in the range complexes and testing ranges with the Study Area.
O04-05	Other temporal and spatial mitigation measures should include avoidance of some or all portions of areas currently designated as critical habitat, National Marine Sanctuaries, or other marine protected areas.	The Navy will conduct mitigation in several areas, as described in Section 5.3.3 (Mitigation Areas) of the Draft and Final EIS/OEIS. For example, Section 5.3.3.1.1.2 (North Atlantic Right Whale Northeast Foraging Habitat) outlines measures the Navy will implement within the defined mitigation area. Outside of the mitigation areas described, the mitigation measures identified throughout Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) will apply year round at each activity location. As described in Section 5.3.4.2.9 (Avoiding Marine Protected Areas in the Study Area), due to the nature of the Proposed Action, supplemental mitigation specific to marine protected areas, including national marine sanctuaries, is not warranted. Please refer to Section 6.1.2 (Marine Protected Areas) for additional information.
O04-06	Mitigation measures should be consistent with "strategic stocks" designations under the MMP A and recovery plans under the ESA.	NMFS uses stock assessment reports as a tool for managing marine mammal stocks in U.S. waters. The Navy has and will continue to consult with NMFS to ensure that its Proposed Action and mitigation measures are consistent with all requirements of the MMPA and ESA. The mitigation measures listed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS and the forthcoming Record of Decision are the result of the consultation with NMFS and U.S. Fish and Wildlife Service. Mitigation under MMPA will be coordinated through the Letters of Authorization from NMFS. Mitigation under ESA will be coordinated through the ESA consultation between the Navy and NMFS and U.S. Fish and Wildlife Service. Marine mammal mitigation measures are generally not species specific and will apply to all marine mammal species equally (with limited exceptions, e.g., mitigation areas).
O04-07	REVISE THE DEIS TO SHOW COMBINED IMPACTS ON EACH SPECIES, INCLUDING IMPACTS RELATIVE TO POPULATION SIZES	There is not a reliable methodology available to predict the number of individual animals that may be impacted. The EIS/OEIS discusses the fact that individual animals may be impacted multiple times over the course of a year (Section 3.4.3.1.2.6, Repeated Exposures), and the conclusions that there will not be impacts on a population's health are fully supported by the best available science.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O04-08	Abandon the SINKEX program of sinking obsolete ships in our waters. SINKEX is a wasteful and environmentally threatening practice of sinking ships that still contain remnant amounts of PCBs even after meeting what we consider to be inadequate cleanup standards required by the EPA. The use of SINKEX involves sinking a large, unarmed, stationary vessel incapable of attempting evasive maneuvers or employing electronic countermeasures. This type of training exercise also fails to meet the requirement for realism, and should be eliminated on those grounds.	The sinking exercise is an essential component of the suite of training activities to ensure that Sailors and Marines are ready to deploy in real-world operations. As stated in Section 1.4.2 (Fleet Readiness Training Plan), the Fleet Readiness Training Plan outlines the training activities required for military readiness that prepares Navy personnel for any conflict or operation. The Navy's building-block approach to training is cyclical and qualifies its personnel to perform their assigned missions. The value of a sinking exercise goes beyond engaging a maneuvering target, and the lessons learned are passed to other members of the fleet. Sinking exercises are also used to complete realistic survivability or lethality testing. This testing is required by Title 10, Section 2366 for major system or munitions programs. Environmental preparation of sinking exercise vessels is done in accordance with USEPA permits and additional guidance.
O04-09	This DEIS rules out several potential mitigation measures because they would make a training practice "unrealistic." The use of SINKEX involves sinking a large, unarmed, stationary vessel incapable of attempting evasive maneuvers or employing electronic countermeasures. This type of training exercise also fails to meet the requirement for realism, and should be eliminated on those grounds. SINKEX has provided a small percentage of trainees the experience of watching live weapons send very large ships to the bottom of the ocean. That experience passes with time, while the ship that was sunk permanently joins what has become the underwater equivalent of an elephant's graveyard on our seabed. Surely this is not an acceptable environmental legacy for the Navy, and we urge that you abandon the use of SINKEX.	The sinking exercise is an essential component of the suite of training activities to ensure that Sailors and Marines are ready to deploy in real-world operations. As stated in Section 1.4.2 (Fleet Readiness Training Plan), the Fleet Readiness Training Plan outlines the training activities required for military readiness that prepares Navy personnel for any conflict or operation. The Navy's building-block approach to training is cyclical and qualifies its personnel to perform their assigned missions. The value of a sinking exercise goes beyond engaging a maneuvering target and the lessons learned are passed to other members of the fleet. Sinking exercises are also used to complete realistic survivability or lethality testing. This testing is required by Title 10, Section 2366 for major system or munitions programs. Environmental preparation of sinking exercise vessels is done in accordance with USEPA permits and additional guidance.
O04-10	We recommend the following: Reconsider mitigation measures offered at scoping meetings or through public comments….the decision as to whether or not a proposed mitigation measure would "have an unacceptable impact on the proposed training and testing activities" should include consideration of the public's perceptions of unacceptable impacts on the resources at risk.	Comments received during the scoping period and Draft EIS/OEIS comment period were considered in the development of the Draft and Final EIS/OEIS. The Navy values public involvement and considers public input during the evaluation process. All mitigation measures are designed to reduce or avoid potential impacts on marine resources, taking into account national security interests, the best available science, and regulatory requirements (including the MMPA and ESA). Additional information on the development of mitigation measures can be found in Section 5.2.2 (Overview of Mitigation Approach).

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O04-11	What we have found, however, is cause for alarm in the … reliance on visual detection methods that would be ineffective for some of the populations most at risk.	The Navy acknowledges the limitations of visual shipboard monitoring and uses aerial monitoring and passive acoustic monitoring for multi-faceted monitoring where practical. The EIS/OEIS, Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), presents the U.S. Navy's mitigation measures, outlining steps that would be implemented to protect marine mammals and federally listed species during training and testing events. In general, there are usually more ships and more observers present on Navy ships and additional aerial assets engaged in exercise events than used during trackline detection during a survey, thereby increasing the potential to detect marine mammals during a Navy activity. Section 3.4.3.1.5.4 (Model Assumptions and Limitations) in the Final EIS/OEIS provides a more robust discussion on marine mammal sightability and the inclusion of implementing mitigation measures to reduce the effects of sound exposures on marine mammals. Section 3.4.3 (Environmental Consequences – Marine Mammals) was revised to account for the Navy's mitigation measures and marine mammal behavioral responses to sound in the water to more accurately reflect the predicted potential effects on marine mammals. In addition, for species-specific take requests permitted under MMPA for activities covered by the AFTT EIS/OEIS, please see the complete Letter of Authorization at the NMFS website: http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications
O05-01	We are saddened to hear that they Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date.	Thank you for your comment.
O05-02	There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine populations or stocks of marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS and this analysis included the use of a range-dependent acoustic propagation model. Also,

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage.	as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The EIS/OEIS is prepared by the Department of the Navy in compliance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality, the Department of the Navy procedures for implementing NEPA, and Executive Order 12114 (*Environmental Effects Abroad of Major Federal Actions*). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
O06-01	Scientists who have dedicated most of their professional careers to studying these mammals do not know their location at any given point and time. Those individuals involved in “underwater sonar/explosive testing” hardly could know!	The Navy used the best available science to develop its analysis and appropriate mitigation measures. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate encompasses the capacity of what could occur to ensure Navy’s permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Though the intensity of training and testing will increase, the events are of relatively short duration and therefore long-term population level impacts are not anticipated.
O06-02	Not only does any sonar testing interrupt communications between particular species but it also disturbs feeding sources for marine life as well as destroy Critical Habitat they need to survive.	Potential impacts from sonar on marine species and critical habitat are analyzed in the applicable chapters from Chapter 3.4 (Marine Mammals) through 3.9 (Fish) in the respective Environmental Consequences sections. Analyses in these sections show that any potential impacts would be short-term and transient, therefore not resulting in the types of impacts the commenter infers.
O06-03	And one has to remember that the fishing industry makes their living on the seas and brings valuable foods to the nation’s tables.	The Navy shares your concern for marine life and those dependent on it. Socioeconomic impacts are thoroughly addressed in Section 3.11.3.1 (Accessibility), which concludes that there would be no impacts on commercial and recreational activities, including the fishing industry.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O06-04	Only in the late 1960s was the dumping by the US military of thousands of canisters of chemical weapons into the waters of the East Coast halted. Records show that the military disposed of WMDs for decades, from 1944 to 1970. Off the coast of New Jersey, even extending to the 350 Nautical Mile Limit, the military dumped containers of mustard gas and nerve gas, off Virginia and South Carolina canisters of arsenic trichloride, white phosphorus, mustard gas and lewisite, and off Florida containers of nerve gas and lewisite. When in 1987 hundred of dolphins washed ashore in Virginia and New Jersey beaches with burns similar to mustard gas exposure, a marine mammal specialist believed chemical weapons dumped in the ocean by the US Army killed these animals. It is a real possibility that any sonar and bomb exploding activity will speed up the breakdown of those aged containers and cause leakage.	The Proposed Action does not involve dumping of chemical weapons or include activities that would be expected to disperse toxic chemicals. Sonar will not cause any leakage, and the potential of an explosive detonation rupturing containers is extremely unlikely.
O06-05	Not only will any dispersal of such toxic chemical cause great harm to marine life, it may also cause major injury, such as severe spastic paralysis and even death if the respiratory muscles become paralyzed in those human workers.	The Proposed Action does not involve dumping of chemical weapons or include activities that would be expected to disperse toxic chemicals. The Proposed Action in the EIS/OEIS includes only training and testing activities and does not include information on military disposal of weapons.
O07-01	The EIS should include an overlay map of Key West OPAREA, W174 and its subdivisions, and W465 and its subdivisions to clearly display any overlap with Florida Keys National Marine Sanctuary (FKNMS), Key West National Wildlife Refuge (KWNWR) or Dry Tortugas National Park (DTNP).	Marine Protected Areas are discussed in Section 6.1.2 (Marine Protected Areas).
O07-02	Last Stand believes that any new live explosive or non explosive training and testing activity is incompatible with the purpose of the sanctuary, refuge and park. The plan should specifically state that these areas will be avoided for these new activities.	The Navy evaluated all areas for consistency with site-specific regulations, including compliance with all National Marine Sanctuary Program Regulations. Information related to the Proposed Action and marine protected areas can be found in Section 6.1.2 (Marine Protected Areas). For example, as discussed in Table 6.1-2, activities other than aircraft overflights are not expected to occur in the Key West National Wildlife Refuge; therefore, due to the nature of the proposed activities, avoidance of this area is not warranted. Discussion specific to the Florida Keys National Marine Sanctuary is provided in Section 6.1.2.5.4 (Florida Keys National Marine Sanctuary).
O07-03	Non-explosive Gunnery Exercise (Air to Air) Medium Caliber Alternatives 1 and 2 plan an increase from 36,000 rounds / year to 56,000 rounds / year. Please provide in the EIS quantities of	As discussed in Chapter 6 (Additional Regulatory Considerations), proposed training and testing activities are not expected to occur within or in the vicinity of the Dry Tortugas National Park. The only activities that

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	projectiles that may fall within FKNMS, KWNWR or DTNP.	are proposed over the Key West National Wildlife Refuge are high altitude aircraft overflights, which are not likely to harm the area's protected natural resources. To ensure compliance with regulations of the Florida Keys National Marine Sanctuary Program, the Navy may conduct activities that are not prohibited according to sanctuary regulations and would not cause potential destruction, loss of, or injury to sanctuary resources. The Navy does not intend to conduct activities within the Florida Keys National Marine Sanctuary or within 2.7 nautical miles of the sanctuary that would require consultation.
O07-04	Mine neutralization explosive ordnance disposal Alternatives 1 and 2 plan an increase of 12 charges per year of 6-10 lb, 11-20lb or 21-60 lb live explosives will occur in Demo Key. The EIS should provide a location of Demo Key.	This area was misidentified in Appendix A (Navy Activities Descriptions). The locations should be: UNDET Test Site H, UNDET Box, EA-1. This has been corrected in the Final EIS/OEIS, and these areas have been added to the maps where appropriate.
O07-05	Although the number of explosions per year seems small, this activity is inconsistent with the purposes of FKNMS, KWNWR and DTNP and alternative locations should be used if in fact Demo Key is located within or in close proximity to these areas.	This area was misidentified in Appendix A (Navy Activities Descriptions). The locations should be: UNDET Test Site H, UNDET Box, EA-1. This has been corrected in the Final EIS/OEIS, and these areas have been added to the maps where appropriate. Information related to the Proposed Action and Marine Protected Areas can be found in Section 6.1.2 (Marine Protected Areas), which discusses management policies specific to military activities.
O07-06	Since the use of sonobouys is evaluated for potential harm to marine mammals, sea turtles and other marine reptiles and fish, the testing plan should provide that none of these tests will be conducted within FKNMS, KWNWR and DTNP.	The Navy evaluated all areas for consistency with site-specific regulations, including compliance with all National Marine Sanctuary Program Regulations. Information related to the Proposed Action and marine protected areas can be found in Section 6.1.2 (Marine Protected Areas). For example, as discussed in Table 6.1-2, activities other than aircraft overflights are not expected to occur in the Key West National Wildlife Refuge; therefore, due to the nature of the proposed activities, avoidance of this area is not warranted. Discussion specific to the Florida Keys National Marine Sanctuary is provided in Section 6.1.2.5.4 (Florida Keys National Marine Sanctuary).
O07-07	The testing plan should also provide for an absolute safety margin outside the boundaries of FKNMS, KWNWR and DTNP of the extended echo range sonobouy.	The Navy evaluated all areas for consistency with site-specific regulations, including compliance with all National Marine Sanctuary Program Regulations. Information related to the Proposed Action and marine protected areas can be found in Section 6.1.2 (Marine Protected Areas). For example, as discussed in Table 6.1-2, activities other than aircraft overflights are not expected to occur in the Key West National Wildlife Refuge; therefore, due to the nature of the proposed activities, avoidance of this area is not warranted. Discussion specific to the Florida

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		Keys National Marine Sanctuary is provided in Section 6.1.2.5.4 (Florida Keys National Marine Sanctuary).
O07-08	Combat system ship qualification trial – surface warfare Alternatives 1 and 2 plan for an increase from 0 to 3 events per year with 561 non-explosive large caliber rounds, 339 high explosive large-caliber rounds, 6,000 non-explosive medium caliber rounds and 3 non-explosive missles. The EIS should confirm that all these events will occur in Key West OPAREA and none of the projectiles or munitions fragments will fall in FKNMS, KWNWR or DTNP.	As discussed in Chapter 6 (Additional Regulatory Considerations), proposed training and testing activities are not expected to occur within or in the vicinity of the Dry Tortugas National Park. The only activities that are proposed over the Key West National Wildlife Refuge are high altitude aircraft overflights, which are not likely to harm the area's protected natural resources. To ensure compliance with regulations of the Florida Keys National Marine Sanctuary Program, the Navy may conduct activities that are not prohibited according to sanctuary regulations and would not cause potential destruction, loss of, or injury to sanctuary resources. The Navy does not intend to conduct activities within the Florida Keys National Marine Sanctuary or within 2.7 nautical miles of the sanctuary that would require consultation.
O07-09	Last Stand is very concerned for the impacts on affordable housing stock in Key West and areas in close proximity to NAS Key West that will be caused by an increased number of enlisted and civilian personnel. Currently over 50% of NAS KW enlisted personnel are housed off-base. NAS KW is selling 157 units of housing built specifically for enlisted personnel. Rental supply in Key West and the Lower Keys at HUD established Fair Market Rent is scarce and quickly rented when available. The EIS should address the housing impacts that will accompany an increase in personnel associated with Alternatives 1 and 2.	The Proposed Action does not involve an increase in personnel, and therefore personnel increases were not analyzed in the EIS/OEIS. Please see Section 2.1 (Description of the Atlantic Fleet Training and Testing Study Area) and Section 2.4 (Proposed Activities) of the EIS/OEIS for a clear definition of the scope of this project.
O08	To whom it may concern, Our organization, Ocean Defender is humbly asking you to STOP all sonar testing on cetaceans. Our oceans are suffering, our ocean creatures are suffering. It's time we put an END to all this atrocities we have been committing against the OCEAN and all its creatures. Overfishing, ocean acidification, nuclear waste, tsunami TRASH in our oceans. How far will YOU go and for what? It is not enough what the OCEAN is going trough right now, you have to continue to inflict PAIN AND DEATH in to our OCEAN WATERS? 90% of all our ocean creatures are GONE, why do you want to KEEP KILLING THEM when you are supposed to PROTECT THEM? We are 70,000 people asking you to reconsider sonar testing. Please STOP! Aloha Oriana Kalama CEO/Founder Ocean Defender	Thank you for participating in the NEPA process.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-01	Our overriding concern is the Navy's failure to protect biologically important areas for marine mammals within the Atlantic Fleet Training and Testing ("AFTT") Study Area.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of a number of potential mitigation measures. The Navy has undertaken consultation with NMFS for the proposed and ongoing activities in the Study Area. The Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Through careful exploration of all mitigation measures to determine which were the most effective, the Navy chose the measures to mitigate potential impacts to marine mammals while still being able to meet its operational needs to train for real-world conditions. The Navy's specific mitigation measures are outlined in the following sections: Section 5.3.1 (Lookout Procedural Measures), Section 5.3.2 (Mitigation Zone Procedural Measures), and Section 5.3.3 (Mitigation Areas). Specifically, Section 5.3.3.1 (Marine Mammal Habitats) addresses important habitat areas. Navy considers biologically important areas (BIAs) whenever appropriate. For instance, as part of the ESA and MMPA processes, NMFS requested the Navy to consider some specific preliminary draft biologically important areas as part of its mitigation analysis. As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Additional information can be found in Section 5.3.3.1.3.1, Planning Awareness Areas. If additional biologically important areas are identified by NMFS after the Navy's Record of Decision, the Navy and NMFS will use the Adaptive Management process to assess whether any additional mitigation should be considered in those areas.
O09-02	The Navy's failure is particularly troubling in light of the emerging scientific consensus about biologically important areas in the AFTT Study Area. For the last year and a half, the National Oceanic and Atmospheric Administration ("NOAA") has been guiding the work of two working groups to improve the tools available to agencies, including the Navy, to evaluate and mitigate the impacts of anthropogenic noise on marine mammals. The Working Groups' draft products were recently released and one key product of this effort was the Cetacean Density and Distribution Mapping Working Group's (CetMap) identification of marine mammal "hot spots" in the AFTT Study Area – biologically important areas for marine mammals as	The Navy has and will continue to support the Cetacean and Sound Mapping project, including providing representation on the Cetacean Density and Distribution Mapping Working Group (CetMap). This working group has two objectives: First, to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors. With the exception of the Atlantic and Gulf of Mexico, the Navy has considered this information as part of the impact and mitigation assessment process. For the Atlantic and Gulf of Mexico, the Navy OPAREA Density Estimates on the Spatial Decision Support System for the Strategic Environmental Research and Development Program

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	evidenced by increases in density and distribution or modeled based on important habitat. Because CetMap's products were not released prior to the completion of the DEIS, the information was not incorporated into the Navy's analysis through the development of reasonable alternatives or examined as possible mitigation measures based on limiting or excluding training and testing activities in these hot spots. The fact that the Navy must analyze this new information and determine how it will impact its development of alternatives and mitigation measures	(available at http://seamap.env.duke.edu/serdp_map.php), are still considered the best available data (Read and Halpin 2010[1]). As of August 2013, CetMap had not released final updated density data products for the Atlantic and Gulf of Mexico. Second, and separately, to augment the more quantitative density mapping and provide additional context for impact analyses, the CetMap also identifies areas of specific importance for cetaceans, such as reproductive areas, feeding areas, migratory corridors, and areas in which small or resident populations are concentrated, otherwise referred to as "biologically important areas". The working group determined that "hot spots" is not an appropriate term and chose to call them Biologically Important Areas. Biologically important areas information was based largely on observational data of animals exhibiting biologically important behaviors. The biologically important areas were only characterized for species, areas, and seasons where there were enough data to support the biologically important areas identification within the U.S. Exclusive Econimc Zone. Most of these assessments are not based on CetMap density work products but on published and often unpublished data held by individual researchers. They only characterized the observational data available and did not use density or habitat-based models to determine the biologically important areas. Biologically important areas are not being designated by CetMap for the purpose of identifying areas off limit to human activities like sonar. Instead, information is being collected to provide additional context within which to examine potential interactions between cetaceans and human activities. This information can assist resource managers with planning, analyses, and decisions regarding how to reduce adverse impacts to cetaceans resulting from human activities. Some preliminary draft results are currently being released on http://cetsound.noaa.gov/important.html. The CetMap Working Group is also undertaking external review of the documents by subject matter experts outside National Oceanic and Atmospheric Administration and is preparing a collection of manuscripts focused on the biologically important areas that will be submitted to a scientific journal for external peer review by subject matter experts. The Navy also recommended to NMFS that a formal expert elicitation on biologically important areas results be conducted, including data review by a larger body of marine scientists and stakeholders.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		When appropriate, NMFS provides draft CetMap information for Navy consideration. As part of the ESA and MMPA processes, NMFS requested the Navy to consider some specific preliminary draft areas as part of its mitigation analysis. As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Additional information can be found in Section 5.3.3.1.3.1, Planning Awareness Areas. If additional biologically important areas are identified by NMFS after the Navy's Record of Decision, the Navy and NMFS will use the Adaptive Management process to assess whether any additional mitigation should be considered in those areas. [1] Read, A. J. and P. Halpin. 2010. Predictive Spatial Analysis of Marine Mammal Habitats. Final Report. SERDP Project SI-1390. January 2010. 292 pp.
O09-03	NEPA requires the Navy to employ rigorous standards of environmental review, including a full explanation of potential impacts, a comprehensive analysis of all reasonable alternatives, a fair and objective accounting of cumulative impacts, and a thorough description of measures to mitigate harm. Unfortunately, the DEIS released by the Navy falls far short of these mandates and fails to satisfy the Navy's legal obligations under NEPA.	The Navy complies with all applicable environmental laws, including NEPA. As such, the Navy has developed this EIS/OEIS to meet the requirements of these laws. Please see Chapter 2 (Description of Proposed Action and Alternatives) which includes selection criteria and alternatives considered but eliminated (Section 2.5.1 Alternatives Eliminated from Consideration). Please see Chapter 3 (Affected Environment and Environmental Consequences) for the description of the affected environment and environmental consequences of the Navy's Proposed Action. Chapter 4 contains a comprehensive cumulative impacts analysis. Information on mitigation measures can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS. Please see *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report on the project web site for a discussion of the acoustic impact modeling approach, which addresses the scientifically established criteria for injury, mortality, and harassment under the MMPA. Further, the USEPA reviewed the EIS/OEIS and stated "the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- 'Lack of Objections.'"

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-04	While the Navy has made progress in assessing the impacts its activities have on the environment, it continues to underestimate harm by disregarding a great deal of relevant information and using approaches that are the opposite of precautionary when factoring uncertainty. As discussed in Appendix C, in revising its DEIS, the Navy must adjust its thresholds for impact and modeling by incorporating the considerable scientific record showing that impacts are even greater than the Navy estimates.	The criteria and thresholds for determining potential effects to marine species used in the AFTT EIS/OEIS and related consultation documents were carefully revised from those used in previous Navy EISs based on best available science, which included lowering the thresholds over much of the hearing range of many species of marine mammals. This included revising the permanent threshold shift threshold for all marine mammal species based on best available science.
O09-05	Neither alternative presents an option that would significantly reduce the predicted harm to the marine environment and wildlife. For example, both of the Navy's alternatives result in the exact same number of marine mammal takes from training with sonar – over 2 million per year. For training then, the DEIS offers no alternative for a decision maker wishing to reduce the harm to marine mammals. It is obvious that the Navy's alternatives were not selected to "inform decision-makers and the public" of how it could "avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1. While the Navy purportedly presents two reasonable alternatives, it leaves no room for decision makers to choose anything but its preferred alternative, which "is contingent upon [and allows for] potential budget increases, strategic *necessity*, and future training and testing *requirements*." DEIS at ES-6; 2-76 (emphasis added). A decision maker that wishes to meet the Navy's needs is compelled to choose the preferred alternative.	The differences between Alternatives 1 and 2 are detailed in Sections 2.7 (Alternative 1: Expansion of the Study Area Plus Adjustments to the Baseline and Additional Weapons, Platforms, and Systems) and 2.8 (Alternative 2: Includes Alternative 1 Plus Increased Tempo of Training and Testing Activities) of the Final EIS/OEIS. The Navy developed the alternatives considered in this EIS/OEIS after careful assessment of the Navy's training and testing requirements by subject matter experts, including military units and commands that perform the training and testing, and Navy environmental managers and scientists. A significant reduction in training and testing activities would fail to meet the Purpose and Need and would not allow the Navy to meet its obligations under Title 10 of the United States Code. Refer to Section 2.5 (Alternatives Development) of the Final EIS/OEIS for an explanation of the development of alternatives.
O09-06	Both alternatives inflict an unprecedented amount of harm on marine life. Neither alternative was developed with an eye to minimizing adverse environmental impacts, but instead reflect differences entirely unrelated to the proposed action's environmental impacts. Such differences – in capabilities, tempo, and locations – are entirely based on operational needs, not on factors related to environmental impacts. As such, they fail to provide the public and decision makers with any options for significantly limiting the impact to marine wildlife. The development of alternatives in this manner violates NEPA, reflecting a classic *post hoc* rationalization for a decision unlawfully made *before* environmental impacts and reasonable alternatives were considered.	The EIS/OEIS reviewed potential environmental consequences (Chapter 3, Affected Environment and Environmental Consequences) of the Proposed Action and alternatives, and provides sufficient information for careful agency decision making. Navy attempted to establish alternatives based on geographical alternatives (Section 2.5.1, Alternatives Eliminated From Further Consideration and Section 5.2.2.1, Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements) and this approach proved to not be feasible. The Navy is not obligated by NEPA to consider alternatives that are not feasible. Therefore, the only reasonable alternatives for the Navy to consider to meet Navy's purpose and need must differ in training tempo, capabilities, and locations. The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. The selection of an

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. Most impacts from the Proposed Action are expected to be brief and recoverable. Long-term impacts to a small number of individuals are not expected to have long-term population consequences.
O09-07	In 2010, the National Oceanic Atmospheric Administration ("NOAA") completed a review of the Navy's sonar mitigation. It concluded that "ongoing mitigation efforts, in our view, must do more" to address uncertainties and protect marine mammals. Nonetheless, the Navy's DEIS proposes the same mitigation scheme that NOAA found lacking. While NOAA emphasized the importance of habitat identification and avoidance, stating that "[p]rotecting important marine mammal habitat is generally recognized to be the most effective mitigation measure currently available," the Navy makes no provision for protecting areas in the AFTT Study Area in addition to the limited areas for North Atlantic right whales and West Indian manatees.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Through careful exploration of all mitigation measures to determine which were the most effective, the Navy has chosen the measures to mitigate potential impacts on marine mammals while still being able to meet its operational needs to train for real-world conditions. Specific mitigation measures are outlined in the following sections: Section 5.3.1 (Lookout Procedural Measures), Section 5.3.2 (Mitigation Zone Procedural Measures), and Section 5.3.3 (Mitigation Areas). Specifically, Section 5.3.3.1 (Marine Mammal Habitats) addresses important habitat areas.
O09-08	As noted, NOAA recently completed a series of workshops designed to learn more about marine mammal "hot spots." The results of these workshops are now available and the Navy must assess the information and develop mitigation measures based on protecting important marine mammal habitat. To offer full protection to the marine mammals found in these "hot spots," the Navy should develop mitigation measures that bar the use of sonar in the areas and provide a buffer for them that limits the received level of sound. At a minimum, the Navy should establish cautionary areas in these habitats.	The Navy has and will continue to support the Cetacean and Sound Mapping project, including providing representation on the Cetacean Density and Distribution Mapping Working Group (CetMap). This working group has two objectives: First, to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors. With the exception of the Atlantic and Gulf of Mexico, the Navy has considered this information as part of the impact and mitigation assessment process. For the Atlantic and Gulf of Mexico, the Navy OPAREA Density Estimates on the Spatial Decision Support System for the Strategic Environmental Research and Development Program (available at http://seamap.env.duke.edu./serdp/serdp_map.php), are still considered the best available data (Read and Halpin 2010[1]). As of August 2013, CetMap had not released final updated density data products for the Atlantic and Gulf of Mexico.

Table E-4: Responses to Comments from Organizations (Continued)

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		Second, and separately, to augment the more quantitative density mapping and provide additional context for impact analyses, the CetMap is also identifying areas of specific importance for cetaceans, such as reproductive areas, feeding areas, migratory corridors, and areas in which small or resident populations are concentrated, otherwise referred to as "biologically important areas". The working group determined that "hot spots" is not an appropriate term and chose to call them Biologically Important Areas. Biologically important areas information was based largely on observational data of animals exhibiting biologically important behaviors. The biologically important areas were only characterized for species, areas, and seasons where there were enough data to support the biologically important areas identification within the U.S. Exclusive Economic Zone. Most of these assessments are not based on CetMap density work products but on published and often unpublished data held by individual researchers. They only characterized the observational data available and did not use density or habitat-based models to determine the biologically important areas. Biologically important areas are not being designated by CetMap for the purpose of identifying areas off limit to human activities like sonar. Instead, information is being collected to provide additional context within which to examine potential interactions between cetaceans and human activities. This information can assist resource managers with planning, analyses, and decisions regarding how to reduce adverse impacts to cetaceans resulting from human activities. Some preliminary, draft results are currently being released on http://cetsound.noaa.gov/important.html. The CetMap Working Group is also undertaking external review of the documents by subject matter experts outside National Oceanic and Atmospheric Administration and is preparing a collection of manuscripts focused on the biologically important areas that will be submitted to a scientific journal for external peer review by subject matter experts. The Navy also recommended to NMFS that a formal expert elicitation on biologically important areas results be conducted, including data review by a larger body of marine scientists and stakeholders. When appropriate, NMFS provides draft CetMap information for Navy consideration. As part of the ESA and MMPA processes, NMFS requested the Navy to consider some specific preliminary draft areas as part of its mitigation analysis. As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends

Table E-4: Responses to Comments from Organizations (Continued)

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		extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Additional information can be found in Section 5.3.3.1.3.1, Planning Awareness Areas. If additional biologically important areas are identified by NMFS after the Navy's Record of Decision, the Navy and NMFS will use the Adaptive Management process to assess whether any additional mitigation should be considered in those areas. [1] Read, A. J. and P. Halpin. 2010. Predictive Spatial Analysis of Marine Mammal Habitats. Final Report. SERDP Project SI-1390. January 2010. 292 pp.
O09-09	But as NMFS has made clear, North Atlantic right whales cannot afford to be seriously harmed if their survival is to be assured. While the Navy has proposed certain mitigation measure for the species, it withdraws others (e.g., requiring permission from fleet forces command prior to any training in right whale foraging habitat) and fails to offer strong enough measures that will guarantee that threats to right whales from sonar and ship strikes will be minimized.	Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) provides an analysis of mitigation effectiveness to explain and analyze changes in mitigation measures. As stated in the effectiveness assessment in Section 5.3.3.1.1.2 (North Atlantic Right Whale Northeast Foraging Habitat) of the Final EIS/OEIS, low-frequency and hull-mounted active sonar training and helicopter dipping activities are not expected to be conducted within the defined mitigation area as part of the Proposed Action. Therefore, the requirement to submit written requests for these activities is no longer needed. In coordination with NMFS, the Navy has developed a suite of specialized mitigation measures specifically designed to avoid or reduce potential impacts on the North Atlantic right whale. Furthermore, the Navy has invested a significant amount of funding and support for North Atlantic right whale conservation efforts. For example, the Navy was integral in the development of the Early Warning System, a reporting program for sightings that helps prevent harmful interactions between North Atlantic right whales and both Navy and non-Navy vessels. The Navy also actively participates in species recovery efforts through scientific research, including aerial and line transect surveys.
O09-10	The fundamental purpose of an EIS is to force the decision-maker to take a "hard look" at a particular action – at the agency's need for it, at the environmental consequences it will have, and at more environmentally benign alternatives that may substitute for it – before the decision to proceed is made. 40 C.F.R. §§ 1500.1(b), 1502.1; Baltimore Gas & Electric v. NRDC, 462 U.S. 87, 97 (1983). This "hard look" requires agencies to obtain high quality information and accurate scientific analysis. 40 C.F.R. § 1500.1(b). "General statements about possible effects and some risk do not constitute a	The EIS/OEIS has taken a "hard look" at potential environmental consequences of the Proposed Action and alternatives, and provides sufficient information for careful agency decision making. The Navy considered the best available science in preparation of this EIS/OEIS and consulted with NMFS as the regulator and a cooperating agency with regard to the Proposed Action, the potential environmental impacts, and any resultant mitigation measures as conditions of anticipated authorizations under the MMPA or reasonable and prudent measures resulting from issuance of a Biological Opinion under ESA.

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	hard look absent a justification regarding why more definitive information could not be provided." Klamath-Siskiyou Wilderness Center v. Bureau of Land Management, 387 F.3d 989, 994 (9th Cir. 2004) (quoting Neighbors of Cuddy Mountain v. United States Forest Service, 137 F.3d 1372, 1380 (9th Cir. 1998)). The law is clear that the EIS must be a pre-decisional, objective, rigorous, and neutral document, not a work of advocacy to justify an outcome that has been foreordained.	
O09-11	In nearly every respect, despite the length and information provided, the Navy's DEIS fails to meet the high standards of rigor and objectivity required under NEPA. The Navy has failed to conduct the "hard look" necessary to thoroughly examine the many environmental consequences of its proposed action.	The EIS/OEIS reviewed potential environmental consequences (Chapter 3, Affected Environment and Environmental Consequences) of the Proposed Action, and provides sufficient information for careful agency decision making. Further, the USEPA reviewed the EIS/OEIS and stated "the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- 'Lack of Objections.'"
O09-12	The Navy's DEIS does not properly analyze environmental impacts. Despite the unprecedented level of harm the Navy predicts, its analysis nonetheless understates the potential effects of its training and testing activities on marine wildlife and fails to acknowledge risks posed to a wide range of marine species from its activities. The DEIS concludes that no "marine mammal strandings or mortality will result from the operation of sonar or other acoustic sources during Navy exercises within the Study Area." DEIS at 3.4-143. The Navy reaches this conclusion despite acknowledging the importance of sound to marine mammal existence and the hundreds of thousands of instances of hearing loss its activities will inflict on marine mammals. For example, the Navy states that "it is likely that a relationship between the duration, magnitude, and frequency range of hearing loss could have consequences to biologically important activities (e.g., intraspecific communication, foraging, and predator detection) that affect survivability and reproduction." DEIS at 3.4-83. The Navy's statements are clearly contradictory; on the one hand the Navy states that a connection between survivability and hearing loss is likely, which must be placed in the context of its prediction of 2.3 million instances of temporary hearing loss, while on the other it concludes that no mortality will result from the use of sonar. The Navy's conclusions are unsupported by its own analysis.	The Draft EIS/OEIS used the most current, relevant scientific information, in many cases in coordination with the NMFS, to develop the analysis on sonar training and testing and potential impacts on marine mammals. There is no research that indicates a temporary hearing loss over a narrow band of an animal's overall hearing range may have long-term consequences for the individual. Furthermore, the estimated effects (found in Tables 3.4-14 through 3.4-17 and Tables 3.4-22 through 3.4-29 of the EIS/OEIS) are overestimates for numerous reasons as described in Section 3.4.3.1.5.4 (Model Assumptions and Limitations) in the EIS/OEIS.

Table E-4: Responses to Comments from Organizations (Continued)

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O09-13	In this case, the Navy's assessment of impacts is consistently undermined by its failure to meet these fundamental responsibilities of scientific integrity, methodology, investigation, and disclosure. As set forth in greater detail in Appendix C and the attached critique by Dr. Bain, the DEIS disregards a great deal of relevant information adverse to the Navy's interests, uses approaches and methods that would not be acceptable to the scientific community, and ignores whole categories of impacts. In short, it leaves the public with an analysis of harm—behavioral, auditory, and physiological—that is at odds with established scientific authority and practice. The Navy must revise its acoustic impacts analysis, including its thresholds and risk function, to comply with NEPA.	The marine mammal acoustical analysis is based on the use of the best available and applicable science (Section 3.4, Marine Mammals, and the technical reports available at www.AFTTEIS.com, specifically, *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* and *Determination of Acoustic Effects on Marine Mammals and Sea Turtles*). The Navy reviewed and considered all literature cited in Appendix C and has been thorough in its use of all relevant information. The analysis is in full compliance with NEPA.The Navy predicted impacts due to acoustic and explosive stressors using conservative assumptions, as described in Section 3.4.3.1.5.4 (Model Assumptions and Limitations) and Section 3.4.3.1.9.3 (Predicted Impacts) for explosives.
O09-14	First, the Navy fails to adequately assess the impact of stress on marine mammals, a serious problem for animals exposed even to moderate levels of sound for extended periods....9 DEIS at 3.4-84 to 85. As the Navy has previously observed, stress from ocean noise—alone or in combination with other stressors, such as biotoxins—may weaken a cetacean's immune system, making it "more vulnerable to parasites and diseases that normally would not be fatal."10 Moreover, according to studies on terrestrial mammals, chronic noise can interfere with brain development, increase the risk of myocardial infarctions, depress reproductive rates, and cause malformations and other defects in young—all at moderate levels of exposure.11 Because physiological stress responses are highly conservative across species, it is reasonable to assume that marine mammals would be subject to the same effects and recent research is bearing this out. A study of North Atlantic right whales produced evidence showing that exposures to low-frequency ship noise may be associated with chronic stress in whales.12 For the Navy, such studies should be particularly relevant when assessing impacts on those marine mammal populations that are subjected to stress inducing impacts from training and testing activities on a regular basis. Nonetheless, despite the potential for stress in marine mammals and the significant consequences that can flow from it, the Navy unjustifiably assumes that such effects would be minimal. (Citations omitted)	The Navy reviewed and considered all of the literature and has been thorough in its use of all relevant information. Stress on marine mammals is addressed as part of the behavioral response function (Sections 3.4.3.1.2.4, Physiological Stress and 3.4.3.1.4.5, Behavioral Responses). Since the impact from noise exposure and the Navy training and testing events in general should be transitory given the movement of the participants, any stress responses should be short in duration and have less than biologically significant consequences. Impacts from vessel noise are discussed in Section 3.4.3.1.13 (Impacts from Vessel Noise). As discussed in Section 3.0.5.3.1.6 (Vessel Noise), Navy vessels contribute a very small portion of overall vessel broadband noise.
O09-15	Second, in the course of its training activities, the Navy would release a host of toxic chemicals, hazardous materials and waste into the	This statement is inaccurate. Chapter 3.1 (Sediments and Water Quality) did not state 11 million pounds of potentially toxic metals would be

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	marine environment that could pose a threat to marine mammals over the life of the range. For example, under its preferred alternative, the Navy plans to abandon over 11 million pounds of potentially toxic metals in AFTT Study Area waters. DEIS at 3.1-61.	abandoned. The chapter concludes that chemical, physical, or biological changes to sediment or water quality would be measurable but below applicable standards, regulations, and guidelines, and would be within existing conditions or designated uses. Neither state nor federal standards or guidelines would be violated.
O09-16	DEIS fails to adequately consider the cumulative impacts of these toxins on marine mammals from past, current, and proposed training exercises. Careful study is needed into the way toxins might disperse and circulate within the area and how they may affect marine wildlife.	The potential for indirect impacts from changes to sediments and water quality was addressed in Section 3.4.3.6 (Secondary Stressors – Marine Mammals). Chapter 4 (Cumulative Impacts) addresses all truly meaningful past, present, and reasonably foreseeable impacts (Section 4.4.4, Sediments and Water Quality), which concludes that the incremental contribution of the alternatives to long-term cumulative impacts would be negligible.
O09-17	The Navy's assumption that expended materials and toxics would dissipate or become buried in sediment leads to a blithe conclusion that releases of hazardous material would have no adverse effects. Given the amount of both hazardous and nonhazardous materials, this discussion is inadequate under NEPA.	The EIS/OEIS presents a thorough description and analysis in Section 3.1 (Sediments and Water Quality) of amounts and types of specific training materials as well as chemical composition and breakdown processes of expended materials. Based on the best available science, no individual expended materials would result in water or sediment toxicity surrounding the expended item. The Navy has taken a hard look through its analysis and has considered the best available data in supporting its conclusions.
O09-18	Acknowledging that entanglement is a serious issue for marine mammals (e.g., "Juvenile humpback whales and North Atlantic right whales in the western North Atlantic were found to have a higher rate of entanglement and be more at risk of serious injury when entangled than mature animals." DEIS at 3.4-247), the DEIS nonetheless dismisses the threat posed by abandoning 31,000 parachutes, claiming without support that a marine mammal that did become entangled could easily become free. DEIS at 252.	The Conceptual Framework for addressing entanglement issues is found in Section 3.0.5.7.4 (Conceptual Framework for Assessing Effects from Entanglement) which describes the approach to analysis with respect to entanglement. Furthermore, Section 3.4.3.4.5 (Impacts from Parachutes) clearly explains that marine mammals could easily free themselves because of the very lightweight fabric of the parachutes, and that there is no evidence of a marine mammal ever becoming entangled in a parachute.
O09-19	Third, the Navy fails to consider the risk of ship collisions with large cetaceans, as exacerbated by the use of active acoustics. For example, right whales have been shown to engage in dramatic surfacing behavior, increasing their vulnerability to ship strikes, on exposure to mid-frequency alarms above 133 dB re 1 µPa (SPL)—a level of sound that can occur many tens of miles away from the sonar systems slated for the range. (Nowacek et al., North Atlantic Right Whales, 271 Proceedings of the Royal Society of London, Part B: Biological Sciences at 227.)	Ship strikes are discussed in the EIS/OEIS, Section 3.4.3.3.1 (Impacts from Vessels). Results of the research by Nowacek et al. (2004) where right whales reacted to an "alert stimuli," used a sound source that has limited correlation to mid-frequency active sonar (Section 3.4.3.3.1, Impacts from Vessels). Results of that study were, however, used to develop the risk function from which the quantification of predicted exposures was derived.

Table E-4: Responses to Comments from Organizations (Continued)

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O09-20	And while the Navy analyzes the threat of ship strikes generally (DEIS at 3.4-231 to 240), it uses a basic probability calculation as opposed to the kind of modeling for take that it uses for other impacts (e.g., acoustic sources), which can underestimate the impact from ship strikes.	The use of a dynamic simulation model to estimate strike probability was considered, but the Navy found that use of historical data was more appropriate for the analysis. The strike probability analysis completed in this EIS/OEIS is based upon actual data collected from historical use of vessels. These data account for real world variables and any model would be expected to be less accurate than the use of actual data.
O09-21	Finally, the Navy draws unsupported conclusions about the threat of collisions for the most vulnerable species, like the North Atlantic right whale. While noting that "[v]essel strikes are considered a primary threat to North Atlantic right whale survival" (DEIS at 3.4-234) and that the species is particularly susceptible to ship strike, with one in five strikes in the Study Area attributed to right whales (DEIS at 3.4- 233), the Navy nonetheless states that it "does not anticipate it will strike a North Atlantic right whale because of the extensive measures in place to reduce the risk of a strike to that species." DEIS at 3.4-237. This statement defies common sense; protective measures have been in place for years to lessen the risk of collision with right whales, yet the species continues to be struck. The Navy cannot rely on protective measures that offer only incomplete protection to conclude that it will not strike a North Atlantic right whale.	The Navy acknowledges the threat that vessels pose to right whales and therefore has develop a unique suite of mitigation measures. For years, the Navy has successfully been employing these Navy-specific mitigation measures designed to avoid ship strikes to right whales.
O09-22	Fourth, the Navy does not adequately analyze the potential for and impact of oil spills. As evidenced by the 1989 *Exxon Valdez* oil spill and the 2010 BP *Deepwater Horizon* disaster, there is a risk of an oil spill in areas where oil is produced and transported, such as areas within the Gulf of Mexico. This risk is exacerbated by increasing the tempo and intensity of Navy training, which will involve more vessels, more transits, and longer missions throughout the AFTT Study Area. In light of this history and the extraordinarily valuable and sensitive natural resources that occur in the Gulf of Mexico, the Navy must evaluate its spill response plan and station salvage equipment accordingly.	The analysis presented in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS is limited to the activities and reasonable outcomes of such activities. Impacts from oil spills, like *Deepwater Horizon*, are considered as part of the baseline information for applicable resources. As accidents involving other vessels and oil spills are not reasonably foreseeable, nor anticipated, as part of the Proposed Action, the impact of such occurrences is not addressed or analyzed in Chapter 3. Oil spills are analyzed in Chapter 4 (Cumulative Impacts) with respect to past, present, and reasonably foreseeable future actions. The Navy has plans and procedures for preventing, reporting, and responding to oil spills. While the number of training and testing activities is likely to increase, since multiple activities usually occur from the same vessel, the increased number of activities is not expected to result in an increase in vessel use or transits.
O09-23	Finally, the Navy's analysis cannot be limited only to direct effects, i.e., effects that occur at the same time and place as the training exercises that would be authorized. 40 C.F.R. § 1508.8(a). It must also take into account the activity's indirect effects, which, though	The approach to direct and indirect impacts is discussed in Section 3.0.5.4 (Resource-Specific Impacts Analysis for Individual Stressors) and Section 3.0.5.7 (Biological Resource Methods). The potential for indirect effects on marine mammals has been considered in

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	reasonably foreseeable (as the DEIS acknowledges), may occur later in time or are further removed. 40 C.F.R. § 1508.8(b). This requirement is particularly critical in the present case given the potential for sonar exercises to cause significant long-term impacts not clearly observable in the short or immediate term (a serious problem, as the National Research Council has observed)	Section 3.4 (Marine Mammals) and it is thereby acknowledged that direct acoustic harassment of an individual can lead to other, indirect effects. The likely existence of such effects is accounted for in the estimation of "take" and they are otherwise not predictable or amenable to quantification. In addition, as described in this analysis, the training activities being analyzed have been performed for decades in the training ranges along the Atlantic and Gulf coasts with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals at those locations. The Navy's analysis indicates and this history indicates there is little relative risk to marine mammal populations from sonar training exercises as proposed in the EIS/OEIS.
O09-24	The Navy limits its analysis of the effects of mid-frequency active sonar on sea turtles on the grounds that their best hearing range appears to occur below 1 kHz. DEIS at 3.5-6 to 7; 3.5-55. Nevertheless, even with this limitation, the Navy predicts almost 40,000 instances of temporary hearing loss for sea turtles, 26 instances of lung damage, and 21 deaths each year from acoustic sources, like sonar and explosives. DEIS at 3.5-57; 3.5-69 to 70. For their Unmanned Underwater Vehicle Demonstrations using sonar and various ship shock trials, the Navy estimates over 2,000 instances of temporary hearing loss for sea turtles, 15 instances of permanent hearing loss, 354 instances of lung damage, and 83 deaths every five years. DEIS at 3.5-58; 3.5-71. Given the endangered status of sea turtles, there is little room for error in assessing impacts. While predicting death and permanent injury to members of these species and acknowledging a complete lack of density data for the species in open ocean conditions, the Navy nonetheless concludes that "impacts are not expected to decrease the overall fitness or result in longterm population-level impacts of any given population.." DEIS at 3.5-138. Yet such conclusions are made without analyzing the impacts against the specific status of each species, even while acknowledging that many of the species have decreasing long-term population trends (e.g., hawksbill sea turtles at DEIS 3.5-13) and that studies indicate that many populations in the AFTT Study Area may be genetically distinct and require independent management (e.g., green sea turtles at DEIS 3.5-7). The Navy must rigorously analyze predicted impacts against the status of the species in the AFTT Study Area before concluding that no population-level impacts are expected.	The Navy conducted a rigorous analysis of the potential impacts from sonar activities (Section 3.5.3.1, Acoustic Stressors) and repeated exposures to individual sea turtles are addressed in Section 3.5.3.1.2.6 (Repeated Exposures). As presented in Section 3.5.3.1.7 (Impacts from Sonar and Other Active Acoustic Sources), current best available science and all available indications are that sea turtles are not likely able to hear mid-frequency sonar. The approach to analysis (Section 3.0.5.4, Resource-Specific Impacts Analysis for Individual Stressors) states the analysis begins with individual organisms and their habitats, and then addresses populations, species, communities, and representative ecosystem characteristics, as appropriate. The conclusions reached in the EIS/OEIS are fully supported by the science and the analysis, which has been refined through the ESA consultation with NMFS. Additionally, it should be noted that the predicted number of acoustic impacts to turtles are large overestimates due to inadvertent adjustment of the turtle onset PTS and TTS thresholds. Because there are no published data on PTS or TTS in turtles, the turtle criteria for PTS and TTS are based on the PTS and TTS criteria for mid- and low-frequency cetaceans. When cetacean criteria were weighted to correlate with Type II frequency weighting, the turtle threshold was inadvertently lowered by 17 dB, even though Type II weighting is not applied to sea turtle hearing. This resulted in an increased number of model-predicted turtle impacts, although the actual impacts are expected to be substantially lower.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-25	Although the Navy acknowledges that "[t]here is little published literature on the hearing abilities of birds underwater…[and] no measurements of the underwater hearing of any diving birds" (DEIS at 3.6-10), it then inexplicably concludes that "any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population." DEIS at 3.6-34. Such reasoning does not bear up to any serious scrutiny. See, e.g., the entirely unsupported assertion that "[s]eabirds would avoid any additional exposures during a foraging dive when they surface" (DEIS at 3.6-34).	In the absence of scientific studies, reliance on professional judgment is required. Statements on the behavior of animals contained in the EIS/OEIS are based on the best available science. The Navy consulted with the U.S. Fish and Wildlife Service as appropriate.
O09-26	Seabirds occur in the AFTT Study Area, dive underwater (in some cases to depths of hundreds of feet), and are sensitive to the frequencies used by the Navy's acoustic sources. They must receive further analysis in the DEIS, both for the direct impacts they may suffer on exposure to the Navy's acoustic sources and for the impacts they may incur indirectly through depletion of prey species and hard bottom habitat. 40 C.F.R. § 1502.16(a), (b).	A thorough analysis of acoustic impacts on seabirds appears in Section 3.6.3.1 (Acoustic Stressors) which is based on the best available science. This section addressed deep diving birds. The EIS/OEIS concludes that there would be no long-term impacts from sonar to marine habitats (Section 3.3, Marine Habitats) or fish (Section 3.9, Fish), and therefore no indirect impacts are expected for seabirds.
O09-27	In its DEIS, the Navy discusses many of the unknowns regarding impacts from training and testing on fish (e.g., "While statistically significant losses were documented in the two groups impacted, the researchers only tested that particular sound level once, so it is not known if this increased mortality was due to the level of the test signal or to other unknown factors." DEIS at 3.9-61-62), while also acknowledging that acoustic and explosive stressors can cause a range of impacts including behavior responses, hearing loss, physical injury, or death to fish near the activity. DEIS at 3.9. Nonetheless, the DEIS concludes that that its training activities – including both the use of midfrequency active sonar and underwater detonations – would have no significant impact on fish, fisheries and essential fish habitat. The Navy's conclusion not only contradicts the available scientific literature on noise but also ignores the valid concerns of fishermen.	While the EIS/OEIS concludes there will be impacts from the Proposed Action to fish, those impacts do not translate into impacts on socioeconomic resources. Impacts analyzed in the EIS/OEIS consider the individual and the population. Impacts on single individuals do not translate to impacts on the entire population or the resource as a whole. The conclusions presented in the EIS/OEIS are fully supported in the analysis.
O09-28	For example, fisherman concerned with declining catch rates wrote letters opposing the Navy's proposal to build an Undersea Warfare Training Range off the coast of North Carolina in 2005. Those fishermen reported sharp declines in catch rates in the vicinity of Navy exercises.	Concerns of commercial fisherman were addressed in the EIS/OEIS (Section 3.11.3, Environmental Consequences – Socioeconomic Resources). Favored fishing areas change over time with fluctuations in fish populations and communities, preferred target species, or fishing modes and styles. Declines in fishing rates can be attributed to several factors both natural and anthropogenic. Section 3.9 (Fish) concludes that no long-term impacts on fish populations are anticipated, therefore, Section 3.11 (Socioeconomic Resources) correctly concludes that there

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		would be no indirect impacts on commercial and recreational fishing.
O09-29	In their comments on the Navy's Draft Environmental Impact Statement for the proposed Undersea Warfare Training Range off the coast of North Carolina, several fishermen and groups of fishermen independently reported witnessing sharp declines in catch rates of various species when in the vicinity of Navy exercises. These reports are also indicative of behavioral changes –such as a spatial redistribution of fish within the water column – that could similarly affect the fisheries in the AFTT Study Area.	Concerns of commercial fisherman were addressed in the EIS/OEIS (Section 3.11.3, Environmental Consequences – Socioeconomic Resources). Favored fishing areas change over time with fluctuations in fish populations and communities, preferred target species, or fishing modes and styles. Declines in fishing rates can be attributed to several factors both natural and anthropogenic. Section 3.9 (Fish) concludes that no long-term impacts on fish populations are anticipated, therefore, Section 3.11 (Socioeconomic Resources) correctly concludes that there would be no indirect impacts on commercial and recreational fishing.
O09-30	The Navy's conclusion that underwater noise will not result in "a decrease in overall fitness of any given population" ignores the scientific literature. A number of studies, including one on non-impulsive noise, show that intense sound can kill eggs, larvae, and fry outright or retard their growth in ways that may hinder their survival later.	The approach to analysis (Section 3.0.5.4, Resource-Specific Impacts Analysis for Individual Stressors) states the analysis begins with individual organisms and their habitats, and then addresses populations, species, communities, and representative ecosystem characteristics, as appropriate. Impacts on a resource, not listed as a federally protected species, are not based on impacts on individuals, but rather to the entire population. Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) and Section 3.9.3.1.3 (Impacts from Explosives and Other Impulsive Acoustic Sources) address potential impacts from all acoustic sources on fish, including non-impulsive noise and swimmer defense airguns. The conclusions reached in the EIS/OEIS are based on the best available science and are fully supported by the science and the analysis.
O09-31	Although the Navy acknowledges studies showing that eggs and larvae are more susceptible to sound, it tries to distinguish them by stating that they "were laboratory studies, however, and have not been verified in the field." DEIS at 3.9-63. However, federal law does not allow the Navy to ignore the valid scientific studies that have already been conducted simply because they are contrary to its interest.	The approach to analysis (Section 3.0.5.4, Resource-Specific Impacts Analysis for Individual Stressors) states the analysis begins with individual organisms and their habitats, and then addresses populations, species, communities, and representative ecosystem characteristics, as appropriate. Impacts on a resource are not based on impacts on individuals, but rather to the entire population. Section 3.9.3.1.1.1 (Direct Injury) contains a detailed discussion of potential direct injury that may result from non-impulsive acoustic sources, as well as explosions and other impulsive acoustic sources. Studies involving larvae are presented and discussed. Furthermore, Section 3.9.3.1.2 (Impacts from Sonar and Other Non-Impulsive Acoustic Sources) and Section 3.9.3.1.3 (Impacts from Explosives and Other Impulsive Acoustic Sources) address potential impacts from all Navy acoustic sources on fish. The conclusions reached in the EIS/OEIS are based on the best available science and are fully supported by the science and the analysis.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-32	There are a variety of live-fire training exercises, some of which involve underwater explosions of torpedoes and other ordnance that will take place in the AFTT Study Area. Given the variety of fish and fisheries inhabiting these waters, the Navy's failure to analyze these effects in significant detail is stunning.	The EIS/OEIS has taken a hard look at impacts on fish in Section 3.9.3 (Environmental Consequences – Fish) which was based on the best available science. This section conducted a rigorous analysis of training exercises using high explosive ordnance, including underwater explosions and ordnance.
O09-33	The Navy arbitrarily dismisses the potential for adverse impacts on fish. The Navy also capriciously dismisses the notion that fisheries in the area would suffer economic loss, even though – judging by the comments from North Carolina fishermen in 2005 – its training activities appear to have disrupted fishing in the past. Just like the training proposed in North Carolina, the available evidence here underscores the need for a more serious and informed analysis than the Navy currently provides.	The EIS/OEIS has taken a hard look at impacts on fish in Section 3.9.3 (Environmental Consequences – Fish) which was based on the best available science. Socioeconomic Resources (Section 3.11.3) adequately addresses concern of economic loss from the Proposed Action. Concerns of commercial fisherman were addressed in the EIS/OEIS (Section 3.11.3, Environmental Consequences – Socioeconomic Resources). Favored fishing areas change over time with fluctuations in fish populations and communities, preferred target species, or fishing modes and styles. Declines in fishing rates can be attributed to several factors both natural and anthropogenic. Section 3.9 (Fish) concludes that no long-term impacts on fish populations are anticipated, therefore, Section 3.11 (Socioeconomic Resources) correctly concludes that there would be no indirect impacts on commercial and recreational fishing.
O09-34	To comply with the requirements of NEPA, the Navy should rigorously analyze the potential for behavioral, auditory, and physiological impacts on fish, including the potential for population-level effects, using models of fish distribution and population structure and conservatively estimating areas of impact from the available literature. 40 C.F.R. § 1502.22.	The analysis of the potential impacts on fish is found in Section 3.9.3 (Environmental Consequences – Fish). Impacts from acoustic stressors appear in Section 3.9.3.1 (Acoustic Stressors – Fish). The Navy used the best available science for the analysis of impacts on fish, and fully complies with the requirements of NEPA.
O09-35	The Navy must also meaningfully assess the economic consequences of reduced catch rates on commercial and recreational fisheries (as well as on marine mammal foraging) in the AFTT Study Area.	As stated in the approach to analysis (Section 3.0.5, Overall Approach to Analysis), indirect impacts result when a direct impact on one resource induces an impact on another resource (referred to as a secondary stressor). If there is no direct impact on a resource, then indirect impacts are not foreseeable. Section 3.9 (Fish) concludes that no long-term impacts on fish populations. The analysis in Marine Mammals (Section 3.4) and Socioeconomic Resources (Section 3.11) screened for any impacts on other resources that might create secondary impacts. Because the EIS/OEIS concludes that there would be no impacts on fish populations, reduced catch rates and prey base were not addressed for Marine Mammals (Section 3.4) or Socioeconomic Resources (Section 3.11).

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-36	It should also consider avoiding essential fish habitat, spawning grounds and other areas of important habitat for fish species, especially hearing specialists. Notably, as with marine mammals, the Navy does not consider exclusion of important fish habitat or fisheries in the AFTT Study Area.	Information on mitigation measures can be found in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS. Section 5.3.3.2 (Seafloor Resources) includes a of description of measures the Navy implements in specified mitigation areas, including important habitat for fish species such as shallow coral reefs, hard bottom, artificial reefs, and shipwrecks. The mitigation measures listed in the Final EIS/OEIS are the result of consultation with NMFS with respect to essential fish habitat, and analysis presented in the AFTT Essential Fish Habitat Assessment.
O09-37	This mitigation scheme disregards the best available science on the significant limits of visual monitoring. Visual detection rates for marine mammals generally approach only 5 percent. Moreover, the species perhaps most vulnerable to sonar-related injuries, beaked whales, are among the most difficult to detect because of their small size and diving behavior. It has been estimated that in anything stronger than a light breeze, only one in fifty beaked whales surfacing in the direct track line of a ship would be sighted; as the distance approaches 1 kilometer, that number drops to zero.33 Many other whales are also hard to detect, especially depending on seasonality, geography, and behaviors. For example, right whales are also notoriously hard to detect, and the Navy plans to train in critical habitat for the highly endangered North Atlantic right whale. Right whales are uniquely vulnerable to ship strikes because they often hover on or near the surface of the water. Due to their dark coloration and lack of a dorsal fin, however, they are difficult to detect. The Navy's reliance on visual observation as the mainstay of its mitigation plan is therefore profoundly misplaced. (Citations omitted)	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Section 5.3.1.2.4.1 (Detection Probabilities of Marine Mammals in the Study Area) has a detailed discussion of available literature on the sightability of marine mammals, based on the average g(0) values presented in Table 5.3-1, which are estimated to range from 0.2 for beaked whales (aerial surveys) up to 0.95 for blue whales (vessel surveys). Specifically, North Atlantic right whales have an average g(0) value of 0.65 for vessel surveys. Section 5.3.3.1 (Marine Mammal Habitats) outlines specific measures that will be employed within North Atlantic right whale mitigation areas, and specifies which activities will not be conducted in these areas. Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures) contains a detailed discussion comparing typical marine mammal surveys to Navy training and testing activities. In particular, this section discusses why the Barlow and Gisiner (2006) paper, which provides a description of typical marine mammal survey methods from ship and aircraft and then provides "a crude estimate" of the difference in detection of beaked whales between trained marine mammal observers and seismic survey mitigation, is not informative with regard to Navy mitigation procedures.
O09-38	In this light, the Navy's claims that it cannot implement more protective mitigation measures ring false. DEIS at 5-66 to 73. Although the Navy goes to some pain to describe "mitigation measures considered but eliminated" —primarily because of "unacceptable impacts on the proposed activity"—its previous adoption of the same measures belies its argument. Clearly the Navy has done more to mitigate the harmful effects of sonar in previous	The measures that Natural Resources Defense Council refer to have not been in place since January 2009, are not included in the current permits. Section 5.3.4 (Mitigation Measures Considered but Eliminated) includes a complete list of mitigation measures that the Navy has considered but eliminated because the measures are ineffective at reducing environmental impacts, currently have an unacceptable operational impact, or are expected to have an unacceptable operational impact in

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	exercises than what it proposes for the AFTT activities. It can, and must, do more to mitigate the harm on marine wildlife.	the future. As described in Section 5.3.4 (Mitigation Measures Considered but Eliminated), it is critical that the Navy be able to conduct anti-submarine warfare training in a variety of environmental and bathymetric conditions, including in the vicinity of canyons and during periods of low visibility. The Navy continuously collects information on the effectiveness of mitigation measures and their impact on military readiness. This accumulation of information helped shaped the Navy's operational assessments throughout Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Draft and Final EIS/OEIS. As part of the mitigation evaluation process, the Navy did not recommend continuing to implement mitigation measures that were causing unacceptable operational impacts, including interfering with the Navy's ability to meet all or part of its military readiness requirements.
O09-39	One of NOAA's Working Groups, CetMap, is identifying marine mammal "hot spots" in the AFTT Study Area – biologically important areas for marine mammals as evidenced by increases in density and distribution or modeled based on important habitat features. Cet Map's identification of these areas should form a basis for creating protection zones where training activities could be barred or limited.	The Navy has and will continue to support the Cetacean and Sound Mapping project, including providing representation on the Cetacean Density and Distribution Mapping Working Group (CetMap). This working group has two objectives: First, to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors. With the exception of the Atlantic and Gulf of Mexico, the Navy considered this information as part of the impact and mitigation assessment process. For the Atlantic and Gulf of Mexico, the Navy OPAREA Density Estimates on the Spatial Decision Support System for the Strategic Environmental Research and Development Program (available at http://seamap.env.duke.edu/serdp_map.php), are still considered the best available data (Read and Halpin 2010[1]). As of August 2013, CetMap had not released final updated density data products for the Atlantic and Gulf of Mexico. Second, and separately, to augment the more quantitative density mapping and provide additional context for impact analyses, the CetMap is also identifying areas of specific importance for cetaceans, such as reproductive areas, feeding areas, migratory corridors, and areas in which small or resident populations are concentrated, otherwise referred to as "biologically important areas". The working group determined that "hot spots" is not an appropriate term and chose to call them Biologically Important Areas. Biologically important areas information was based largely on observational data of animals exhibiting biologically important behaviors. The biologically important areas were only characterized for species, areas, and seasons where there were enough data to support

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		the biologically important areas identification within the U.S. Exclusive Economic Zone. Most of these assessments are not based on CetMap density work products but on published and often unpublished data held by individual researchers. They only characterized the observational data available and did not use density or habitat-based models to determine the biologically important areas. Biologically important areas are not being designated by CetMap for the purpose of identifying areas off limit to human activities like sonar. Instead, information is being collected to provide additional context within which to examine potential interactions between cetaceans and human activities. This information can assist resource managers with planning, analyses, and decisions regarding how to reduce adverse impacts to cetaceans resulting from human activities. Some preliminary, draft results are currently being released on http://cetsound.noaa.gov/important.html. The CetMap Working Group is also undertaking external review of the documents by subject matter experts outside National Oceanic and Atmospheric Administration and is preparing a collection of manuscripts focused on the biologically important areas that will be submitted to a scientific journal for external peer review by subject matter experts. The Navy also recommended to NMFS that a formal expert elicitation on biologically important areas results be conducted, including data review by a larger body of marine scientists and stakeholders. When appropriate, NMFS provides draft CetMap information for Navy consideration. As part of the ESA and MMPA processes, NMFS requested the Navy to consider some specific preliminary draft areas as part of its mitigation analysis As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Additional information can be found in Section 5.3.3.1.3.1, Planning Awareness Areas. If additional biologically important areas are identified by NMFS after the Navy's Record of Decision, the Navy and NMFS will use the Adaptive Management process to assess whether any additional mitigation should be considered in those areas. [1] Read, A. J. and P. Halpin. 2010. Predictive Spatial Analysis of Marine Mammal Habitats. Final Report. SERDP Project SI-1390. January 2010. 292 pp.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-40	The following biologically important areas – all in the Gulf of Mexico – are but a sample of the kind of areas that should be analyzed by the Navy for the development of protection zones as informed by the results of CetMap: 1) Mississippi Canyon.— It is well established, on the basis of historic whaling records, mark-recapture data, and extensive surveys including by GulfCet II and the Sperm Whale Seismic Study, that this area constitutes important habitat for the Gulf's small, biologically distinct population of sperm whales, most likely due to the input of a nutrient-rich, freshwater plume from the Mississippi Delta.36 Nearly all sightings of females and mother-calf groups have occurred there, strongly suggesting that it functions as a nursery ground.37 2) DeSoto Canyon.— The DeSoto Canyon represents important habitat for Bryde's whales, the most commonly occurring baleen whale in the Gulf of Mexico, as well as habitat for sperm whale and other cetaceans. Nearly all known sightings of Bryde's whales have occurred in the canyon.38 The stock size is estimated as well under 50 animals, leaving it extremely vulnerable to human disturbance, particularly if it constitutes a resident population as several studies have suggested.39 3) Coastal waters landward of the 20m isobath.— The coastal ecotype of bottlenose dolphin comprises more than 30 identified stocks across the Northern Gulf, many of which have best population estimates well below 100 individual animals; and manatees are an ESA-listed species whose habitat choices are highly correlated to the absence of predominantly low-frequency sound.40 Bottlenose dolphins have seen three major mortality spikes since early 2010.41 These waters provide habitat for both species. 4) West of the Florida Keys and Tortugas.— This area, which lies along the continental slope west of the islands, constitutes an area of consistent sperm whale concentration in the Eastern Gulf.42 (Citations omitted)	The Navy has and will continue to support the Cetacean and Sound Mapping project, including providing representation on the Cetacean Density and Distribution Mapping Working Group (CetMap). This working group has two objectives: First, to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors. With the exception of the Atlantic and Gulf of Mexico, the Navy considered this information as part of the impact and mitigation assessment process. For the Atlantic and Gulf of Mexico, the Navy OPAREA Density Estimates on the Spatial Decision Support System for the Strategic Environmental Research and Development Program (available at http://seamap.env.duke.edu/serdp_map.php), are still considered the best available data (Read and Halpin 2010[1]). As of August 2013, CetMap had not released final updated density data products for the Atlantic and Gulf of Mexico. Second, and separately, to augment the more quantitative density mapping and provide additional context for impact analyses, the CetMap is also identifying areas of specific importance for cetaceans, such as reproductive areas, feeding areas, migratory corridors, and areas in which small or resident populations are concentrated, otherwise referred to as "biologically important areas". The working group determined that "hot spots" is not an appropriate term and chose to call them Biologically Important Areas. Biologically important areas information was based largely on observational data of animals exhibiting biologically important behaviors. The biologically important areas were only characterized for species, areas, and seasons where there were enough data to support the biologically important areas identification within the U.S. Exclusive Economic Zone. Most of these assessments are not based on CetMap density work products but on published and often unpublished data held by individual researchers. They only characterized the observational data available and did not use density or habitat-based models to determine the biologically important areas. Biologically important areas are not being designated by CetMap for the purpose of identifying areas off limit to human activities like sonar. Instead, information is being collected to provide additional context within which to examine potential interactions between cetaceans and human activities. This information can assist resource managers with planning, analyses, and decisions regarding how to reduce adverse impacts to cetaceans resulting from human activities.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		Some preliminary, draft results are currently being released on http://cetsound.noaa.gov/important.html. The CetMap Working Group is also undertaking external review of the documents by subject matter experts outside National Oceanic and Atmospheric Administration and is preparing a collection of manuscripts focused on the Important Areas that will be submitted to a scientific journal for external peer-review by subject matter experts. The Navy also recommended to NMFS that a formal expert elicitation on biologically important areas results be conducted, including data review by a larger body of marine scientists and stakeholders. When appropriate, NMFS provides draft CetMap information for Navy consideration. As part of the ESA and MMPA processes, NMFS requested the Navy to consider some specific preliminary draft areas as part of its mitigation analysis. As a result of the Navy's Biological Assessment and Operational Assessment, the Navy recommends extending the boundary of the eastern Gulf of Mexico planning awareness area to further protect a population of Bryde's whale that has been exclusively observed in that area year-round. Additional information can be found in Section 5.3.3.1.3.1, Planning Awareness Areas. If additional biologically important areas are identified by NMFS after the Navy's Record of Decision, the Navy and NMFS will use the Adaptive Management process to assess whether any additional mitigation should be considered in those areas. [1] Read, A. J. and P. Halpin. 2010. Predictive Spatial Analysis of Marine Mammal Habitats. Final Report. SERDP Project SI-1390. January 2010. 292 pp.
O09-41	The DEIS fails to set forth any mitigation measures concerning the massive amount of discarded debris and expended materials associated with its proposed activities in the AFTT Study Area. The Navy claims that ocean currents will rapidly disperse the expended materials and thus no mitigation is required. "In NEPA's demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented,' is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." Robertson, 490 U.S. at 352-53. The Navy's "all-or-nothing approach" is not a sufficient discussion of how the adverse impacts of expended material can be avoided. By failing to explore mitigation measures for expended	The Navy conducted a full analysis of the potential impacts of military expended materials on marine resources and has proposed several mitigation measures to help avoid or reduce those impacts. The analysis is contained throughout Chapter 3 (Affected Environment and Environmental Consequences) of the Draft and Final EIS/OEIS (e.g., Section 3.3.3.2.1, Impacts from Military Expended Materials discusses marine habitats). For example, military expended materials related to training exercises under a worst-case scenario under Alternatives 1 and 2 would not impact more than 0.00009 percent of the available soft bottom habitat annually within any of the range complexes. The Navy has standard operation procedures in place to reduce the amount of military expended materials (Section 5.1.4.2, Weapons Firing Range Clearance),

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	materials, the Navy does not even attempt to avoid, minimize, rectify, reduce, or compensate for its dumping of debris – all of which are options included in the CEQ regulation's definition of "mitigation." 40 C.F.R. § 1508.20.	including recovering targets and associated parachutes to the maximum extent practical. In addition, the Navy has developed mitigation areas (Section 5.3.3.2, Seafloor Resources) to avoid and reduce potential impacts of military expended materials on seafloor habitats, including coral and hard bottom habitats.
O09-42	In addition to considering protection zones and mitigation for expended materials, the Navy should adopt the following measures: 1) Seasonal avoidance of marine mammal feeding grounds, calving grounds, and migration corridors; 2) Avoidance of, or extra protections in, marine protected areas; 3) Avoidance of bathymetry likely to be associated with high-value habitat for species of particular concern, including submarine canyons and large seamounts, or bathymetry whose use poses higher risk to marine species; 4) Avoidance of fronts and other major oceanographic features, such as areas with marked differentials in sea surface temperatures, which have the potential to attract offshore concentration of animals, including beaked whales; 5) Avoidance of areas with higher modeled takes or with high-value habitat for particular species; 6) Concentration of exercises to the maximum extent practicable in abyssal waters and in surveyed offshore habitat of low value to species; 7) Use of sonar and other active acoustic systems at the lowest practicable source level, with clear standards and reporting requirements for different testing and training scenarios; 8) Expansion of the marine species "safety zone" to a 4km shutdown, reflecting international best practice, or 2 km, reflecting the standard prescribed by the California Coastal Commission;44 9) Suspension of relocation of exercises when beaked whales or significant aggregations of other species are detected by any means within the orbit circle of an aerial monitor or near the vicinity of an exercise; 10) Use of simulated geography (and other work-arounds) to reduce or eliminate chokepoint exercises in near-coastal environments, particularly within canyons and channels, and use of other important	In cooperation with NMFS, the Navy has developed a suite of mitigation measures that provide protection for marine species, are practicable to implement, and allow training and testing activities to meet their readiness requirements. 1) The balance between procedural measures and mitigation area measures provide a way for the Navy to mitigate potential impacts while maintaining its military readiness objectives. Section 5.3.4.1.11 (Avoiding Marine Species Habitats in the Study Area) discusses seasonal restrictions. The Navy has proposed several seasonal measures, as discussed in Section 5.3.3 (Mitigation Areas). Many measures that were originally developed specifically for the North Atlantic right whale will subsequently provide avoidance or reduction of potential impacts on all marine mammals within those mitigation areas during the proposed time periods. 2) As described in Section 5.3.4.2.1.12 (Avoiding Marine Protected Areas), avoiding all marine protected areas for the purpose of mitigation would result in an unacceptable impact on readiness; increase safety risks to personnel; be impractical with regard to implementation; and would not be warranted based on the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for biological resources, and Section 6.1.2 (Marine Protected Areas) discussions. Section 6.1.2 (Marine Protected Areas) discusses the marine protected areas contained within the Study Area, and which activities may occur within each area. 3) Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions) discusses habit avoidance. 4) Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions) discusses habitat avoidance. As discussed throughout Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), Lookouts will be employed to visually observe for marine mammals in all types of oceanographic conditions. 5) Section 5.3.4.1.11 (Avoiding Marine Species Habitats in the Study Area) discusses marine species habitats with respect to modeled takes.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	habitat; 11) Avoidance or reduction of training during months with historically significant surface ducting conditions, and use of power-downs during significant surface ducting conditions at other times; 12) Use of additional power-downs when significant surface ducting conditions coincide with other conditions that elevate risk, such as during exercises involving the use of multiple systems or in beaked whale habitat; 13) Planning of ship tracks to avoid embayments and provide escape routes for marine animals; 14) Suspension or postponement of chokepoint exercises during surface ducting conditions and scheduling of such exercises during daylight hours; 15) Use of dedicated aerial monitors during chokepoint exercises, major exercises, and near-coastal exercises; 16) Use of dedicated passive acoustic monitoring to detect vocalizing species, through established and portable range instrumentation and the use of hydrophone arrays off instrumented ranges; 17) Modification of sonobuoys for passive acoustic detection of vocalizing species; 18) Suspension or reduction of exercises outside daylight hours and during periods of low visibility; 19) Use of aerial surveys and ship-based surveys before, during, and after major exercises; 20) Use of all available range assets for marine mammal monitoring; 21) Use of third-party monitors for marine mammal detection; 22) Application of mitigation prescribed by state regulators, by the courts, by other navies or research centers, or by the U.S. Navy in the past or in other contexts; 23) Avoidance of fish spawning grounds and of important habitat for fish species potentially vulnerable to significant behavioral change, such as widescale displacement within the water column or changes in breeding behavior; 24) Evaluating before each major exercise whether reductions in sonar use are possible, given the readiness status of the strike groups involved;	6) Section 5.3.4.1.6 (Limiting Activities to a Few Specific Locations) discusses limiting activities to abyssal waters and offshore habitats. 7) The Navy concurs; Section 5.3.4.1.3 (Reducing Sonar Source Levels and Total Number of Hours) discusses how the Navy uses active sonar at the lowest practicable source level consistent with mission requirements. Section 5.5 (Monitoring and Reporting) discusses the Navy's reporting requirements, which will be coordinated through NMFS during the permitting process. 8) Section 5.3.4.1.13 (Increasing the Size of Observed Mitigation Zones) discusses mitigation zone expansion. There is no internationally recognized best practice with regard to mitigation zone distance. The mitigation zones discussed throughout the Draft and Final EIS/OEIS were developed using the latest best available science, are consistent with regulatory requirements and criteria, and are tailored to the Proposed Action; therefore, adopting other mitigation zones would neither be a practical nor effective mitigation scheme for the Proposed Action. 9) Mitigation will be implemented within the mitigation zone for all marine mammals regardless of species. Passive acoustic monitoring will be used to inform visual observations because resources are not available for the Navy to locate vocalizing animals through passive acoustics during training and testing activities. Mitigation specific to beaked whales and "significant aggregations" are not necessary because the mitigation will be implemented for all species and any number of animals observed. 10) Section 5.3.4.1.2 (Replacing Training and Testing with Simulated Activities) discusses simulated activities. 11) Section 5.3.4.1.9 (Avoiding or Reducing Active Sonar During Strong Surface Ducts) discusses surface ducts. 12) Section 5.3.4.1.3 (Reducing Sonar Source Levels and Total Number of Hours) discusses sonar levels and hours, and Section 5.3.4.1.9 (Avoiding or Reducing Active Sonar During Strong Surface Ducts) discusses surface ducts. Mitigation measures are implemented equally in all locations where the activity occurs. Chapter 3.4 (Marine Mammals) and the *Navy Marine Species Density Database* technical report provide information on beaked whale habitat within the Study Area. Beaked whales inhabit all portions of the Study Area except the West Greenland Shelf Large Marine Ecosystem. Otherwise limiting active sonar activities to the West Greenland Shelf or implementing additional power-downs throughout the remainder of the Study Area would cause an

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	25) Dedicated research and development of technology to reduce impacts of active acoustic sources on marine mammals; 26) Establishment of a plan and a timetable for maximizing synthetic training in order to reduce the use of active sonar training; 27) Prescription of specific mitigation requirements for individual classes (or sub-classes) of testing and training activities, in order to maximize mitigation given varying sets of operational needs; and 28) Timely, regular reporting to NOAA, state coastal management authorities, and the public to describe and verify use of mitigation measures during testing and training activities. While the Navy considers, and summarily dismisses, many of these measures in its DEIS, it fails to do so in a manner permitted by NEPA and we note that similar or additional measures may be required under the Marine Mammal Protection Act, Endangered Species Act, and other statutes.	unacceptable impact on readiness. 13) Section 5.3.4.1.6 (Limiting Activities to a Few Specific Locations) discusses limiting the location of activities. 14) Section 5.3.4.1.8 (Avoiding or Reducing Active Sonar at Night and During Periods of Low Visibility) and Section 5.3.4.1.9 (Avoiding or Reducing Active Sonar During Strong Surface Ducts) discuss activities conducted during varying environmental conditions. 15) Section 5.3.4.1.12 (Increasing Visual and Passive Acoustic Observations) discusses visual observations. 16) Section 5.3.4.1.12 (Increasing Visual and Passive Acoustic Observations) discusses passive acoustic observations. 17) Section 5.3.4.1.12 (Increasing Visual and Passive Acoustic Observations) discusses passive acoustic observations. As described throughout Chapter 5, Passive acoustic monitoring will be conducted with Navy assets, such as sonobuoys, when practicable. 18) Section 5.3.4.1.8 (Avoiding or Reducing Active Sonar at Night and During Periods of Low Visibility) discusses activities conducted during varying environmental conditions. 19) As described throughout Chapter 5, visual observation (aerial and vessel-based) would be conducted in association with Navy activities. Section 5.3.4.1.12 (Increasing Visual and Passive Acoustic Observations) discusses visual observations. 20) Section 5.3.4.1.12 (Increasing Visual and Passive Acoustic Observations) discusses visual observations. For additional information on the Navy's marine mammal monitoring efforts, see http://www.navymarinespeciesmonitoring.us/. 21) Section 5.3.4.1.14 (Conducing Observations Using Third-Party Observers) discusses third-party observers. 22) Section 5.3.4.1.15 (Adopting Mitigation Measures of Foreign Navies) discusses foreign navies. Mitigation is developed in cooperation with NMFS and was refined through the MMPA and ESA consultation processes. Evaluation of past and present Navy mitigation measures is included throughout Chapter 5; most measures originated through past environmental analyses and associated consultations with regulators. 23) Section 5.3.4.1.11 (Avoiding Marine Species Habitats) discusses habitat avoidance. Section 3.9 (Fish) provides the effects determinations

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		on fish in the Final EIS/OEIS. 24) Section 5.3.4.1.3 (Reducing Sonar Source Levels and Total Number of Hours) discusses how the Navy uses active sonar at the lowest practicable source level and number of hours consistent with mission requirements. 25) The Navy provides a significant amount of funding and support to marine research. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and nongovernmental conservation organizations in collecting, evaluating, and modeling information on marine resources. Details on the Navy's involvement with future research will be worked out through the Navy and NMFS adaptive management process, which regularly considers and evaluates the development and use of new science and technologies for Navy applications. 26) Section 5.3.4.1.2 (Replacing Training and Testing with Simulated Activities) discusses simulated activities. 27) The Navy has developed mitigation by activity type to reduce potential impacts from the Proposed Action while not causing an unacceptable impact on readiness. Chapter 5 discusses these measures. 28) Navy reporting requirements, including exercise and monitoring reporting, are described in Section 5.5, Monitoring and Reporting. Section 5.3.4.1.16 (Increasing Reporting Requirements) provides additional discussion. Comment noted. The Navy worked cooperatively to finalize mitigation measures through the permitting and consultation processes for MMPA, ESA, and Essential Fish Habitat. The final mitigation measures are those determined to both minimize impacts and allow the Navy to meet its military readiness requirements. The mitigation measures mentioned do not provide any additional protection for marine species beyond what is currently implemented.
O09-43	The Navy's cumulative impact analysis fails to meet these basic requirements. Nowhere in its cumulative impact analysis does the Navy consider—let alone reach the conclusion—that the sum of the various environmental impacts that are enumerated will be limited. DEIS at 4-1 to 44. The Navy's analysis cannot provide such support because the Navy fails to explain what the sum of these impacts is expected to be. NEPA requires more than just a recital of possible impacts: it requires the Navy to actually analyze the overall impact of	The Navy used the best available science and a comprehensive review of past, present and reasonably foreseeable actions to develop a robust Cumulative Impacts analysis (Chapter 4, Cumulative Impacts). As required under NEPA, the level and scope of the analysis are commensurate with the potential impacts of the action as reflected in the resource-specific discussions in Chapter 3 (Affected Environment and Environmental Consequences). The EIS/OEIS considered its activities alongside those of other activities in the region whose impacts are "truly

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	the accumulation of individual impacts. Grand Canyon Trust, 290 F. 3d at 345. The DEIS fails to make this analysis.	meaningful" to the analysis.
O09-44	The Navy apparently believes it is enough to find that cumulative impacts will be "significant" and that, defying logic, impacts from its proposed activities will be relatively low when compared to other actions to support its conclusion that further analysis is not warranted. Yet most well-informed laypeople know that human activities have a significant impact on the marine environment, contributing to population declines, extinctions, and challenges to recovery. The Navy's recitation that it is hard out there for struggling species, offers no insight as to how impacts from its proposed activities should be placed in perspective when assessing cumulative threats to marine wildlife. To the extent that the Navy does offer perspective, it is to claim, without any support, that the relative contribution of its activities is low when compared to other threats. Such assertions are patently absurd given the amount of take – nearly 19 million instances of marine mammal take over 5 years, including over 2 million instances of temporary hearing loss – projected to result from the Navy's activities.	The Navy used the best available science and a comprehensive review of past, present and reasonably foreseeable actions to develop a robust Cumulative Impacts analysis (Chapter 4, Cumulative Impacts). As required under NEPA, the level and scope of the analysis are commensurate with the potential impacts of the action as reflected in the resource-specific discussions in Chapter 3 (Affected Environment and Environmental Consequences). The EIS/OEIS considered its activities alongside those of other activities in the region whose impacts are "truly meaningful" to the analysis. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis.
O09-45	The Navy must also consider the full effects of its sonar training. It simply assumes that all behavioral impacts are short-term in nature and cannot affect individuals or populations through repeated activity—even though the anticipated takes of its preferred alternative would affect the same populations year after year. While the DEIS's analysis focuses on impacts over 5 years, naval training and testing will undoubtedly continue in the AFTT Study Area for the foreseeable future. At current rates, which is a conservative estimate given increases in training and testing activities over the last decade, the marine mammal populations of the AFTT Study Area will suffer nearly 100 million takes over the next 25 years.	The Navy used the best available science and a comprehensive review of past, present and reasonably foreseeable actions to develop a robust Cumulative Impacts analysis (Chapter 4, Cumulative Impacts). As required under NEPA, the level and scope of the analysis are commensurate with the potential impacts of the action as reflected in the resource-specific discussions in Chapter 3 (Affected Environment and Environmental Consequences). The EIS/OEIS considered its activities alongside those of other activities in the region whose impacts are "truly meaningful" to the analysis. The scope of the EIS/OEIS only extends to 2019, at which time, further NEPA analysis will be conducted for the permitting process. At that time, the needs of the Navy's training and testing communities will be re-evaluated.

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Comment Identifier	Comment	Navy Response
O09-46	Nor does the Navy consider the potential for acute synergistic effects from sonar training. Although the DEIS discusses the potential for ship strike in the training area (DEIS 4-27 for marine mammals), it does not consider the greater susceptibility to vessel strike of animals that have been temporarily harassed or disoriented by certain noise sources. The absence of analysis is particularly glaring in light of the Haro Strait incident, in which killer whales and other marine mammals were observed fleeing away from the sonar vessel at high speeds. Neither does the Navy consider the synergistic effects of noise with other stressors in producing or magnifying a stress response. For these reasons alone, the Navy should have concluded that the cumulative and synergistic impacts from sonar training are significant and focused its efforts to analyze and develop mitigation measures to avoid those impacts.	Based on the page numbers described, this comment seems to have been made on the Atlantic Fleet Active Sonar Training EIS/OEIS document and not the Atlantic Fleet Training and Testing (AFTT) EIS/OEIS. Although the Navy acknowledges that acute synergistic effects are not well-studied and can only be accounted for qualitatively, a section for each resource exists that discusses this particular issue. For marine mammals, it is Section 3.4.4.1 (Combined Impact of All Stressors).
O09-47	The Navy acknowledges that the AFTT Study Area is crowded with human and military activities, many of which introduce noise, chemical pollution, debris, and vessel traffic into the habitat of protected species. DEIS at 4-4 to 21. Yet it inexplicably fails to conclude what the cumulative effects will be for the environment other than saying the impacts will be “significant.”	This comment seems to have been made on the Atlantic Fleet Active Sonar Training EIS/OEIS and not the Atlantic Fleet Training and Testing (AFTT) EIS/OEIS. The Navy used the best available science and a comprehensive review of past, present and reasonably foreseeable actions to develop a robust cumulative impacts analysis in Chapter 4 (Cumulative Impacts). As required under NEPA, the level and scope of the analysis are commensurate with the potential impacts of the action as reflected in the resource-specific discussions in Chapter 3 (Affected Environment and Environmental Consequences). The EIS/OEIS considered its activities alongside those of other activities in the region whose impacts are "truly meaningful" to the analysis.
O09-48	To comply with NEPA, an EIS must “inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment.” 40 C.F.R. § 1502.1. The regulation itself describes the requirement as “the heart of the environmental impact statement.” Id. at § 1502.14. Courts similarly portray the alternatives requirement as the “linchpin” of the EIS. Monroe County Conservation Council v. Volpe, 472 F.2d 693 (2d Cir. 1972). The agency must therefore “[r]igorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.” 40 C.F.R. § 1502.14(a). The agency must also state how the alternatives considered in the DEIS and decisions based on the DEIS will or will not achieve the	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission. Further, the USEPA reviewed the EIS/OEIS and stated “the draft EIS/OEIS provides

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	requirements of sections 101 and 102(1) of NEPA and other environmental laws and policies. See 40 C.F.R. § 1502.2(d). Consideration of alternatives is required by (and must conform to the independent terms of) both sections 102(2)(C) and 102(2)(E) of NEPA. Here, the Navy's alternatives analysis misses the mark.	an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- 'Lack of Objections.'"
O09-49	These alternatives do not provide decision makers with a range of genuine choices and are a stark departure from the Atlantic Fleet's previous EIS. While the purpose of the alternatives analysis is to "consider the likely environmental impacts of the preferred course of action as well as reasonable alternatives," which "facilities informed decisionmaking by agencies and allows the political process to check those decisions," New Mexico ex rel. Richardson v. BLM, 565 F.3d 683, 703-704 (10th Cir. N.M. 2009), the DEIS falls short of this goal. The Navy's alternatives amount to a presentation of only one true course of action: potential training and testing in all areas at all times.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
O09-50	The Navy claims it "considers potential environmental impacts" while executing its responsibilities under federal law, including NEPA. DEIS at 1-1. But the Navy's alternatives were not selected to "inform decision-makers and the public" of how the Navy could "avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1. Instead, as discussed in the DEIS and below, the Navy chose alternatives based on factors unrelated to the proposed action's environmental impacts.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-51	At no point in the DEIS does the Navy discuss how the alternatives pose different environmental choices for the public and decisionmakers. The DEIS fails entirely to comply with NEPA's regulations, requiring the Navy to "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14. The Navy fails to sharply define the environmental issues applicable to each alternative and include these differences in a comparison of alternatives. There is simply no comparison of the risks and benefits of each alternative site showing what is and is not known and what species and habitats would be most at risk from each alternative.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration).
O09-52	The two alternatives that meet the Navy's purpose and needs present no options for a decisionmaker wishing to reduce harms to the environment or for the public to hold decisionmakers accountable for their choices based on environmental impacts. For example, a decisionmaker wishing to choose the alternative that does less harm to sea turtles has nowhere to turn. Similarly, both of the Navy's alternatives result in the exact same impact to marine mammals from training with sonar – over 2 million takes per year. Violating NEPA's regulations, there is no presentation of an alternative that details a way forward that "avoid[s] or minimize[s] adverse impacts or enhance[s] the quality of the human environment." Id.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
O09-53	Several alternatives were recommended to the Navy during the scoping process that addressed this absence of environmental impact-based alternatives. However, the DEIS improperly dismisses all these suggestions. "While NEPA 'does not require agencies to analyze the environmental consequences of alternatives it has in good faith rejected as too remote, speculative, or impractical or ineffective,' it does require the development of 'information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned.'" New Mexico ex rel. Richardson v. BLM, 565 F.3d 683, 708-709 (10th Cir. 2009) quoting Colorado Envtl. Coalition v. Dombeck, 185 F.3d 1162, 1174 (10th Cir. 1999).	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, and comments received via the EIS/OEIS public participation process.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-54	"The primary purpose of the impact statement is to compel federal agencies to give serious weight to environmental factors in making discretionary choices." I-291 Why? Ass'n v. Burns, 372 F.Supp. 233, 247 (D. Conn. 1974). If an agency is permitted to consider and compare the environmental impacts of its proposed action with only equally convenient alternatives—and permitted to omit from such analysis any alternatives that are less convenient, no matter that they might result in significant environmental benefits—this purpose would be thwarted and the alternatives analysis loses its purpose entirely. An agency must discuss all reasonable alternatives—those that will accomplish the purpose and need of the agency and are practical and feasible—not simply those it finds most expedient. 40 C.F.R. § 1502.14. By improperly disregarding many alternatives, the Navy has failed to discuss all reasonable alternatives.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
O09-55	The Navy's analysis is devoid of geographic alternatives and even minor seasonal restrictions. This omission is inappropriate in light of the strong consensus—at NOAA and in the scientific community—that spatial-temporal avoidance of high-value habitat represents the best available means to reduce the impacts of mid-frequency active sonar and certain other types of ocean noise on marine life.49 Protected areas should ordinarily be identified during the planning stage based on biological and oceanographic factors, rather than merely on the confirmed presence of marine animals in real time; and, indeed, the Naval Facilities Engineering Command, Atlantic undertook just such an analysis in the Navy's previous EIS for Atlantic Fleet Active Sonar Training. The Navy's detailed planning for certain training and testing exercises, particularly major exercises, provide an ideal opportunity to develop reasonable alternatives for the timing and siting of such activities based on biological and oceanographic factors.	As described throughout Chapter 2 (Description of Proposed Action and Alternatives), geographic and seasonal flexibility is required to support evolving Navy training and testing requirements, which are linked to real-world events. As described in Section 5.2.2.1 (Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements) of the Draft EIS/OEIS, the Atlantic Fleet Active Sonar Training EIS/OEIS analysis determined that geographically restricting sonar training in areas of increased awareness did not result in a statistically significant decrease in the predicted effects on marine mammals (i.e., geographical avoidance would not necessarily result in a reduction of potential impacts). The Navy determined that large geographic restrictions and alternative-specific mitigations would not be practicable or an effective mitigation scheme for the AFTT EIS/OEIS. The Navy proposes mitigation measures (a portion of which will include specific mitigation areas, as described in Section 5.3.3, Mitigation Areas) on a case-by-case basis that would apply to all locations where a specified activity occurs. The balance between procedural measures and mitigation area measures provide a way for the Navy to mitigate potential impacts while maintaining its military readiness objectives. The proposed mitigation measures were developed in coordination with NMFS to avoid or reduce potential impacts on a particular resource.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-56	Despite this recognition, the Navy fails to identify other areas and develop an alternative based on avoiding a handful of biologically important areas. Instead, all of the alternatives propose year-round, unrestricted use without regard to seasonal variations in marine mammal and fish abundance. This is true despite the well-documented seasonal migrations of numerous endangered species and the identification of biologically important areas.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. The Navy proposes mitigation measures (a portion of which will include specific mitigation areas, as described in Section 5.3.3, Mitigation Areas) on a case-by-case basis that would apply to all locations where the activity occurs. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of this Final EIS/OEIS. The Navy needs to ensure it has the ability to train and test in areas that are environmentally similar to where current threats operate, as well as areas that may arise in the future. Limiting where naval forces can train and test will eliminate this critical option of training flexibility to respond to future crises.
O09-57	The DEIS fails to include a range of mitigation measures among its alternatives. Many such measures have been employed by the U.S. Navy in other contexts, as discussed in Section IV; and there are many others that should be considered. Such measures are reasonable means of reducing harm to marine life and other resources on the proposed range, and their omission from the alternatives analysis renders that discussion inadequate. For instance, while safety zones are no substitute for geographic mitigation (which, as noted above, is the most effective means of reducing impacts on marine mammals), they do provide a form of last-recourse protection for any animals that are spotted near the array. The Navy must analyze safety zone enhancements outside critical points of its training and consider modifications in the safety zone provisions.	As described throughout Chapter 2 (Description of Proposed Action and Alternatives), geographic and seasonal flexibility is required to support evolving Navy training and testing requirements, which are linked to real-world events. As described in Section 5.2.2.1 (Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements) of the Draft EIS/OEIS, the Atlantic Fleet Active Sonar Training EIS/OEIS analysis determined that geographically restricting sonar training in areas of increased awareness did not result in a statistically significant decrease in the predicted effects on marine mammals (i.e., geographical avoidance would not necessarily result in a reduction of potential impacts). The Navy determined that large geographic restrictions and alternative-specific mitigations would not be a practicable or effective mitigation scheme for the AFTT EIS/OEIS. By not including ties to specific alternatives, the Navy has greater flexibility for what can be considered for implementation. The Navy proposes mitigation measures (a portion of which will include specific mitigation areas, as described in Section 5.3.3, Mitigation Areas) on a case-by-case basis that would apply to all locations where the activity occurs. The proposed mitigation measures were developed in coordination with NMFS to avoid or reduce potential impact on a particular resource. Visual observations remain a NMFS- and U.S. Fish and Wildlife Service-approved method for mitigating potential impacts from the Proposed Action. Section 5.3.4.1.13 (Increasing the Size of Observed Mitigation Zones) discusses mitigation zone expansion.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-58	Given the Navy's *de facto* use of a wider safety zone in past exercises, it should consider how to provide for safety zone enhancements outside critical points of its training.	The measures the Natural Resources Defense Council refer to have not been in place since January 2009, are not included in the current permits, do not further reduce the potential for injury or mortality over mitigation employed for the past five years or what is included in the Draft and Final EIS/OEIS, and are impractical to implement. As described in Section 5.3.2 (Mitigation Zone Procedural Measures), the Navy updated the acoustic propagation modeling for the AFTT Draft EIS/OEIS, which in some cases increased the ranges to effects compared to those from previous models. Due to the ineffectiveness and the unacceptable operational impacts associated with mitigating such large areas, the Navy is unable to mitigate for onset of temporary threshold shifts for every activity. The Navy developed each proposed mitigation zone to avoid or reduce the potential for onset of the lowest level of injury (permanent threshold shift) out to the predicted maximum range. Section 5.3.4.1.13 (Increasing the Size of Observed Mitigation Zones) discusses mitigation zone expansion.
O09-59	While we appreciate the Navy's plan to use range sensors and other passive acoustic platforms in limited instances, such efforts must be expanded. The Navy has failed to set forth an action plan and timeline in its EIS (and as part of its adaptive management under its current incidental take permits) to bring these sensors and platforms on line for purposes of more meaningful mitigation.	The technology does not currently exist to use passive acoustics in an expanded role to conduct effective mitigation. The Navy is actively pursuing advancement of this technology and is evaluating the ability to implement the technology and application of science effectively. Given the uncertainties involved with technological development, a timeline is not available at this time. If that technology becomes available, the Navy would re-examine this option.
O09-60	The Navy's statement of purpose and need contains no language that would justify the limited set of alternatives that the Navy considers (or the alternative it ultimately prefers). Yet it is a fundamental requirement of NEPA that agencies preparing an EIS specify their project's "purpose and need" in terms that do not exclude full consideration of reasonable alternatives. 40 C.F.R. § 1502.13; City of Carmel-by-the-Sea v. United States Dep't of Transp., 123 F.3d 1142, 1155 (9th Cir. 1997) (citing Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 196 (D.C. Cir. 1991)). "The existence of a viable but unexamined alternative renders an environmental impact statement inadequate," Idaho Conservation League v. Mumma, 956 F.2d 1508, 1519 (9th Cir. 1992), and an EIS errs when it accepts "as a given" parameters that it should have studied and weighed. Simmons v. U.S. Army Corps of Eng'rs, 120 F.3d 664, 667 (7th Cir. 1997). In sum, the DEIS shortchanges or omits from its analysis reasonable alternatives	The range of alternatives presented in the EIS/OEIS includes reasonable alternatives. To be reasonable, an alternative must meet the stated purpose of and need for the Proposed Action. The purpose of the Proposed Action is to conduct training and testing activities to ensure that the Navy meets its mission, achieved in part by conducting training and testing within the Study Area. The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	that might achieve the Navy's core aim of testing and training while minimizing environmental harm.	facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission.
O09-61	…the DEIS does not adequately consider the effects on wildlife viewing and other wildlife-dependent recreational interests. The DEIS makes no mention of the value lost from the harm to marine mammals that attract a number of our organizational members and members of the public to the potentially affected areas of the Eastern United States and Gulf of Mexico.	As stated in the approach to analysis (Section 3.0.5, Overall Approach to Analysis), indirect impacts result when a direct impact on one resource induces an impact on another resource (referred to as a secondary stressor). If there is no direct impact on a resource, then indirect impacts are not foreseeable. Section 3.9 (Fish) concludes that no long-term impacts on fish populations. The analysis in Marine Mammals (Section 3.4) and Socioeconomic Resources (Section 3.11) screened for any impacts on other resources that might create secondary impacts. Because the EIS/OEIS concludes that there would be no impacts on fish populations, reduced catch rates and prey base were not addressed for Marine Mammals (Section 3.4) or Socioeconomic Resources (Section 3.11). The biological resources sections (Sections 3.4 through 3.9) determined there would be no long-term impacts on populations, therefore not reaching the level of "harm" as to impact tourism activities.
O09-62	Nor does it address the potential economic value lost from decreased tourism (e.g., whale watching, cruise ships, etc.), particularly those areas centered on observing whales and other marine mammals in their natural habitats.	As stated in the approach to analysis (Section 3.0.5, Overall Approach to Analysis), indirect impacts result when a direct impact on one resource induces an impact on another resource (referred to as a secondary stressor). If there is no direct impact on a resource, then indirect impacts are not foreseeable. The Socioeconomic Resources (Section 3.11) analysis screened for any impacts on other resources that might create secondary impacts. The biological resources sections (Sections 3.4 through 3.9) determined there would be no long-term impacts on populations, therefore not reaching the level of "harm" as to impact tourism activities.
O09-63	For meaningful public input, the Navy must describe source levels, frequency ranges, duty cycles, and other technical parameters relevant to determining potential impacts on marine life. The DEIS provides some of this information, but it fails to disclose sufficient information about active sonobuoys, acoustic device countermeasures, training targets, or range sources that would be used during the exercises. And the DEIS gives no indication of platform speed, pulse length, repetition rate, beam widths, or operating depths—that is, most of the data that the Navy used in modeling acoustic impacts.	This information is classified to protect national security.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-64	The Navy—despite repeated requests—has not released or offered to release CASS/GRAB or any of the other modeling systems or functions it used to develop the biological risk function or calculate acoustic harassment and injury.	The CASS/GRAB program is classified and not available for public release; however, approximate results can be obtained using other mathematical models commonly available to those with the technical expertise to utilize those tools. See the *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report and the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles* technical report which can be found at www.AFTTEIS.com, for details on the development of the Navy Acoustic Effects Model and Criteria.
O09-65	In addition, the Navy has also ignored repeated Freedom of Information Act requests regarding information and reports cited in the DEIS.	After conducting a review of Freedom of Information Act records, the Navy identified six Freedom of Information Act requests from National Resources Defense Council that may have potentially included requests about CASS/GRAB or other modeling systems based on the Freedom of Information Act subject names and the year the Freedom of Information Act request letter was submitted. Five of the six Freedom of Information Act requests were granted in full and the remaining request received a Freedom of Information Act determination type of "other reasons."
O09-66	These models, reports, and requests for information must be made available to the public, including the independent scientific community, for public comment to be meaningful under NEPA and the Administrative Procedure Act. 40 C.F.R. §§ 1502.9(a), 1503.1(a) (NEPA); 5 U.S.C. § 706(2)(D) (APA). In addition, guidelines adopted under the Data (or Information) Quality Act also require their disclosure. The Office of Management and Budget's guidelines require agencies to provide a "high degree of transparency" precisely "to facilitate reproducibility of such information by qualified third parties" (67 Fed. Reg. 8452, 8460 (Feb. 22, 2002)); and the Defense Department's own data quality guidelines mandate that "influential" scientific material be made reproducible as well.	This information has been evolving in response to new data and will be subject to independent peer review for conferences or journal submissions. The EIS/OEIS provides all source levels, frequency ranges, duty cycles, and other technical parameters relevant to determining potential impact on marine life unless this information was classified (Table 2.3-2 in Chapter 2, Description of Proposed Action and Alternatives). Supporting technical reports have been provided to the public via the project web site (www.AFTTEIS.com).
O09-67	A number of other statutes and conventions are implicated by the proposed activities. Among those that must be disclosed and addressed during the NEPA process are the following: (1) The Marine Mammal Protection Act ("MMPA"), 16 U.S.C. § 1361 et seq., which requires the Navy to obtain a permit or other authorization from NMFS or the U.S. Fish and Wildlife Service prior to any "take" of marine mammals. The Navy must apply for an incidental take permit under the MMPA, and NRDC will submit comments regarding the Navy's application to NMFS at the appropriate time.	The Navy has addressed all of these statutes and conventions. Please see Section 3.0.1 (Regulatory Framework) for a complete list of Federal Statues and Executive Orders addressed in Chapter 3 (Affected Environment and Environmental Consequences) and Chapter 6 (Additional Regulatory Considerations). The Clean Water Act was addressed in Section 3.1 (Sediments and Water Quality) and the Clean Air Act was addressed in Section 3.2 (Air Quality). As part of this process, the Navy has consulted under the Marine Mammal Protection Act, Endangered Species Act, and Magnuson-Stevens Fishery Conservation and Management Act. The Proposed Action did not warrant

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	(2) The Endangered Species Act, 16 U.S.C. § 1531 et seq., which requires the Navy to enter into formal consultation with NMFS or the U.S. Fish and Wildlife Service, and receive a legally valid Incidental Take Permit, prior to its "take" of any endangered or threatened marine mammals or other species, including fish, sea turtles, and birds, or its "adverse modification" of critical habitat. See, e.g., 1536(a)(2); Romero-Barcelo v. Brown, 643 F.2d 835 (1st Cir. 1981), rev'd on other grounds, Weinberger v. Romero-Carcelo, 456 U.S. 304, 313 (1982). Given the scope and significance of the actions and effects it proposes, the Navy must engage in formal consultation with NMFS and the U.S. Fish and Wildlife Service over the numerous endangered and threatened species that will be harmed from its activities. (3) The Coastal Zone Management Act, and in particular its federal consistency requirements, 16 U.S.C. § 1456(c)(1)(A), which mandate that activities that affect the natural resources of the coastal zone—whether they are located "within or outside the coastal zone"—be carried out "in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs." The Navy must fulfill its CZMA commitments along the U.S. Atlantic Coast and in the Gulf of Mexico. (4) The Magnuson-Stevens Fisheries Conservation and Management Act, 16 U.S.C. § 1801 et seq. ("MSA"), which requires federal agencies to "consult with the Secretary [of Commerce] with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken" that "may adversely affect any essential fish habitat" identified under that Act. 16 U.S.C. § 1855 (b)(2). In turn, the MSA defines essential fish habitat as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." 16 U.S.C. § 1802 (10). The AFTT Study Area contains such habitat. As discussed at length above, anti-submarine warfare exercises alone have the significant potential to adversely affect at least the waters, and possibly the substrate, on which fish in these areas depend. Under the MSA, a thorough consultation is required. (5) The Marine Protection, Research and Sanctuaries Act, 33 U.S.C. § 1401 et seq., which requires federal agencies to consult with the Secretary of Commerce if their actions are "likely to destroy, cause the loss of, or injure any sanctuary resource." 16 U.S.C. § 1434(d)(1).	consultation under the Marine Protection, Research and Sanctuaries Act or the Migratory Bird Treaty Act. The Navy has submitted consistency determinations to 20 states/territories in compliance with the Coastal Zone Management Act. Chapter 6 (Additional Regulatory Considerations) has thoroughly addressed Marine Protected Areas (Section 6.1.2) under Executive Order 13158.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	Since the Navy's exercises would cause injury and mortality of species, consultation is clearly required if sonar use takes place either within or in the vicinity of the sanctuary or otherwise affects its resources. Since sonar may impact sanctuary resources even when operated outside its bounds, the Navy should indicate how close it presently operates, or foreseeably plans to operate, to such sanctuary and consult with the Secretary of Commerce as required. In addition, the Sanctuaries Act is intended to "prevent or strictly limit the dumping into ocean waters of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities" (33 U.S.C. § 1401(b)), and prohibits all persons, including Federal agencies, from dumping materials into ocean waters, except as authorized by the Environmental Protection Agency. 33 U.S.C. §§ 1411, 1412(a). The Navy has not indicated its intent to seek a permit under the statute. (6) The Migratory Bird Treaty Act, 16 U.S.C. § 703 et seq. ("MBTA"), which makes it illegal for any person, including any agency of the Federal government, "by any means or in any manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation. 16 U.S.C. § 703. After the District Court for the D.C. Circuit held that naval training exercises that incidentally take migratory birds without a permit violate the MBTA, (see Center for Biological Diversity v. Pirie, 191 F. Supp. 2d 161 (D.D.C. 2002) (later vacated as moot)), Congress exempted some military readiness activities from the MBTA but also placed a duty on the Defense Department to minimize harms to seabirds. Under the new law, the Secretary of Defense, "shall, in consultation with the Secretary of the Interior, identify measures-- (1) to minimize and mitigate, to the extent practicable, any adverse impacts of authorized military readiness activities on affected species of migratory birds; and (2) to monitor the impacts of such military readiness activities on affected species of migratory birds." Pub.L. 107-314, § 315 (Dec. 2, 2002). As the Navy acknowledges, many migratory birds occur within the AFTT Study Area. The Navy must therefore consult with the Secretary of the Interior regarding measures to minimize and monitor the effects of the proposed range on migratory birds, as required. (7) Executive Order 13158, which sets forth protections for marine protected areas ("MPAs") nationwide. The Executive Order defines MPAs broadly to include "any area of the marine environment that has	

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." E.O. 13158 (May 26, 2000). It then requires that "[e]ach Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions," and that, "[t]o the extent permitted by law and to the maximum extent practicable, each Federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA." Id. The Navy must therefore consider and, to the maximum extent practicable, must avoid harm to the resources of all federally- and state-designated marine protected areas. The proposed activities also implicate the Clean Air Act and Clean Water Act as well as other statutes protecting the public health. The Navy must comply with these and other laws.	
O09-68	NEPA requires agencies to assess possible conflicts that their projects might have with the objectives of federal, regional, state, and local land-use plans, policies, and controls. 40 C.F.R. § 1502.16(c). The Navy's training and testing activities may affect resources in the coastal zone and within other state and local jurisdictions, in conflict with the purpose and intent of those areas. The consistency of Navy operations with these land-use policies must receive more thorough consideration.	The Navy has prepared Coastal Zone Management Act consistency determinations to ensure consistency with the enforceable policies of the applicable Coastal Zone Management Programs. In addition, the Draft EIS/OEIS was submitted to each state and territory adjacent to the Study Area for comment.
O09-69	In issuing a revised DEIS the Navy should (1) reduce its thresholds or risk function for marine mammal injury, hearing loss, and significant behavioral change, in accordance with the available science; (2) address the considerable scientific record that has developed around sonar and whale injury and mortality; and (3) revise its impact assessment model to take account of complex sound fields, synergistic effects from multiple sound sources, and the presence of vulnerable populations in the AFTT Study Area.	The criteria and thresholds for determining potential effects on marine species used in the AFTT EIS/OEIS and related consultation documents were carefully revised based on best available data, which included lowering the thresholds over much of the hearing range of many species of marine mammals. Species which show a sensitivity to sound, such as harbor porpoises and beaked whales, received a lower threshold for predicting behavioral reactions than other marine mammal species. There is no available science that provides a mechanism for sonar to directly cause mortality or injury (other than permanent threshold shift which is assessed) to any species of marine mammal. The Navy's acoustic analysis, which includes the Navy Acoustic Effects Model, accounts for all sound sources within a given training or testing activity.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-70	The Navy sets the threshold for permanent threshold shift ("PTS"), which is the highest threshold for direct physical injury, at 198 dB re 1 μPa^2 s for all mysticetes, dolphins, beaked whales, and medium- and large-toothed whales; 172 dB re 1 μPa^2 s for harbor porpoise and Kogia spp.; and 197 dB re 1 μPa^2 s for harbor, bearded, hooded, common, spotted, ringed, harp, ribbon, and gray seals and West Indian manatee. DEIS at 3.4-105. These thresholds are inconsistent with the scientific literature.	The criteria and thresholds for determining potential effects on marine species used in the AFTT EIS/OEIS and related consultation documents were carefully revised based on best available data. See the *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report, which can be found at www.AFTTEIS.com.
O09-71	In addition, the DEIS goes to great pains to create uncertainty about published research on bubble growth in marine mammals, which separately indicates the potential for injury and death at levels far lower than what the Navy proposes. DEIS at 3.4-79 to 81. According to the best available scientific evidence, as represented by multiple papers in flagship journals such as Nature and Veterinary Pathology, gas bubble growth is the causal mechanism most consistent with the observed injuries; in addition, it was singularly and explicitly highlighted as plausible by an expert panel convened by the Marine Mammal Commission, in which the Navy participated. Nonetheless, the Navy fails to evaluate the impacts from this potential avenue of injury. NEPA requires agencies to evaluate all "reasonably foreseeable" impacts, which, by definition, include "impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason." 40 C.F.R. § 1502.22. The scientific literature supporting bubble growth rises far above this standard, and the Navy's failure to incorporate it into its impact model is arbitrary and capricious. Thus, the Navy's refusal to consider these impacts is insupportable under NEPA. 40 C.F.R. §§ 1502.22, 1502.24.	Based on best available science, bubble growth under realistic conditions is highly unlikely. Please see Section 3.4.3.1.2.1 (Direct Injury) in the EIS/OEIS for further explanation.
O09-72	The DEIS sets its threshold for temporary hearing loss and behavioral effects, or "temporary threshold shift" ("TTS"), at 178 dB re 1 μPa^2 s for all mysticetes, dolphins, beaked whales, and medium- and large-toothed whales; 152 dB re 1 μPa^2 s for harbor porpoise and Kogia spp.; and 183 dB re 1 μPa^2 s for harbor, bearded, hooded, common, spotted, ringed, harp, ribbon, and gray seals and West Indian manatee. DEIS at 3.4-105. It bases its cetacean threshold primarily on a synthesis of studies on two species of cetaceans, bottlenose	The criteria and thresholds for determining potential effects on marine species used in the AFTT EIS/OEIS and related consultation documents were carefully revised based on best available data. See the *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report, which can be found at www.AFTTEIS.com.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	dolphins and beluga whales, conducted by the Navy's SPAWAR laboratory in San Diego and, to a lesser extent, by researchers at the University of Hawaii. DEIS at 3.4-106. Notably, the Navy's extrapolation of data from bottlenose dolphins and belugas to all cetaceans other than harbor porpoises and Kogia is not justifiable. Given the close association between acoustic sensitivity and threshold shift, such an approach must presume that belugas and bottlenose dolphins have the best hearing sensitivity in the mid-frequencies of any cetacean. However, killer whales are more sensitive over part of the mid-frequency range than are the two species in the SPAWAR and Hawaii studies. Furthermore, it is likely that the animals in the studies do not represent the full range of variation even within their own species, particularly given their age and situation: the SPAWAR animals, for example, have been housed for years in a noisy bay	
O09-73	There are many glaring problems with the Navy's adoption of an acoustic risk function to estimate the probability of behavioral effects. Dr. Bain sets forth a detailed critique, which is attached to this letter. Several problems are discussed below. Once again, the Navy relies on studies of temporary threshold shift in captive animals for its primary source of data. DEIS 3.4-110. Marine mammal scientists have long recognized the deficiencies of using captive subjects in behavioral experiments, and to blindly rely on this material, to the exclusion of copious data on animals in the wild, is not supportable by any standard of scientific inquiry. Cf. 40 C.F.R. § 1502.22.	The Navy and NMFS relied upon best available science to derive the behavioral response function. The data used was based on one captive animal study and two studies that involved observations of wild animals exposed to sonar or sonar-like signals.
O09-74	In addition, the Navy appears to have misused data garnered from the Haro Strait incident—one of only three data sets it considers—by including only those levels of sound received by the "J" pod of killer whales when the USS Shoup was at its closest approach. DEIS at 3.4-89; 3.4-110. These numbers represent the maximum level at which the pod was harassed; in fact, the whales were reported to have broken off their foraging and to have engaged in significant avoidance behavior at far greater distances from the ship, where received levels would have been orders of magnitude lower.96 Not surprisingly, then, the Navy's results are inconsistent with other studies of the effects of various noise sources, including mid-frequency sonar, on killer whales. We must insist, again, that the Navy provide the public with its propagation analysis for the Haro	The killer whales of J-pod were exposed to multiple stimuli, and it is impossible to assess a precise sound level at which the animals reacted due to all the other stimuli such as the presence of whale watching vessels. Furthermore, the Navy did use the estimated received levels from the Haro Strait/USS *Shoup* incident in the development of the behavioral response function.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	Strait event.	
O09-75	The Navy also fails to include data from the July 2004 Hanalei Bay event, in which 150-200 melon-headed whales were embayed for more than 24 hours during the Navy's Rim of the Pacific exercise. According to the Navy's analysis, predicted mean received levels (from mid-frequency sonar) inside and at the mouth of Hanalei Bay ranged from 137.9 dB to 149.2 dB. The Navy has from the beginning denied any connection between its major international exercise and the mass stranding. However, the Navy's specious reasoning is at odds with the stranding behavior observed during the event and with NMFS' report on the matter, which ruled out every other known potential factor and concluded that sonar was the "plausible if not likely" cause. The Navy's failure to incorporate these numbers into its methodology as another data set is unjustifiable.	Please see the *Marine Mammal Stranding Report* on the project web site (www.AFTTEIS.com) for further discussion of stranding events including the 2004 Hanalei Bay event.
O09-76	The Navy also fails to incorporate data on harbor porpoises and beaked whales when setting its thresholds. For both harbor porpoises and beaked whales, the Navy uses lower thresholds to determine behavioral impacts (120 dB and 140 dB, respectively) but fails to also incorporate that data when determining thresholds for other species. While these animals may reflect a particular sensitivity to noise, the DEIS fails to explain why this data cannot be incorporated in some way when determining thresholds for other species. By failing to incorporate this data into its modeling, the Navy unjustifiably ignores relevant information.	Both beaked whales and harbor porpoises have been shown to be particularly sensitive to sound and therefore have been assigned a lower threshold. The Navy will assess data on additional species as it becomes available and work with NMFS to assign the most appropriate thresholds for predicting significant behavioral effects.
O09-77	Furthermore, the risk function should have taken into account the social ecology of some marine mammal species. For species that travel in tight-knit groups, an effect on certain individuals can adversely influence the behavior of the whole. (Pilot whales, for example, are prone to mass strand for precisely this reason; the plight of the 200 melon-headed whales in Hanalei Bay, and of the "J" pod of killer whales in Haro Strait, and the most recent stranding of melon-headed whales in the Philippines may be pertinent examples.) Should those individuals fall on the more sensitive end of the spectrum, the entire group or pod can suffer significant harm at levels below what the Navy would take as the mean. In developing its "K" parameter, the Navy must take account of such potential indirect effects. 40 C.F.R. § 1502.16(b).	As explained in the EIS/OEIS, the acoustic effects model does not operate on the basis of an individual animal but quantifies potential effects that NMFS may classify as takes based on the summation of fractional marine mammal densities. The acoustic effects model is run multiple times and the average of the results is used to report the number of potential acoustic effects. This method provides a good estimate of potential effects when considering multiple scenarios over a wide area and multiple years. Additionally, the behavioral response function includes observations of the J-pod in Haro Strait.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-78	We must also note that the Navy's exclusive reliance on sound pressure levels ("SPLs") in setting a behavioral threshold is misplaced. The discussion in the DEIS speaks repeatedly of uncertainty in defining the risk function and recapitulates, in its summary of the earlier methodology, the benefits implicit in the use of a criterion that takes duration into account. It is therefore appropriate for the Navy to set dual thresholds for behavioral effects, one based on SPLs and one based on energy flux density levels ("ELs").	There are multiple acoustic metrics that could be used to determine potential behavioral reactions, although the Navy and NMFS currently believe, based on the best available science, that sound pressure level is the most appropriate metric to use within a behavioral response function.
O09-79	In addition, the Navy's threshold is applied in such a way as to preclude any assessment of long-term behavioral impacts on marine mammals. It does not account, to any degree, for the problem of repetition: the way that apparently insignificant impacts, such as subtle changes in dive times or vocalization patterns, can become significant if experienced repeatedly or over time.	The potential for repeated exposures was addressed in Section 3.0.5.7.1.7 (Long-Term Consequences to the Individual and the Population) and in Section 3.4.3.1.2.6 (Repeated Exposures) of both the Draft EIS/OEIS and the Final EIS/OEIS. These sections discuss the available literature on potential responses of animals, including marine mammals, from repeated exposure to sound sources.
O09-80	Finally, while the Navy has set a specific threshold for beaked whales (140 dB) based on the Tyack et al. study, it fails to incorporate additional data on beaked whales indicating that the threshold should be even lower.	Based on the best available science 140 dB re 1µPa (root mean square) is a conservative threshold for predicting potential behavioral effects on beaked whales from sonar signals. See the *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report, which can be found at www.AFTTEIS.com.
O09-81	The Navy bases its calculation of marine mammal impacts on a series of models that determine received levels of sound within a limited distance of a sonar array and then estimate the number of animals that would therefore suffer injury or disruption. It is difficult to fully gauge the accuracy and rigor of these models with the limited information that the DEIS provides; but even from the description presented here, it is clear that they are deeply flawed. Among the non-conservative assumptions that are implicit in the model: (1) As discussed above, the thresholds established for injury and behavioral effects are inconsistent with the available data and are based, in part, on assumptions not acceptable within the field; (2) The Navy does not properly account for reasonably foreseeable reverberation effects (as in the Haro Strait stranding incident), giving no indication that its modeling sufficiently represents areas in which the risk of reverberation is greatest; (3) The model fails to consider the possible synergistic effects of using multiple sources, such as ship-based sonars, in the same exercise, which can significantly alter the sound field. It also fails to	This comment is inaccurate. The methodology used is based on the best available science. See Section 3.4.3.1.6 (Quantitative Analysis) in the EIS/OEIS. See the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles* technical report and *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* technical report which are on the project web site (www.AFTTEIS.com).

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	consider the combined effects of multiple exercises, which, as NMFS indicates, may have played a role in the 2004 Hanalei Bay strandings; (4) In assuming animals are evenly distributed, the model fails to consider the magnifying effects of social structure, whereby impacts on a single animal within a pod, herd, or other unit may affect the entire group; and (5) The model, in assuming that every whale encountered during subsequent exercises is essentially a new whale, does not address cumulative impacts on the breeding, feeding, and other activities of species and stocks. Before issuing a new DEIS, the Navy must revise its flawed modeling systems and make them available to the public.	
O09-82	Rather than using a fixed received level threshold for whether a take is likely to occur from exposure to mid-frequency sonar, the Navy proposed a method for incorporating individual variation. Risk is predicted as a function of three parameters: 1) a basement value below which takes are unlikely to occur; 2) the level at which 50% of individuals would be taken; and 3) a sharpness parameter intended to reflect the range of individual variation. This paper reviews whether the parameters employed are based on the best available science, the implications of uncertainty in the values, and biases and limitations in the model. Data were incorrectly interpreted when calculating parameter values, resulting in a model that underestimates takes.	The analytical method used in this EIS/OEIS was developed in close coordination with NMFS. This represents the best available and most applicable science with regard to analysis of effects on marine mammals from mid- and high-frequency active sound sources. While recognizing there is incomplete and unavailable information with regard to behavioral impacts on marine mammals (Section 3.4.3.1.2.5, Behavioral Reactions), the risk function curve extends to a sound pressure level of 120 dB re 1µPa specifically to encompass uncertainty and the potential for behavioral reactions in marine mammal species that may be affected by sounds perceived at levels just above ambient.
O09-83	Errors included failure to recognize the difference between the mathematical basement plugged into the model, and the biological basement value, where the likelihood of observed and predicted takes becomes non-negligible; using the level where the probability of take was near 100% for the level where the probability of take was 50%; and extrapolating values derived from laboratory experiments that were conducted on trained animals to wild animals without regard for the implications of training; and ignoring other available data, resulting in a further underestimation of takes.	NMFS, as a cooperating agency and in its role as the MMPA regulator, reviewed all available applicable data and determined there were specific data from three data sets that should be used to develop the criteria. NMFS then applied the risk function to predict exposures that resulted in exposures that NMFS may classify as harassment. (This is described in the Final EIS/OEIS in Section 3.4.3.1.4.5, Behavioral Responses.) NMFS developed two risk curves based on the Feller adaptive risk function, one for odontocetes and pinnipeds and one for mysticetes, with input parameters of B=120 dB, K=45, 99 percent point=195 dB, 50 percent point=165 dB.
O09-84	In addition, uncertainty, whether due to inter-specific variation or parameter values based on data with broad confidence intervals, results in the model being biased to underestimate takes.	The commenter provides no specifics on why the takes would be underestimated. There is much conservativeness (overestimation) built into the modeling process (see the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and*

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		Testing Environmental Impact Statement/Overseas Environmental Impact Statement technical report available on the project web site www.AFTTEIS.com). Additionally, NMFS, as a cooperating agency and in its role as the MMPA regulator, reviewed all available applicable data and determined there were specific data from three data sets that should be used to develop the criteria. NMFS then applied the risk function to predict exposures that resulted in exposures that NMFS may classify as harassment. (This is described in the Final EIS/OEIS in Section 3.4.3.1.4.5, Behavioral Responses.) NMFS developed two risk curves based on the Feller adaptive risk function, one for odontocetes and pinnipeds and one for mysticetes, with input parameters of B=120dB, K=45, 99 percent point=195 dB, 50 percent point=165 dB.
O09-85	The model also has limitations. For example, it does not take into account social factors, and this is likely to result in the model underestimating takes. This analysis has important management implications.	Conservative assumptions have resulted in a likely overestimate of effects by the model, as discussed in Section 3.4.3.1.5.4 (Model Assumptions and Limitations) and Section 3.4.3.1.9.3 (Predicted Impacts) for explosives. Animal distribution in the model accounts for average group size.
O09-86	First, not only do takes occur at far greater distances than predicted by the Navy's risk model, the fact that larger areas are exposed to a given received level with increasing distance from the source further multiplies the number of takes. This implies takes of specific individuals will be of greater duration and be repeated more often, resulting in unexpectedly large cumulative effects. Second, corrections need to be made for bias, and corrections will need to be larger for species for which there are no data than for species for which there are poor data.	Modeling accounts for exposures NMFS may classify as takes at distances up to 180 kilometers as described in the Final EIS/OEIS section 3.4.3 (Environmental Consequences – Marine Mammals) and the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report on the project web site (www.AFTTEIS.com). These clearly demonstrate the modeling was conducted over a wide range of bathymetry, sound velocity profiles, and bottom classes. Using these sound propagation characteristics, the risk function modeling resulted in less than 1 percent of the exposures that NMFS may classify as a take occurring between 120 dB and 140 dB (does not include harbor porpoises, for which a step function of 120 dB is applied). Risk function data sets and the parameters, such as the basement values, were chosen to account for uncertainties and for species for which there was less or no data regarding potential behavioral reactions. The area encompassed by this sound propagation, as determined by NMFS for exposures that may constitute harassment, avoids a bias toward underestimation because the risk function parameters were designed with this in mind.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-87	Third, the greater range at which takes would occur requires more careful consideration of habitat-specific risks and fundamentally different approaches to mitigation.	Section 5.3.4 (Mitigation Measures Considered but Eliminated) of the Final EIS/OEIS evaluates alternative or additional mitigations, specifically, as they relate to potential mitigation approaches. The examples of the fundamentally different approaches noted in the comment were addressed in this section of the Final EIS/OEIS. In addition, NMFS has identified general goals of mitigation measures. These goals include avoidance of death or injury, a reduction in the number of marine mammals exposed to received levels when these are expected to result in takes, a reduction in the number of times marine mammals are exposed when these are expected to result in takes, a reduction in the intensity of exposures that are expected to result in takes, and a reduction in adverse effects on marine mammal habitat. As discussed below, NMFS and Navy have identified mitigation measures that are practicable and reasonably effective. For example, the safety zones reduce the likelihood of physiological harm, the number of marine mammals exposed, and the intensity of those exposures. In Section 5.3 (Mitigation Assessment), the Navy has determined that mitigation measures will likely prevent animals from being exposed to the loudest sonar sounds or explosive effects that could potentially result in temporary threshold shift or permanent threshold shift and more intense behavioral reactions. Mitigation measures that are practicable involve those that reduce direct physiological effects within the TTS and PTS thresholds.
O09-88	The population effects of Level A takes on populations are relatively easy to assess, as individuals that are killed are obviously removed from the population, and those that are injured are more likely to die whenever the population is next exposed to stress.	This comment is a mischaracterization of the analysis presented in the EIS/OEIS. Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Additionally, there is no evidence that the type of injuries that could potentially occur (fully recoverable or limited permanent threshold shift) has resulted or will result in follow-on mortality.
O09-89	Temporary Threshold Shifts in captive marine mammals are commonly used as an index of physical harm (e.g., Nachtigall et al. 2003, Finneran et al. 2002 and 2005, Kastak et al. 2005). Limiting experimental noise exposure to levels that cause temporary effects alleviates ethical concerns about deliberately causing permanent injury. However, repeated exposure to noise that causes temporary	The commenter has mischaracterized the cited studies, which did not index harm. Most of the sound sources analyzed are of short duration; it is unlikely that an animal would be chronically exposed to any proposed sound source resulting in repeated TTS.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	threshold shifts can lead to permanent hearing loss. In fact, chronic exposure to levels of noise too low to cause temporary threshold shifts can cause permanent hearing loss.	
O09-90	Changes in behavior resulting from noise exposure could result in indirect injury in the wild. A variety of mechanisms for Level B harassment to potentially lead to Level A takes have been identified.	In prior rulemakings, NMFS established that exposures resulting in Level A and B harassment cannot be considered to overlap, otherwise the regulatory distinction between the two criteria would be lost, and the required quantification of takes would be ambiguous. To facilitate the regulatory process, the Final EIS/OEIS maintained a clear and distinct division between Level A and Level B Harassment as required by NMFS.
O09-91	Studies of captive marine mammals provide an excellent setting for identifying direct effects of sound. E.g., one of the datasets employed by the Navy consists of studies relating short-term exposure of bottlenose dolphins and belugas to high levels of noise to Temporary Threshold Shifts. The Navy (Dept. Navy 2008b, p 3-7) noted aggressive behavior toward the test apparatus, suggesting stress was another consequence of the test (see also Romano et al. 2004). Such effects would be unconditional results of noise exposure. However, extrapolation of the level at which aggression was observed to the level at which behaviorally mediated effects might occur in the wild is problematic, as this depends on how well trained the subjects were. For example, the Navy has been a leader in training dolphins and other marine mammals to cooperate with husbandry procedures. Tasks like taking blood, stomach lavage, endoscopic examination, collection of feces, urine, milk, semen and skin samples, etc. once required removing individuals from the water and using several people to restrain them. With training, painful and uncomfortable procedures can be accomplished without restraint and with a reduction in stress that has significantly extended lifespans of captive marine mammals (Bain1988).	The Navy and NMFS relied upon best available science to derive the behavioral response function. The data used was based on one captive animal study and two studies that involved observations of wild animals exposed to sonar or sonar-like signals.
O09-92	Right whales exposed to alerting devices consistently responded when received levels were above 135 dB re 1 µPa. Due to the small sample size (six individuals), it is unclear whether this is close to the 50% risk, the 100% risk level, or both. These data do not allow identification of B, as lower exposure levels were not tested. In mysticetes exposed to a variety of sounds associated with the oil industry, typically 50% exhibited responses at 120 dB re 1 µPa. Thus right whales may be similar to killer whales.	Results of the research by Nowacek et al. (2004) indicated that right whales reacted to multiple "alert stimuli" which were developed specifically to elicit a response. These stimuli had a limited similarity to Navy sonar systems. In addition, Nowacek et al. was one of three primary references used to derive the risk function curve, which accounts for effects down to 120 dB sound pressure level.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
O09-93	The Navy incorrectly concludes that additional datasets are unavailable. In addition to the other killer whale datasets mentioned above, data illustrating the use of acoustic harassment and acoustic deterrent devices on harbor porpoises illustrate exclusion from foraging habitat (Laake et al. 1997, 1998 and 1999, Olesiuk et al. 2002). Data are also available showing exclusion of killer whales from foraging habitat (Morton and Symonds 2002), although additional analysis would be required to assess received levels involved. The devices which excluded both killer whales and harbor porpoises had a source level of 195 dB re 1 µPa, a fundamental frequency of 10kHz, and were pulsed repeatedly for a period of about 2.5 seconds, followed by a period of silence of similar duration, before being repeated. Devices used only with harbor porpoises had a source level of 120-145 dB re 1 Pa, fundamental frequency of 10 kHz, a duration on the order of 300 msec, and were repeated every few seconds. Harbor porpoises, which the Navy treats as having a B+K value of 120 dB re µPa (with A large enough to yield a step function) in the AFAST DEIS (Dept. Navy 2008a), 45 dB lower than the average value used in the HRC SDEIS, may be representative: of how the majority of cetacean species, which are shy around vessels and hence poorly known, would respond to mid-frequency sonar. Even if harbor porpoises were given equal weight with the three species used to calculate B+K, including them in the average would put the average value at 154 dB re 1 µPa instead of 165 dB re 1 µPa.	The data sources these comments present as requiring such consideration involve contexts that are neither applicable to the Proposed Action nor the sound exposures resulting from those actions. For instance, the comments' citation to Lasseau et al. involve disturbance to a small pod of dolphins exposed to 8,500 whale-watching opportunities annually. This is nothing like the type or frequency of action that is proposed by the Navy for the Hawaii Range Complex. In a similar manner, the example from noise used in drive fisheries is not applicable to Navy training. Navy training involving the use of active sonar typically occurs in situations where the ships are located miles apart, the sound is intermittent, and the training does not involve surrounding the marine mammals at close proximity. Furthermore, suggestions that effects from acoustic harassment devices and acoustic deterrent devices, which are relatively continuous, high-frequency sound sources (unlike mid-frequency active sonar) and are specifically designed to exclude marine mammals from habitat, are also fundamentally different from the use of mid-frequency active sonar. Finally, reactions to airguns used in seismic research or other activities associated with the oil industry are also not applicable to mid-frequency active sonar, since the sound or noise source, its frequency, source level, and manner of use is fundamentally different.
O09-94	An important property of the model is that the biologically observed basement value is different than the mathematical basement value. The Navy proposes using 120 dB re I ~Pa as the basement value. They indicate the selection of this value is because it was commonly found in noise exposure studies.	The 120 dB level is taken as the estimated received level below which the risk of significant change in a biologically important behavior approaches zero for the risk assessment of sonar and other active acoustic sources. This level is based on a broad overview of the levels at which multiple species have been reported responding to a variety of sound sources, was recommended by a scientific panel, and has been used in other publications. The Navy recognizes that for actual risk of changes in behavior to be zero, the signal-to-noise ratio at the animal must also be zero.
O09-95	For example, many looked at changes in migration routes resulting from noise exposure, and found that 50% of migrating whales changed course to remain outside the 120 dB re 1 µPa contour (Malme et al. 1983, 1984). These results might be interpreted in several ways. They could be seen as minor changes in behavior,	The sound source in the Malme studies, which elicited these observed responses. was low-frequency continuous industrial noise. The current NMFS threshold for a continuous source is 120 dB re 1 µPa SPL rms (Sound Pressure Level root mean square), which is used in this analysis to assess impacts due to vibratory pile driving. Furthermore, Malme also

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	resulting in a slight increase in energy expenditure. Under this interpretation, they would not qualify as changes in a significant behavior, and are irrelevant to setting the basement value. They could be interpreted as interfering with migration, even though the whales did not stop and turn around, and hence 120 dB would make an appropriate B+K value rather than B value. Third, the change in course could have been accompanied by a stress response, in which case the received level at which the course change was initiated rather than the highest level received (120 dB re 1 µPa) could be taken as the biological basement value.	found that the context was potentially more important than the received level. When the sound source was placed out of the whales' migration path, they proceeded with no evident disturbance. Only when the sound source was directly in their migration corridor did the whales avoid the sound source at 120 dB SPL rms.
O09-96	Take numbers are based on Alternative 3 in the Hawaii Range Complex SDEIS (Dept. Navy 2008b), which in turn is based on the No Action Alternative, Table 3.3.1-1. Where the number of takes approaches the size of the population, the actual number of takes will be smaller than shown in the table. However, individuals will be taken multiple times and the duration of takes will be longer than if the calculated number of takes were small. Presumably, longer and more frequent takes of individuals will have more impact on the population than takes due to single exposures.	The vast majority of these Level B takes are short term behavioral responses to relatively short term activities. The population level impacts are fully discussed in the EIS/OEIS. See Sections 3.0 (Introduction) and 3.4 (Marine Mammals) for the overall discussion, and Sections 3.0.5.7.1 (Conceptual Framework for Assessing Effects from Sound-Producing Activities) and 3.4.3 (Environmental Consequences – Marine Mammals) for specifics.
O10	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Please re-think your plans and incorporate additional protective measures. Thank you very much. Paula Kislak, DVM President, Humane Society Veterinary Medical Association	The Navy shares your concern for marine life. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
O11	While the Airport supports military training, the Airport is concerned about the continued impacts on general aviation (the livelihood for many small airports) and further expansion of restricted airspace. The Airport is not in favor of seeing Military Operating Areas expand and based on the draft EIS and conversation with Open House staff, the Airport is reading and hearing, respectively, that airspace will not be affected by the Proposed Action of the Atlantic Fleet Training and	Thank you for your comment. The Draft EIS/OEIS was submitted to the Federal Aviation Administration for review and comment.

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
	Testing.	
O12-01	Your analysis fails to present and analyze reasonable alternatives that would significantly reduce the unprecedented level of harm to marine life.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, comments received via the EIS/OEIS public participation process, and the requirements of the Navy in order to fulfill its mission. Further, the USEPA reviewed the EIS/OEIS and stated “the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- ‘Lack of Objections.’”
O12-02	The mitigation scheme that the Navy principally relies on centered on the ability of lookouts to detect whales and dolphins will not result in an appreciable decrease in marine mammal injuries. Federal courts have found this same scheme inadequate and ineffective for good reason: it is largely useless in conditions (common at sea) that impair visual surveillance, it is unsuitable for detecting cryptic and deep-diving species that spend little time at the surface, and, even if it were fully effective at detecting whales and dolphins, would only protect species form the most serious injuries.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
O12-03	I call on the Navy to identify and set aside areas of high marine mammal density acknowledged to be the most effective means of reducing marine mammal injury.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
O13	"Stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico."	Below is a summary of the facts and analyses related to the AFTT EIS/OEIS: • The Navy employs extensive mitigation measures during training and testing activities, which the Navy believes significantly minimize

Table E-4: Responses to Comments from Organizations (Continued)

Comment Identifier	Comment	Navy Response
		the risk to marine mammals. • During several decades of training and testing with explosives, only four marine mammals are known to have died during one training accident. Following this incident and in accordance with standard operating procedures, the Navy ceased all similar training, reviewed its mitigation measures, worked with regulators, and revised its mitigation measures. • There is evidence of fewer than 40 marine mammal stranding deaths worldwide connected to Navy sonar training, and no such incidents have occurred since 2006. There has never been a recorded marine mammal stranding in which Navy training or testing was a causal factor along the east coast, west coast, Gulf of Mexico, or Hawaii. • The modeling, which does not account for mitigation efforts, estimates there is a possibility marine mammals may be exposed to sound levels in certain frequencies that could result in a loss of hearing sensitivity. Through mitigation measures, actual numbers of marine mammals affected by Navy training and testing are expected to be much lower. See the Final EIS/OEIS for the refined analysis (refined in coordination with NMFS). The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. Additionally, loss of hearing sensitivity at certain frequencies does not mean marine mammals will become deaf—they will still be able to hear, hunt for food, and perform other normal activities.

Table E-5 contains comments from private individuals (P) received during the public comment period and the Navy's response. Responses to these comments were prepared and reviewed for scientific and technical accuracy and completeness. Comments appear as they were submitted and have not been altered with the exception that expletives, addresses, and phone numbers have been removed, as necessary.

Table E-5: Responses to Comments from Private Individuals

Comment Identifier	Comment	Navy Response
P001	The proposed plan is indefensible from the point of view of putting at risk many thousands of marine mammals, who are considered by leading scientists to be sentient and self-aware. A similar proposal that involved the planned death of 2000 primates, many of endangeded species, along with irreversible damage to tens of thousands of others would never even be considered. If indeed these exercises are important to our future security, it is imperative that measures be taken to minimize the impact on marine mammals. These measures could include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P002	Please abandon your plans to perform training sessions in areas where whales and dolphins will be seriously injured or killed by passively being near your warships' training maneuvers. The inhabitants of this world do not exist for you to extinguish at you every whim. Respect them.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P003	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Aaron Dressin	Thank you for your comment.
P004	National Security is important; that's a given, but at what cost to our environment and the majestic ocean creatures that help keep it diverse. If we keep disregarding the world we live in, what will be left to protect?	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P005	Please do not do your training exercises in an Area that would hurt whales. Please do them elsewhere.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P006	To the Navy: Please do not carry through on your proposal to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii, involving the use of live explosives and high-intensity sonar. I understand the need for protecting our country, but you can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. If testing plans as they stand happens, it will KILL 17,700 cetaceans. Without their hearing, dolphins will be unable to use their echolocation to hunt. Whales will not be able to communicate. It will make it impossible for all cetaceans to survive. Please rethink this!This operation should not be allowed to go through. The consequences are far too severe. Sincerely, Alexi Curington, Seattle, WA	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P007	The U.S. Navy is completely inconsiderate [EXPLETIVE DELETED] . They should know that we have already had several important sea animals die from the oil spill and more etc. Now they wanna do super explosions with what little life is even [EXPLETIVE DELETED] left in the ocean? I hate our army. I hate the people who don't give a [EXPLETIVE DELETED] about any other living creatures we SHARE this planet with. If I was in charge, i'd make my own prison to put idiots like that, away for life. This is another reason why i hate the american army. Got [EXPLETIVE DELETED] rednecks controlling everything, little rich kids	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	don't know [EXPLETIVE DELETED].	
P008	It is utterly inconceivable to me how backward, inhumane and sociopathic the Americans can be when it comes to their defense forces. You cut the legs off live goats, train and kill dolphins and dogs and now you propose to wipe out millions of marine mammals for some testing. GET OVER YOURSELVES. This is not your planet to destroy. One day in history people will observe you and your actions and they will be horrified by how blinkered and backward a society you are. It is inconceivable to me that a government would even allow such a violent and destructive training practice to ensue. I will circulate this story on my blog, facebook and all over the internet if this really goes through. People in the world are waking up to you and your dastardly acts. This is an opportunity to do the right thing - DO IT. Amanda Evans	Thank you for participating in the NEPA process.
P009	Please do not endanger marine and aquatic life for any reason. The irreparable damage may be beyond the scope of our current understanding, but a loss of life (direct or through side effects) in such magnitude of any species is reprehensible, and I'm shocked that the US Navy would even consider such actions.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P010	Please do not do this sonar and explosive testing. There are much safer alternatives that will not harm the marine life. Our oceans are an important environmental resource and should not be put at unnecessary risk for either military or civilian testing.	The Navy shares your concern for marine life. The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P011	I am alarmed that the US Navy would consider using explosives and high intensity sonar in areas where marine mammals such as dolphins and whales will be killed and injured. Surely there is some other way to conduct the testing that the Navy believes is necessary. Please do not continue with this testing. It is indefensible and wrong.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P012-01	Unlike the Canadian Department of Fisheries and Oceans (DFO), the National Marine Fisheries has no ocean noise standards against which to evaluate the U.S. Navy's EIS as a potential increase in the ocean background noise and its effects on the use of sound by various types of marine mammals. The DFO considered ocean noise as a component of the Eastern Scotian Shelf Integrated Management Plan (ESSIM). Since President Obama's proposed National Ocean Policy NOP) and its Strategic Action Plan (SAP) stress an ecosystem based approach to management (EBM) of spatial regions in the ocean, I feel that it is premature for NMFS to approve of the Navy's EIS until ocean nose standards are develop and the EBM approach is defined.	The Navy is an integral part of the National Ocean Policy. Additionally, the acoustic criteria used in this analysis were developed in cooperation with NMFS and are germane to the activities analyzed. The acoustical analysis is based on the use of the best available and applicable science (Section 3.4, Marine Mammals and the technical reports available at www.AFTTEIS.com, specifically, *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* and *Determination of Acoustic Effects on Marine Mammals and Sea Turtles*). Furthermore, throughout the AFTT EIS/OEIS, the Navy employed ecosystem-based techniques to the analysis by incorporating large marine ecosystems and open ocean areas as a way to describe where potential impacts may occur. In addition, the Navy prepared an *Ecosystem Technical Report for the AFTT EIS/OEIS* that is available at www.AFTTEIS.com.
P012-02	The Navy EIS needs to address how we move into the future under an ecosystems approach that employs adaptive management concepts as way to make the needed changes required to protect marine mammals and their supporting habitats (food resources; migration pathways; biotic and abiotic environmental preferences; etc.)	As indicated in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), recommended measures are a result of the Navy's internal adaptive management process, and the assessment of planners, scientists, and the operational community. In accordance with the cooperating agency agreement with NMFS, mitigation and monitoring measures focus on the requirements for protection and management of marine resources. The Navy's Integrated

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy operates and established a Scientific Advisory Group of leading marine mammal scientists to provide a "vision" for Navy monitoring across geographic regions as part of the annual adaptive management process.
P012-03	Even though the U.S. Navy supports research on marine mammals and may understand their distribution in space/time better than NMFS, I feel that the Navy's interaction with environmentalists leaves a lot to be desired. I was active in the Superfund and Safe Drinking Water Act cleanup at the Massachusetts Military Reservation (MMR) for over 20 years. The National Guard and Air Force/Department of the Army have a much better constituent outreach and engagement process than does the U.S. Navy.	NEPA provides a forum for public involvement in federal decision making. Several opportunities have been provided including scoping meetings, public meetings, and opportunities to comment on the Draft EIS/OEIS. A public web site (www.AFTTEIS.com) has been established to provide current information on the status of the EIS/OEIS and opportunities for public involvement.
P012-04	I don't see any indication in the EIS for the U.S. Navy to improve their interactions with the public in a meaningful way or adjust their training in significant ways to reduce the takes of marine mammals under the MMPA.	NEPA provides a forum for public involvement in federal decision making. Several opportunities have been provided including scoping meetings, public meetings, and opportunities to comment on the Draft EIS/OEIS. A public web site (www.AFTTEIS.com) has been established to provide current information on the status of the EIS/OEIS and opportunities for public involvement.
P012-05	The MMPA and ESA are underlain by an ecosystems approach concept and need to develop proactive measures to reduce takes of marine mammals from human activities.. I don't see this aspect being given enough attention in the EIS.	The Navy considered the best available science in preparation of this EIS/OEIS. Section 3.0.3 (Ecological Characterization of the Study Area) provides a breakdown of the biogeographic classifications that organize and describe the patterns and distributions of organisms and the biological and physical processes that influence this distribution. Additional ecosystem-related concepts, as well as a discussion of how Navy activities and potential stressors of the Proposed Action fit into the ecosystem, are presented in a separate detailed report titled the *Ecosystem Technical Report* for the Atlantic Fleet Training and Testing (AFTT) Draft Environmental Impact Statement (U.S. Department of the Navy 2012) which can be found on the project web site (www.AFTTEIS.com). The Navy has consulted with NMFS as the regulator and cooperating agency with regard to the Proposed Action and any resultant mitigation measures as conditions of anticipated authorizations under the MMPA or reasonable and prudent measures resulting from issuance of a Biological Opinion under ESA.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P012-06	Some type of adaptive management (AM) process is required to adjust the Navy training to accommodate these shifting baselines in the marine ecosystem. AM involves both scientific aspects (monitoring; modelling; filling in the data gaps and synthesis of data into information products useful to managers and the public) and a management component (public outreach and revising management plan based upon new scientific information).	As indicated in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), recommended measures are a result of the Navy's internal adaptive management process, and the assessment of planners, scientists, and the operational community. In accordance with the cooperating agency agreement with NMFS, mitigation and monitoring measures focus on the requirements for protection and management of marine resources. The Navy's Integrated Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy operates and established a Scientific Advisory Group of leading marine mammal scientists to provide a "vision" for Navy monitoring across geographic regions as part of the annual adaptive management process.
P013	Please consider steps to reduce the harmful impacts to marine mammals when conducting your training activities on the east and western shore. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. You can continue doing the invaluable work you do to protect our country AND protect animals as well. The two can coexist.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P014	Don't kill & or deafen innocent animals for testing, find a better way. Dawn & Jeff Kirch	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P015	The Navy's plans to test high frequency (et al.) sound equipment underwater will kill an estimated 1,800 cetaceans and deafen another 15,900 (a probable death sentence for beings which rely so heavily on echolocation) over the next five years alone. It is irresponsible and immoral of us to so casually discard the lives of so many intelligent beings, so close to extinction as it is, and especially so when the benefit to us is uncertain and of questionable importance to the security of our nation. It would be unconscionable to knowingly take steps which kill and maim these unique beings.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P016	I am urging you to consider steps to reduce the harmful impacts to marine mammals when conducting training exercises. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Many animal welfare organizations, including The Humane Society of the United States, are happy to work together to come to the best, most humane solution for all. Please explore all options before sacrificing the precious species that call our oceans home. Thank you in advance for your compassion.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P017	Please stop the testing work you are doing in the oceans that is killing and deafening cetaceans. As human beings we owe more to this world than simply indiscriminately killing off species at our whim. Where is the character, understanding, and compassion for species other than our own? This is disgusting behavior and brings us all down to a truly sub-human level. STOP THIS UNWARRANTED SLAUGHTER OF THESE	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	GREAT CREATURES!	
P018	I understand the need for the Navy to run these exercises but, it is also so important and necessary to protect the mammals living peacefully in the ocean.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P019	Please rethink your current plan and instead, protect marine mammals from explosives and sonar. Killing marine mammals, having some get lung damage, or permanently or even temporarily deafening them is unconscionable. You can at least avoid areas of feeding or calving grounds and avoid migratory corridors. Please also use a "safety zone," finding where marine mammals are then testing at a safe distance so they won't be harmed. Please also use aerial and acoustic monitoring to make sure that what you are doing is not harming any of these wonderful creatures. Please do the intelligent and humane thing and act with every precaution possible. We trust you not only with our own lives, but the lives of creatures who share this planet earth with us.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P020	I am writing to you to question the necessity of the training exercises being planned which will use live explosives and high intensity sonar. Is it truly necessary to carry out these exercises for the benefit of our defense? These types of exercises have been known to have a major impact on marine life that so many have spent time trying to preserve and protect. Please reconsider these maneuvers---is it REALLY worth the destruction of many marine species???? I understand the importance of practice, but we must consider the effects imposed upon	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	other living creatures that have no bias against anyone--is this fair to subject them to pain and suffering in the name of practice. I appreciate your time and hope that you will find an alternate way to educate our Navy without harming our marine ecosystem. Sincerely, Deborah Seemayer-Iannotti	implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P021	Dear U.S. Navy, Please protect marine mammals from explosives and sonar!!!!! We cannot do this! The negative environmental impact on marine life needs to be stopped!!!!!!! Protect our planet and its inhabitants!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P022	Please stop the testing on marine life with sonar and explosives. They are kind and gentle mammals and deserve to live a life of peace.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P023	We hope we are in time to be counted as opposing unnecessary sound/radar testing by the Navy which will harm the navigational abilities of whales and dolphins. While defense of our country is important, it must not be done at the cost of the lives of these innocent creatures. They are an important part of the total eco-system of the oceans. We have signed these petitions in the past, and are dismayed to learn we must do so again. At 9:00 pm on July 10th, there is not the time to cite the many studies which have proven this is lethal to marine mammals. Undoubtedly you have received copies of them. We are totally opposed to our tax money being used for this and our country's participation in this folly and despicable practice. Consider please, the continuation of	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	such unnecessary "testing", erodes the support for the Navy and the military in general in this family. There are other ways to accomplish the same objectives. In short, the answer is "NO" - We do not support the testing of lethal sound radar, which destroys the balance and hearing of sea mammals.	
P024	The military needs to immediately stop training using sonar for they are torturing and commiting heinous crimes against all creatures living in the ocean.	Thank you for participating in the NEPA process.
P025	What a horrible thing!!! Please stop it!!!!	Thank you for participating in the NEPA process.
P026	I see no particular problems with this training. The Navy has to train to be prepared.	Thank you for your comment.
P027	The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We are calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures. --Mr Ken Cowing and Ms. Denise Wilson	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P028	I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy’s permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P029	The Navy must not harm or kill cetaceans. There is no valid excuse for doing so. The sonar exercises that have the potential to deafen marine mammals must stop immediately and permanently. The U.S. must protect cetaceans, not harm them. The U.S. must not sink to such depths of immorality. To cause so much pain and suffering and death to dolphins and whales is despicable and inexcusable. We must stop all these tests now.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P030	Please protect marine mammals from explosives and sonar. Please consider steps to reduce the harmful impacts to marine mammals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P031	Almost everybody agrees that we need a robust and strong Navy to protect national security. And almost all of us agree that whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. But a recent proposal from the federal government tries to make Americans pick between these options, and it's a false choice. The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, porpoises, sea turtles, sharks, and many other marine creatures. My family and I are asking the Navy today to protect marine mammals from explosives and sonar along the East Coast, and California/Hawaii!	testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P032	I am writing to voice my opposition to testing of underwater high-frequency, low-frequency, and high-power sound generating equipment. The damage to life in our our oceans is impossible to measure, and once done cannot be undone. Future generations will look back and judge us - please consider your own place in history. In addition, this technology, while interesting, is of dubious practical use. The threat of underwater attack upon the US is a cold-war-era issue. Today's threats are very unlikely to be discovered by this kind of technology. Our nation's time, energy and money would be better spent elsewhere. Whales and dolphins are amazing creatures. Please stop killing them. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities.
P033	STOP !	Thank you for participating in the NEPA process.
P034	PLEASE PLEASE protect marine life from explosives and sonar in Navy and all exercises. This is unnecessary.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P035	I can't believe this is acceptable behavior...to allow the Navy to deafen 15,900 whales and dolphins and kill 1,800 more!!! Stop the insanity! If this is true, I'm asking you to STOP...begging if its necessary. I expect a better example of myself, my country, and the armed services. This is	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	shameful.	Consequences) of the EIS/OEIS The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P036	As the Navy you are very near and dear to the American people. The American people are very near and dear to the wonderful Whales, Dolphins and all sea animals. Please do not hurt any of these beautiful creatures that adorn our Coastal oceans in California, Hawaii and the Eastern Coastline. Please take into account the life under the water will suffer and die needlessly with the Sonar testing you do. There has to be other alternatives for this type of testing. Please reconsider where and how the Navy does this testing. Our oceans are in enough trouble without this. The animals & fish that call the ocean their home deserve to live there without this man made horrific trauma to their bodies, hundreds will die, thousands will suffer. Please rethink please. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P037	This is in protest of the planned Navy live explosives and high-intensity sonar exercises that will devastate marine life, in different parts of the ocean around America. I understand the need for practice but there must be some way to do dry runs of some sort that will not kill off or injure the already at risk marine life. I respectfully request that this option is reconsidered, and a way found to 'practice' in a way that eliminates the extensive harm this will bring to our unsuspecting fellow	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	creatures	potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P038	please stop this testing!!!!!!	Thank you for participating in the NEPA process.
P039	Stop killing our fish with bombs. Stop the war games in our oceans.	Thank you for participating in the NEPA process.
P040	I have learned that the Navy is proposing to conduct training exercises that would involve the use of live explosives and high-intensity sonar and would kill up to 2,000 marine mammals. Please reconsider and do not do these exercises. For what? So many creatures are risk to be killed, maimed and/or otherwise disabled. Do don't this please. Leave nature alone. Thanks, Doris Maat	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P041	Hello, I am a Florida citizen and business owner. It seems to me that you are not taking into account the serious damage this will due to whales, dolphins, and other sea life. I am dead set against this type of testing. We already have established the connection between military acoustic testing, etc. and strandings, and this will make the problem much, much worse. I ask that you reconsider your proposal. I also ask that you "turn downy the volume" in the sea. (CNN recently wrote and op/ed piece eloquently starting the reasons why this is important.) As a country, we should value our stewardship of the environment; please do your part and reconsider your plans so as to further and greatly mitigate any harm to our aquatic neighbors. Sincerely, Doug Maesk, Ft. Lauderdale, FL	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P042	We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please consider alternate means which will help protect these amazing animals. Thanks you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P043	Don't do it! Protect our ocean creatures!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P044	Dear US Navy, In consideration of all marine mammals, please severely limit your sonar testing in ocean waters. We won the Cold War long ago, and don't need to continue harassing the marine mammals just to pretend to protect us against the next to non-existent Chinese navy. Thanks for your consideration. Ed Madej	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities.
P045	Please do not kill marine mammals. Very disturbing to think of the US Navy undertaking such a thing. This action diminishes my respect for the US Navy, which otherwise if a fine awesome organization. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P046	While Americans recognize the need to train armed forces, we also know that training can be conducted intelligently without causing harm to innocent and vulnerable marine life. If officials use their ingenuity and intelligence, they can plan exercises that do not cause harm to marine animals. In our efforts to protect ourselves from those who would cause war against us, we must not sink to their level by declaring war on innocent and vulnerable animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable,

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P047	When the US Navy is conducting training exercises along the eastern coast it must first take into consideration the wildlife living along the coast and plan accordingly. With the Navy's greatness should come compassion.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P048	The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. PLEASE DON'T DO THIS!!!!!!!!!!!!!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P049	You are NOT fighting a Congressionally declared war. STOP TORTURING ANIMALS ANYWHERE, unless you are fighting a declared war! You DO NOT NEED to torture animals to maintain a state of readiness! Do your testing in deep water well away from concentrations of marine wildlife! Eleanor White	The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P050	*Duplicate comment to P049*	*See response to comment P049*
P051	The United States Navy must cease the decimation of the Atlantic Ocean through the use of sonic testing. Such testing is detrimental to ocean creatures, such as dolphins, and contributes to the devastation of our planet. Other methods must be used to implement change.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P052	The continued use of sonar weaponry testing by the U.S. Navy is just cruel and ignorant. You guys are obliterating the hearing of and KILLING our endangered, majestic marine life!!!! I understand you are trying to keep America safe, but PLEASE stop sacrificing our sea life. Have more respect for them. They have been here much longer than we have. It is our duty to set an example as s country who treats animals and the environment with kindness, respect, and dignity. The government continues to break my heart. Make me proud to be an American, and change this.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P053	I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P054	You need to re-thing your testing ideas and consider the thousands of helpless mammals you are going to injure and kill. What about considering the environment and the animals in it that we continue to distory every single day. The Navy should go back to the drawing board and think about what impact its having on the world in which we live in; the world that is not going to exist for long if we continue are distructive human ways. As an American citizen who pays taxes, I strongly urge you to stop this and please reconsider the very harmfu actions you are about to take.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P055	I respectfully request that you take all prudent measures to protect the lives and health of marine mammals during sonar and explosive training and testing. Thank for your consideration of my request. Elizabeth Hall	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P056	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	harmed or killed. Thank you for your time and consideration.	NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P057	The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P058	Dear Navy, Thank you for preparing an Environmental Impact Study. However, I have some doubt about its objectivity, or certainly its sense of responsibility. Please know that there is little doubt about the intelligence and independence of cetaceans in our oceans. If your sonar tests are damaging these beautiful animals, and I believe they are, please try to find another way to perform or field-test your equipment or your operations that will not harm them. Re-locate, or test in a special laboratory, but please discontinue operations that deafen or kill whales. Do not substitute convenience for responsibility. Thank you very much. Sincerely, Eric S. Mallin	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Use of simulation, as described in Section 2.5.1.3.1 (Simulated Training) of the Final EIS/OEIS, concludes today's simulation technology does not permit effective training and testing.
P059	I find the news of the Navy testing explosives and sonar to be both distressing and altogether horrifying. I cannot believe that our country would sacrifice and put in harm's way so many living things. These are not simply after-thoughts; they are living, breathing, feeling, thinking animals. They do not deserve this kind of careless and thoughtless mistreatment. Please reconsider for the sake of our oceans and these incredible animals we have fought so hard to protect over the years.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P060	I urge that you start paying attention to the life undersea. There are sensetive animals like whales an dolphins that will not cope with these sound testings. The underwater life is an important part of Planet Earths setting. Without these creatures we have lost a lot of intelligence. Plunging into their environment is a serious thing. They are totally depending on the group holding together by sound signals. Let them have their space. We will all regret this later, if it happens :(Sincerely, Erika Chotai in Stockholm, Sweden. 10th of July 2012	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P061	Do NOT do this. Do not do this. Do not do this.	Thank you for participating in the NEPA process.
P062	Please, for heavens sake, stop these training exercises that would involve the use of live explosives and high-intensity sonar. I ask you to protect marine mammals.....please, please, please!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P063	imagine yourself being strapped to the outside of a jet engine. On the ground, the noise is deafening, the vibration hurts every bone in your body, but then the takeoff is terrifying, soon you can't breathe, and once in the skies, you are virtually blind because your eyes are damaged from	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	these extreme effects. You are already gasping with fear and pain, then dropped from the sky to land in the ocean, disoriented, in agony, in terror, struggling to breathe... Now, imagine increasing the numbers and magnitude of those effects by the hundreds until you and a couple of thousand of your friends, family, and neighbors are dying, caught up in a tide of what seems to be your own blood pouring from your ears and mouths and you wash up on a strange shoreline, your lives slowly draining out of you, then silently dying under a stinking sun. And you never for one moment understood what happened... Or why.	
P064	!!! stop it	Thank you for participating in the NEPA process.
P065	Our Earth is beautiful fascinating, and human being's existence relies completely on that of our planet. The Earth's delicate ecosystem can only exist because of all integral components contained within it. All parts of the ecosystem are needed to maintain homeostasis, human existence will cease to exist if we do not stop destroying the world we live in. War isn't necessary for coexistence among men, or any other life form. Destroying and permanently maiming such an enormous population, regardless of the species or form is just ignorant, we too will die with our planet. Stop being idiots. Put your weapons away. Stop killing.., us, our children, and our future.	Thank you for participating in the NEPA process.
P066	re: the use of high frequency underwater sound for testing in Hawaii, the California and Atlantic Coasts, and the Gulf of Mexico. According to your estimates it will deafen more than 15,900 whales and dolphins and kill 1,800 more over the next 5 years. Whales and dolphins depend on sound to navigate and live. Please start caring for the environment and quit killing the whales and dolphins. Works towards being a peaceful military. I am the daughter to to WWII vets. I would have rather had a father.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P067	I am writing to ask that the Navy to protect marine mammals from explosives and sonar along the east coast and California/Hawaii coasts! Please rethink your plans and incorporate additional protective measures. Thanks Ms. Florence Eaise	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P068	Please do not harm the marine life on the East Coast to perform military operations. There are other steps that can be taken without so much destruction of such important species that live and thrive in these waters.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P069	no more weapons - grow up already! why can't anyone find the profit incentive in doing something that benefits us instead of causing harm??	Thank you for participating in the NEPA process.
P070	Just because you can doesn't mean you should. Whoever thought it was okay to hurt these beautiful creatures should be ashamed of themselves.	Thank you for participating in the NEPA process.
P071	don't do that!	Thank you for participating in the NEPA process.
P072	Please protect marine mammals from explosives and sonar, Thanks in advance	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P073	This comment is to object to the underwater high frequency sound testing. Find another way to test these things that does not involve slaughtering sea mammals and who knows what else.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P074	Dear Sir or Madam, It is my understanding that your organization will cause great harm to sea animals on this program. As a loyal citizen of the United States of America, a taxpayer and Veteran, I ask that your organization immediately cease and desist from any and all actions that could possibly result in the harming of any sea life. There is a great cost associated with knowingly harming life. Thank you. Sincerely, Frederick Rose	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P075	I am deeply concerned over the sonar testing proposed off the east coast. The cost to marine mammals resulting from such testing is unthinkable, especially since there are other alternatives which would avoid this catastrophic massacre and permanent impairment to such a large number fellow inhabitants - all feeling, thinking creatures. This is unbearable. Don't let this happen, please!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P076	plz do not do this its to cruel	Thank you for participating in the NEPA process.
P077	PLEASE, I beg you. End this harmful procedure to marine life. Your practices are NOT necessary!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P078	killing lives and the planet just because of [EXPLETIVE DELETED] navy exercises?? Please, are you people totally crazy????? do you want to destroy the all planet once and for all??? disgusting!!! its because of people like you that we still have all this wars,deaths and destruction in the world! cant you learn how to be good? how to share with others? how to live life peacefully and respect all kinds of life??? i´m sorry, but i need the planet to live, who [EXPLETIVE DELETED] do you think you are to take away my right??????????? FROM THE OTHER SIDE OF THE WORLD, PORTUGAL	Thank you for participating in the NEPA process.
P079	U.S. Navy needs to re-think its plans and to incorporate additional protective measures. It is inhumane to harm the whales and other sea creatures. do what is right, please.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P080	I implore you to search your hearts and refrain from this harmful testing. I am sure that most of you are better than this, thus the chance for the public to comment. I am a proud USN vet from the 60s and would be even prouder of my service if you were to abandon these tests. Thank you for the opportunity to comment.	The Navy shares your concern for marine life. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P081	I am writing to ask you to stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico. These numbers, from your own estimates, are uacceptable, and completely preventable. Whales and dolphins depend on sound to navigate and live, and our scientists and researchers are intelligent enough to offer humane alternatives.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P082	It is the Navy's desire to make sure there's no mitigation zone, to make sure there is safe navigation and to better understand marine species, to refine the methods, to detect and monitor the species before and during training/testing, to develop tools to model an estimate/potential effects of underwater sounds, to test alternative energy sources to come up with alternative energy, to develop new programs to safeguard marine protected species in all marine species. I'd like to add to the ESA that	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	active sonar acoustic sources will adversely affect marine mammals. 25 to 36 species of marine mammals are in Hawaii and 67 of those are threatened/endangered. I would like to see you fulfill your desires in being a world leader in marine species research because so far the evidence is to the contrary and I have given a few but of the many many examples of this. Navy sonar is dangerous technology- it is continuous sound above 235 decibels of mid-frequency sonar that is comparable to a rocket blast off. Imagine that sound being magnified in a water dense environment – to me it seems unimaginable the sounds these animals must hear and the pain and the fear that they must endure…. it is truly unimaginable in my eyes. Conclusion In 2006 (July 10, 2006 National Geographic news Maryann Mott) under restraining order following the court case with NRDC the Navy agreed to use intense sonar sparingly, to add additional Whale spotters on every vessel during drills, to steer clear of a vast new protected area and to publicize a hotline for reporting marine mammal incidents related to international war games. Further, it was prevented from sonar use within 25 nautical miles of the new Northwestern Hawaiian Islands Marine National Monument. These Whales and Dolphins are magnificent and magical creatures of the ocean. I expect the government to take all necessary measures to protect these awesome animals and for you to fulfill these agreements that you have previously made. Truly take your place in this world to be the true world leaders in marine species research as you so claim. Show the other world leaders that you are beacons and true leaders and be the example that will light the way for a sustainable ocean and all of its inhabitants-especially the Whales and Dolphins and will defend that and fight for a mighty cause worth fighting for. And THIS should be your main reason why Navy sonar should not be done. Thank you so very much for your time and interest reading this lengthy proposal/comment. I am profoundly thankful as are the Dolphins and Whales as well.	with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. Additionally, the sound level comparison made is incorrect, see Section 3.0.4 (Acoustic and Explosives Primer).
P083	I am writing to ask you to protect marine mammals during your sonar exercises on the East Coast and in Hawaii, and anywhere else such exercises are conducted. I am asking you to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P084	Stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico. There has got to be a better way to get this done without so much collateral damage. Please seek alternatives.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P085	As you begin Navy training exercises along the east coast and Hawaii and California seacoasts, PLEASE consider steps to reduce the harmful impacts to marine mammals. PLEASE protect marine mammals from effects caused by explosives and sonar. PLEASE avoid the most harmful activities in areas used as calving grounds or migratory corridors. PLEASE avoid seasonal high-use feeding areas. PLEASE create a larger "safety zone" around these exercises. PLEASE use aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. By taking these steps it would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. PLEASE re-think your training plans and incorporate additional protective measures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P086	The U.S. Navy CANNOT conduct their sonar training exercises along any coast of the U.S. It was projected that 2,000 marine mammals would be killed and it is absolutely unacceptable when too many of these species are nearly extinct. This is not a necessary exercise for the military, and frankly, is probably a waste of federal money. It is disgusting that we have overpopulated the globe and the U.S. will bulldoze its way to the top of the food chain. There is a reason we as a human species and all others exists in the world. We have gone too far in completely disregarding the fact that the existence of other species IS THE REASON WE STILL EXIST. Such a simple yet fundamental idea. Just as fisherman who have been banned from hunting whales, dolphins and seals even if it was an "indigenous tradition", the U.S. military should be banned from carrying out such exercises for training purposes. The human species as a whole needs to AVOID AT ALL COSTS intervening in the harm or extinction of all other species. We as the United States need to set that example for the rest of the world starting at the government level. There is too much of an abundance of information asserting the sonar practices of the U.S. Navy are detrimental to whales and dolphin species. We can no longer play the ignorance/denial card and must take responsibility for our actions. I am urging that the U.S. Navy take necessary preventative steps to avoid a mass tragedy of marine wildlife, by: avoiding areas used as calving grounds and migratory corridors; avoiding areas which are seasonal high-use feeding grounds; and using aerial and acoustic monitoring technologies to determine whether marine mammals are nearby and may be harmed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures that the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P087	Please take additional steps to protect marine mammals before performing military exercises involving high explosives and sonar off the eastern seaboard of the United States. We are the greatest force for good the world has ever seen. Let's not undermine our own moral leadership by causing the unnecessary suffering of millions of protected, sentient creatures like dolphins and whales. The US Navy has the expertise and the equipment to protect our country, while protecting helpless animals as well. Let's use it. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P088	Why are you wanting or planning to conduct testing on the last remains of ocean natural habitat left on the east and west coast. We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. Thanks Hanna Chitrik [ADDRESSED DELETED]	Thank you for your comment.
P089	The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please rethink your plans. There must be a way to protect these magnificent creatures from the terrible effects of sonar and explosives.	marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P090	The Navy has killed(taken)and is planning to kill(take)hundreds of thousands more marine mammals than Japan ever does, and yet Japan is seen as the bad guy while the irresponsible Navy does whatever it wants and it has got to stop. These are protected animals yet, Navy sees no problem in killing them. Ridiculous. and it must stop before Nation-wide protests will be formed and executed bringing to light the reality of Naval testing to the American public (which they apparently don't know about, due to extreme coverups and lies.)	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The commenter's characterization of take is incorrect. Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely.
P091	I am writing to ask the Navy to consider steps to reduce the harmful impacts to marine mammals during planned exercises that involve the use of live explosives and high-intensity sonar. I learned these planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. This is horrible!! Whales have stranded and died after major military sonar exercises. If the Navy could avoid the most harmful activities in areas used as calving grounds	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	or migratory corridors; avoid seasonal high-use feeding areas; create a larger “safety zone” around the exercises; and use aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed, it could save their lives. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Please do the right thing. Save all lives!	wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P092	"These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises." This is not worth it. Please find other ways to practice or don't practice these drills.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy’s permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Also, as described in Chapter 5 (Standard

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P093	Almost everybody agrees that we need a robust and strong Navy to protect national security. And almost all of us agree that whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. But a recent proposal from the federal government tries to make Americans pick between these options, and it's a false choice. The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please protect marine mammals from explosives and sonar along the East Coast and California/Hawaii. We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P094	I am truly saddened to learn that the US Navy is planning to use live explosives and high intensity sonar that will affect the lives of 2000 marine animals. I have seen programs about marine mammals affected by navy exercises involving the use of explosives and that footage is highly disturbing as it highlights the effect such equipment has on marine	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	life. In addition, the US Navy is carrying out these exercises without any regard for the marine life that is being affected in other countries by the use of it's sonar equipment. It is well documented that sound channels in the sea allow sound to travel over vast distances. Other countries deserve to be made aware and consulted about the US Navy's exercises. Please consider this matter seriously the Navy's actions impact upon lives of so many marine animals.	
P095	I object to blasting our ocean with sonar or exploding bombs or other dangerous training and testing activities. Marine life will be harmed and die and the government needs to stop this detrimental act on our natural resources.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P096	Please cancel planned under-water explosives/sonar exercises along the Eastern Seaboard and California and Hawaiian coasts to avoid harming and killing marine mammals. These exercises can be modified to avoid such destruction, and proceed later. In the past whales stranded and died in the wake of major military sonar exercises, bleeding from the ears and additional tissue damage, for example: Beaked whales died in the Canary Islands following sonar exercises. Panicked orcas and porpoises fled off Washington State in 2003. Dozens of whales (including pregnant females) from several species died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. Please cancel the planned exercises and take steps to protect marine mammals, such as: Avoid the most harmful activities in areas used as calving grounds or migratory corridors and seasonal high-use feeding areas. Create a larger “safety zone” around the exercises using aerial or acoustic monitoring to determine whether marine mammals are nearby. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P097	please do not do this horrible testing that will rob whales and dolphins of their senses, without which they cannot live. nothing you can find out from these tests is worth the sacrifice of their lives. please please find your heart. thank you, holly gallo	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P098	The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. Using live explosives and high-intensity sonar will harm thousands of marine mammals! According to the Navy's own Environmental Impact Statements, damage estimates from these exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Please reconsider these practices! There is no excuse for killing countless marine animals!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Also, as described in Chapter 5 (Standard

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P099	I urge the Navy to move its testing to less critical marine animal habitat. The use of sonar as planned will result in hearing impairment and loss to a significant number of marine animals including endangered turtles. The environmental review has highlighted the potential impact. The Navy, contrary to its assertions, has a history of ignoring and covering up the damage to marine animals caused by the use of sonar in testing. As a resident of the impacted coastal area, I don't want dead or deaf animals washing up on our beaches as a result of your testing. Test in a less sensitive location.	The Navy shares your desire to preserve marine life. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P100	I am saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities.	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. I look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact me.	
P101	Stop!	Thank you for participating in the NEPA process.
P102	We are saddened to hear that they Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. Sincerely, J.Behrens	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P103	"ScienceDaily (Mar. 16, 2011) — Scientists have long been aware of a link between naval sonar exercises and unusual mass strandings of beaked whales. Evidence of such a link triggered a series of lawsuits in which environmental groups sued the U.S. Navy to limit sonar exercises to reduce risk to whales. In 2008, this conflict rose to the level of the US Supreme Court which had to balance potential threat to whales from sonar against the military risk posed by naval forces inadequately trained to use sonar to detect enemy submarines. The court ruled that the Navy could continue training, but that it was essential for the Navy to develop better methods to protect the whales." Please halt the scheduled tests until the fatal repercussions on sea mammals has been eliminated. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P104	I am writing to ask you to please stop the high frequency tests that are harming whales and porpoises. They are intelligent,thinking, and feeling animals that deserve our respect and care not our abuse. Thank you for this opportunity to speak on their behalf. Sincerely, Jack Foreman	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar

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Comment Identifier	Comment	Navy Response
		training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P105	On May 17, 2012, news reports that "Mass dolphin deaths in Peru caused by acoustic trauma" were announced by "…Dr. Carlos Yaipen Llanos of ORCA in Peru informed Hardy Jones of Blue Voice that acoustical trauma is the cause of the Mass Mortality Event (MME) that killed an estimated one thousand dolphins along the coast of northern Peru in March 2012…" [28]. This is another reason to begin to limit sonar, laser, radar, and electromagnetic weapons testing in the Atlantic, Pacific, and the Gulf of Mexico. I oppose the expansion of the U.S. NAVY expanding or adding new 5-Year Warfare testing ranges in the Pacific, Atlantic, and the Gulf of Mexico:	The Navy was not conducting sonar or explosives training activities within 500 miles of the Peruvian coast in the three months prior to the 2012 stranding event in Peru. Credible marine scientists do not believe the Peru stranding event resulted from acoustic trauma based on (1) the condition of the animals' ears, which clearly were not impacted by an acoustic event; (2) the timing of the strandings, which is not typical for strandings from acoustic trauma; and (3) the types of animals affected, which suggest the Peru strandings more likely occurred due to weather or biological factors such as toxic algae or disease. Experienced veterinary pathologists and other qualified experts should be consulted before people draw conclusions about the cause for strandings. The Navy will continue to assist the National Marine Fisheries Service and stranding networks as needed, and remains committed to protecting marine life while performing its national security mission.
P106-01	We began to experience extensive gear damage and down time as soon as we started fishing the 2011 squid season which occurs on the edge of the continental shelf. It was not until a fishing vessel caught a Navy target that we realized there were obstructions placed on the grounds.	The Navy shares your concern regarding impacts on fisheries and gear loss. The Navy provides up-to-date notification of Navy activity to fisherman and mariners through Notices to Mariners, or NOTMARs. Notices to Mariners are required for activity within waterways of each U.S. Coast Guard District, and are available on line at http://www.navcen.uscg.gov/. Notices to Mariners are also broadcast on radio stations that broadcast marine information and Mariners may register for personal notifications when new local Notices to Mariners become available from each U.S. Coast Guard District. The Navy also communicates with organizations such as the Mid-Atlantic Fisheries Management Council to provide information and receive Council's recommendations and concerns regarding Navy activity.
P106-02	I was also informed that the Navy had requested US Coast Guard issue a "Notice to Mariners" pertaining to this operation. It should be noted that the fishing industry rarely receive "Notice to Mariners" unless there is a prior advisement of potential action of Naval Operations. In this case due to the obstructions being placed on fishing grounds, the Navy should have provided detailed location of the targets to the industry, to help reduce any loss or damage of fishing gear or Navy equipment. I strongly recommend the Navy notify "National Marine Fisheries Service" (NMFS) prior to this type of exercise. NMFS could easily send a "Permit Holder Letter" to advise the fisherman of this type of exercise.	The Navy issues Notices to Mariners and Notices to Airmen as part of its standard operating procedures. Notices to Mariners can be found on the U.S. Coast Guard web site (http://www.navcen.uscg.gov/).

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Comment Identifier	Comment	Navy Response
P106-03	I also suggest that there be an opportunity for fisherman to be consulted by Naval personal as to which areas could be established with little loss to fishing operations and more protection of sensitive, expensive Naval equipment. This approach must be done region by region to best utilize fisherman expertise of specific areas.	NEPA provides a forum for public involvement in federal decision making. Several opportunities have been provided including scoping meetings, public meetings, and opportunities to comment on the Draft EIS/OEIS. The Navy has engaged the regional fishery management councils. Further, the Navy has involved the Fishery Management Councils in the development of the EIS/OEIS.
P106-04	The Navy must reconize the commercial fishing industry also provides this country a service by providing a high protein, sustainable food source.	The Navy shares your concern for marine life and those dependent on it. Socioeconomic impacts are thoroughly addressed in Section 3.11.3.1 (Accessibility), which concludes that there would be no impacts on commercial and recreational activities, including the fishing industry.
P107	Please do not use the explosives and sonar that will harm marine wildlife during your exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P108	Please do not kill thousands of innocent whales and dolphins by increasing the Navy's sonar program! America does not need to do this. What possible reason does the Navy have for this additional killing of cetaceans??	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P109	STOP THIS MADNESS! The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final

Table E-5: Responses to Comments from Private Individuals (Continued)

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	estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. I AM APPALLED BY THIS SO CALLED TRAINING/KILLING EXERCISE STOP THIS MADNESS! angelika davis, citizen and taxpayer of the USA	EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P110	As a citizen of the United States, a California native and current resident, I join the Humane Society of the United States and other environmental and animal welfare groups in urging the Navy to please consider steps to reduce the harmful impacts to marine mammals of proposed training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We would not want anyone setting off live explosives and high-intensity sonar in our homeland; let us not use these devices in their watery world. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P111	Please stop the exercises!	Thank you for participating in the NEPA process.
P112	PLEASE protect wildlife! Please consider avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P113	It seems to me that there should be a more environmentally safe way of testing the sonar equipment. To knowly damage marine mammals hearing from sonar testing is atrocious. The effect will be devastating to those mammals. Shameful.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P114	I have always been proud to be a NAVY family - please keepour faith in the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		impacts to marine mammal species or stocks.
P115	WHY????	Thank you for participating in the NEPA process.
P116	According to the Navy's own Environmental Impact Statements upwards of 2,000 marine mammals will be killed due to the exercises that are currently being planned along the U.S. East coast. Such exercises include live explosives and high intensity sonar. These 2,000 mammals include animals that are currently on the endangered species list. Now, what is the point of having an endangered species list if practices such as these are allowed to threaten their already fragile existence? Furthermore, to prevent more species from being placed on that list, practices such as the ones being planned by the Navy should not be permitted to take place. Other causalities would follow these practices as well. Such causalities include, permanent lung damage, permanent hearing loss, and millions facing temporary hearing loss. In the past whales have even been stranded and died that way in the aftermath of military sonar exercises. These animals should not have to have their homes invaded and their lives threatened to meet an unnecessary demand by the Navy. There are steps that the Navy could follow to reduce the harm that will come to marine mammals. Such steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger safety zone around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Those steps would allow for both the survival of thousands of marine mammals, and the advancement of Navy techniques. The idea that marine life cannot survive while military operations continue is an illusion. The two are not mutually exclusive.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P117	Please do not hurt more sea mammals with your tests in the Atlantic & Pacific. Too much damage has already occurred to these animals & fish in the Gulf of Mexico. Please let's cherish what is left.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P118	Dont kill whales and use your head when you think more.	Thank you for participating in the NEPA process.
P119	Dear Navy, Please stop using ultra-sound equipment that can hurt Whales and Dolphins. It's really sad to hear that my tax dollars will be used for hurting innocent whales and dolphins. We should be protecting other smart creatures on the planet, not testing equipment that doesn't necessarily do any good anyways. I am very sad to learn about all of this. Please don't continue it. Thank you. Sincerely, Jarrett Gable Chicago, IL	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P120	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities.	Thank you for your comment.

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Comment Identifier	Comment	Navy Response
	As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations.	
P121	i am definitely opposed to the us navy bombing america for alleged "training". the dead whales, dolphins and other marine life that wash up on our shores from this absurd ludicrous bombing of america are an outrage. the us navy does not need to bomb america to train its men. this is an example of the us navy going too far. it needs to stop this horror. we are sick of the dead bodies of the whales that hemorrhage from the huge sonar impact. it is like the bends. their brains explode. and the navy is so [EXPLETIVE DELETED] sneaky it has hidden the results of science that shows this is what happens. stop bombing america.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P122	What is this world coming to? What is your thinking, that marine life has to be destroyed for someones thought to better our security system. That really is sick....	Thank you for participating in the NEPA process.
P123	What, [EXPLETIVE DELETED], are you thinking about? Is it still time to destroy our environment? If you have got just a little bit of sense, you would recognize that you are making a enormous mistake!	Thank you for participating in the NEPA process.
P124	Please do not conduct this training which will, at a minimum, deafen almost 16000 cetaceans and kill nearly 1600 more. In the 21st century this is just not an acceptable practice. Please consider disbanding this testing and spend the money on a project less suited for the cold war, which has ended. I don't know what words to use to convince you not to do this cruel, cruel thing except Please. Please do not do this.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P125	My family has been involved in the military for many years, indeed we have ancestors who served on the Virginia Line in the Revolution. I fully understand the need to protect our waters, but that also means to be a proper steward of the bounty that God has afforded the world. While I can see that there is a need for limited testing of naval weaponry, to do so with a sense of impunity is flouting our responsibility of that stewardship, and besmirches the record of the U. S. Navy. We can test, but to a limited degree, and in limited locales that have a minimal effect on cetacean life. The oceans are huge. Remember that the concept of shipping in convoys during World War 2 was developed by	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.

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	mathematicians who recognized counterintuitively that if many ships steamed together, there was that much more oceanic vastness that ships were not in, and were therefore safer from detection and attack. So think, this concept is possible to apply in a way to cetacean pretection. Find areas where whales and dolphins don't tend to congregate, breed, gestate, and give birth. Locate tracts of open sea that avoid their migratory routes. Add to the pride of our Naval Forces by instigating plans to protect our wildlife. Lead the world, not only in naval power, but in naval responsibility by showing how it can be done, and set an example for other countries and those who come after us. Set standards for ocean wildlife protection that speak to and enhance the heritage that John Paul Jones began. Stop it now.	
P126	This training program is both devastating and unnecessary. The projected mortality rates are staggering. The number of animals left deafened will slowly starve. The impacts of this kind of testing are well documented in numerous studies. These impacts are far ranging and are damaging and lethal to ocean life -- from fisheries to marine mammals to all kinds of flora and fauna in the ocean. The only responsible action is to not use this lethal technology.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P127	Subject: Testing activities off Ft. Lauderdale, Florida Please be advised that I am against testing and harming animals and the environment. Your destructive activites could cause temporary hearing loss in over 200,000 marine mammals. That could result in devastating effects, long term, for these animals. This is their home. Treat their home with respect. If you like your activities, go test your war toys in your own homes on your own families... if you believe that what you do is so good. Stay away from these defenseless animals. I speak for the animals that	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	have no voice regarding your dangerous activities.	training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P128	Please consider the damaging effects of your actions on our endangered wildlife, including our whales, and halt your negative behavior. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P129	Please stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico. This is an unacceptable level of "takes". Sincerely, Jennifer Vuillermet	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P130	Whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. The U.S. Navy is proposing to conduct training	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

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	exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. In the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. Consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Re-think plans and incorporate additional protective measures.	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P131	Please respect Cetaceans by heeding research concerning their health and wellbeing and ocean sound pollution.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the

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Comment Identifier	Comment	Navy Response
		Study Area with no documented proof of injuries to marine mammals.
P132	We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please protect marine mammals from explosives and sonar!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P133	The U.S. Navy is proposing to conduct training exercises in the rich marine environment along the East Coast. I am calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures for marine wildlife. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. Please protect marine mammals from explosives and sonar on the East Coast by considering steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you.	understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P134	PLEASE rework this plan to provide better protection for marine mammals! The current plan is predicted to cause deafness, stranding, and death to thousands of animals. I appreciate military protection, but not at the cost of killing any innocent animals just for training; please do not carry on exercises that would cause marine mammals to suffer and die. Instead, consider and adopt alternative suggestions that animal welfare organizations can recommend, and consider exercises that don't require the actual deployment of explosives and high intensity sonar that cause so much suffering. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P135	I respectively ask you, the United States Navy, to rethink your training exercises. There MUST be a way that you can safeguard our Nation and safeguard those animals that have the right to live in these waters. We depend on them for a balanced world and ecosystem. I grieve to think of the pain and suffering these beautiful, amazing, intelligent	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5

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Comment Identifier	Comment	Navy Response
	creatures will endure due to your training exercises. PLEASE revise your plans, and take into greater consideration the importance and worth of these creatures, and the responsibility we have as humans to make sure our actions don't cause undue, unnecessary, and uncaring harm to those we share the earth with. I have faith in your capabilities to make a different, more compassionate, and more sensible plan. Thank you.	(Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P136	Please do not begin testing that could disrupt our already fragile aquatic ecosystem. The consequences could be huge.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P137	I am against the new naval testing that will destruct our already fragile aquatic ecosystem.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P138	PLEASE DO NOT PROCEED WITH THIS PLAN. THERE MUST BE A BETTER WAY TO CONDUCT THESE TESTS JILL OLSON WILMETTE, IL	Thank you for participating in the NEPA process.
P139	Please implement any and all protective measures in the East Coast testing to be performed to protect our marine life. Our marine life is already threatened from too many sources and this precious resource MUST BE PROTECTED. As a former resident of the Outer Banks of North Carolina, I am well aware of the losses we have already experienced in marine life. I also remember quite well the 1970's when	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the

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Comment Identifier	Comment	Navy Response
	our whales were in so much trouble from overharvesting. Their slow and steady comeback cannot be threatened by any sonar testing unless ALL biological protections are implemented and strictly enforced. Thank-you.	EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P140	PLEASE take steps to reduce the harmful impacts of testing to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Please re-think training exercise and testing plans and incorporate additional protective measures. THANK YOU. Jill Nelson - Kansas City, KS	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P141	I just read about the Navy's plans to conduct sonar exercises and use explosives in the east coast area of the United States and the Californian/Hawaiian areas. I am very concerned that this will harm marine life and would like to ask the Navy to call it off. If not please protect marine mammals from the explosives and sonar in these areas. Please reduce the harmful impacts of sonar exercises to these creatures. Thank you	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P142	You can't be serious about the sonar testing being a good thing?! Really?! DON'T DO IT!!!!!!!!	Thank you for participating in the NEPA process.
P143	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures that the Navy recommends in specific mitigation areas that are important to marine mammals.
P144	Please protect the future of our wildlife.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P145	*Duplicate to comment P144*	*See response to comment P144*
P146	Please do not deafen and kill marine life with your military practices. Why is it something you are not concerned with? Find a way to practice without hurting anything. We know you can do it with computer simulation - so why hurt our marine life? WHY?????????	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Regarding the use of simulation, as described in Section 2.5.1.3.1 (Simulated Training) of the Final EIS/OEIS, today's simulation technology does not permit effective training and testing.
P147	STOP USING SONAR AND WATER BOMBS!!! Do not use sonars they are killing wild life that are endangered! If our oceans die we will die as a	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	species as well! Stop killing marine life!!! These tests are UN-necessary!	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P148	We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. I join the HSUS and other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We are calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.

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Comment Identifier	Comment	Navy Response
P149	Please do not test if dolphins or manatees or sea turtles are present. I am a guide on the water and I think we all know how much so many people care about not harming these animals and being able to see them in our waters. Thank you - John Webb	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P150	The AFTT map shows an unacceptably massive testing range for weapons and high frequency sonar that includes all of the eastern seaboard and much of the deep sea off the coast, as well as most of the Gulf of Mexico. The fleet's testing plan would harm or kill huge numbers (many millions) of marine mammals and fish over the course of the next 5 years. The "take" would be indiscriminate in terms of species harmed, and the types of injuries sustained. In fact, it appears that the effects of the tests are unpredictable to a degree because of the level of experimentation involved in the weaponry and sonar. The Navy cannot be sure which species or how many of their kind will succumb in the 5 year take. The Atlantic Fleet has already been surprised by greater than expected numbers in the take during their EIS fact finding. What is to prevent the Atlantic Fleet from unexpectedly impairing species survival of many marine mammals and fish during testing and training? I believe that this plan places too many marine species in jeopardy. The AFTT plan should be severely restricted in area and duration to protect mass harm to Atlantic and Caribbean sea life in general. In particular, it must make greater effort to identify and protect areas that are important to the breeding and migration of endangered species.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P151	Page 3.1-79. Section 3.1.3.4.7.3, under the paragraph for Training Activities, the 4th line refers to Alternative 1, but it should refer to Alternative 2.	Thank you for your comment. This was corrected in the Final EIS/OEIS.
P152	Page 3.12-16. Section 3.12.3.3 states that if all military expended materials were located side by side in the Study Area, the footprint would be 0.185 square meters. That should be 0.185 square miles.	Thank you for your comment. This was corrected in the Final EIS/OEIS.
P153	How can the Navy even THINK about killing and maiming thousands of sea mammals in this way? First off, this is not necessary to do - and certainly not on this scale. Second, if you ruin the hearing of whales and	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

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	dolphins, how can they hunt? Find each other? Use their own finely tuned sonar to move through their ocean home? You are simply dooming them to a lingering, confusing death. Third, many of these animals, so intelligent we cannot even fathom the full extent of their intelligence, are critically endangered due to our human stupidity already. How can you justify taking more lives in this widespread, wanton manner? I urge you to desist at ONCE and give up this horrible idea. Thank you.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P154	Page A-2 states that Alternative 2 events in Key West Range Complex account for the proposed increase in Key West Range Complex Environmental Impact Statement (underway). Shouldn't that read: Alternative 2 events in Key West Range Complex account for the proposed increase in the Naval Air Station Key West Airfield Operations Environmental Impact Statement (underway)?	Thank you for your comment. This text has been removed in the Final EIS/OEIS.
P155	Page 2-2 last bullet states "Section 2.9 (Summary of Activities) provides a quantitative summary of the sonar hours, ordnance and munitions fired, and military expended materials." There is no Section 2.9 or summary of sonar hours.	Text has been revised to reflect the correct table number.
P156	It is sad that I have to take time out of my day to suggest that the United States Navy not do something that any reasonably healthy individual would not consider doing. I am a US Army veteran who understands a need for national security, but I draw the line at this type insensitive disregard for environmental destruction. Just quit.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P157	Hello, I would just like to voice my opposition to continued testing of underwater high-frequency, low-frequency, and high-power sound generating equipment. The damage to life in our our oceans is impossible to measure, and once done cannot be undone. Future generations will look back and judge us - please consider your own place in history. In addition, this technology, while interesting, is of dubious practical use. The threat of underwater attack upon the US is a cold-war-era issue. Today's threats are very unlikely to be discovered by this kind of technology. Our nation's time, energy and money would be better spent elsewhere.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. Chapter 1 (Purpose and Need) provides information on the Navy's mission and the need for military readiness training and testing activities. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P158	Don't commit murder.	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P159	Please reconsider using training exercises that deafen and kill sea life!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P160	I am writing this comment to implore you to reconsider the decision to continue with the fleet training and testing which will impact the ocean wildlife. While the safety of our nation is a top priority, we should show that we have learned from past mistakes and pursue an alternative. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P161	I understand that the U.S. Navy is proposing to conduct more training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii, using live explosives and high-intensity sonar. According to your own Environmental Impact Statements, it is estimated that these exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. National security issues can be addressed without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. In the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. I am writing to ask the Navy to consider steps to reduce the harmful impacts to marine mammals, which include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I am urging you to re-think your plans and to incorporate additional protective measures.	web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P162	I understand the importance of protecting our country, but please rethink your plans, so that so many whales and dolphins are not brutally harmed in the process.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P163	Please protect marine animals against sonar and explosives... :(	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P164	It is known that the use of sonar and explosives in naval maneuvers threatened the lives of marine mammals and fish. Since many species of	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	marine mammals are threatened with extinction, I can not understand that use of sonar and explosives are required for these exercises. Don't inflict such damage to the habitat ocean for only a maneuver!	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P165	Hello, I am concerned that upcoming explosives and sonar testing will kill sea life indiscriminately including endangered species. Please postpone the testing so that risk to the aquatic ecosystem can be assessed and safe alternatives explored. Thank you, Julia Becker	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P166	There are other thing that won't cause the harm your about and have done to the animals go wash a ship	Thank you for participating in the NEPA process.
P167	Please! Stop the use of sonar in our oceans! If we kill the life in the Ocean there will be no life to protect on earth!	Thank you for participating in the NEPA process.
P168	I do not feel safe in a country that chooses to annihilate innocent marine life. With thousands of marine animals that will lose their life in explosions with high intensity sonar, please take protective measures. I worry for the thousands more that are not killed instantly, but become deaf and die slow, terrifying deaths as ear tissue is destroyed and sonar communication becomes impossible... effectively intelligent marine life like dolphins and whales die alone and afraid. I believe national security is important, but I also believe in the 21st century with the great amount of intelligence and creativity the finest in the US Navy offer, we can find a better way. Please include protective measures. I know the US Navy is designed to protect US citizens such as myself, but I do not feel protected if the wildlife I love is destroyed. These actions hurt the reputation of the military and country I respect and admire. It becomes more difficult to defend that the US Navy is a force for good, when that force is used to harm. Please mitigate the harm these training actions will take and take protective measures supported by the Humane Society of the US as well as many environmental groups. Thank you so very much for your time and consideration!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P169	This comment is about the Navy Sonar Warfare Testing program in the Pacific. There is ever increasing evidence and clear indication that simply turning off sonar tests when marine mammals are visually spotted is not sufficient to protect them from serious injury and death resulting from these tests. This testing is devastating to vast numbers of marine mammals. Knowing this, I can only implore those reviewing this practice to immediately STOP these tests. They are injuring and killing precious and defenseless marine mammals. I refer you to NRDC article documenting this "staggering" and severe harm here: http://www.nrdc.org/wildlife/marine/sonar.asp and here: http://switchboard.nrdc.org/blogs/zsmith/harm_of_staggering_proportions.html The WASHINGTON POST stated that: (Associated Press) May 11, 2012 – "New Navy study says use of sonar, explosives may hurt more marine mammals than once thought "…HONOLULU-The U.S. Navy may hurt more dolphins and whales by using sonar and explosives in Hawaii and California under a more thorough analysis that reflects new research and covers naval activities in a wider area than previous studies…" "The Navy estimates its use of explosives and sonar may unintentionally cause more than 1,600 instances of hearing loss or other injury to marine mammals each year, according to a draft environmental impact statement that covers training and testing planned from 2014 to 2019. The Navy calculates the explosives could potentially kill more than 200 marine mammals a year" Please tell us how, with this brutally painful injury imminent and clearly KNOWN, the Navy can continue this destructive warfare testing? "Mass dolphin deaths in Peru caused by acoustic trauma" were announced by "…Dr. Carlos Yaipen Llanos of ORCA in Peru informed Hardy Jones of Blue Voice that acoustical trauma is the cause of the Mass Mortality Event (MME) that killed an estimated one thousand dolphins along the coast of northern Peru in March 2012…". Digital Journal News Report – "Mass Dolphin Deaths in Peru Caused by Acoustic Trauma" May 17, 2012 - Read more: http://www.digitaljournal.com/print/article/325075#ixzz1vnKmJkGL http://www.digitaljournal.com/print/article/325075 This is another reason to begin to limit sonar, laser, radar, and electromagnetic weapons testing in the Atlantic, Pacific, and the Gulf of Mexico. Some more documentation here about the connection between tests and MARINE MAMMAL STRANDINGS ASSOCIATED WITH U.S. NAVY SONAR ACTIVITIES April 2012: http://hstteis.com/Portals/0/hstteis/SupportingTechnicalDocs/Marine%20Mammal_Stranding_Report_v02.pdf Thank you for your attention and	The Navy shares your desire to preserve marine life. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements. The Navy was not conducting sonar or explosives training activities within 500 miles of the Peruvian coast in the three months prior to the 2012 stranding event in Peru. Credible marine scientists do not believe the Peru stranding event resulted from acoustic trauma based on (1) the condition of the animals' ears, which clearly were not impacted by an acoustic event; (2) the timing of the strandings, which is not typical for strandings from acoustic trauma; and (3) the types of animals affected, which suggest the Peru strandings more likely occurred due to weather or biological factors such as toxic algae or disease. Experienced veterinary pathologists and other qualified experts should be consulted before people draw conclusions about the cause for strandings. The Navy will continue to assist NMFS and stranding networks as needed, and remains committed to protecting marine life while it performs its national security mission.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	serious consideration of this comment & grave matter.	
P170	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, Thanks, Justin Holt	Thank you for your comment.
P171	Please do not do this. 2,000 deaths of any animal cannot be justified. I know we need to keep our country safe but these beautiful creatures losing their lives would be too high of a price to pay.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammals.
P172	I am asking you to please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P173	Please look at what you can do to minimize the impact that your testing will have on marine life. I am shocked that by your own numbers, thousands of animals will be killed or harmed. This is simply cruel and unethical. You're a smart bunch of people; please use your intelligence to do a better job of protecting our fragile ecosystem and the animals that inhabit it. Thanks much.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P174	I am in disbelief that the sonar testing which would harm so many whales and dolphins is even being considered. No matter what your ability to empathize, please understand that it is not fair to do this. Please find an alternative.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P175	I ask you to stop the ongoing underwater testing that poses a risk to the world's whales including the endangered North Atlantic Right Whale and other sea life. How can you state "no expected impacts" when we don't	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	know what whales hear. We do know that they navigate by sound. Your experiments are inhumane and should not continue. Thank you for adding my objection to this testing to the official record.	
P176	I respectfully call on the Navy to put safeguards in place before unleashing a deadly barrage certain to deafen, injure and kill countless whales, dolphins and other majestic marine mammals. The projected damage to these magnificent creatures, our national treasures, is staggering and appalling: over 5 million instances of temporary hearing loss, 16,000 instances of permanent hearing loss, almost 9,000 lung injuries,and over 1,800 deaths. The level of carnage reflected in these numbers in shocking, unconscionable and unacceptable. Please take common sense precautions, like keeping training out of key whale habitat, before launching this sonic assault. These common sense and humane precautions will NOT compromise the nation's military readiness, but it will save these extraordinary creatures of the sea from excruciating and unspeakable suffering or death. The ocean is their home - where they give birth, raise families, eat, sleep, play and socialize - let's keep it their "home-sweet-home." I call on the Navy to identify and set aside areas of high marine mammal density - acknowledged to be the most effective means of reducing marine mammal injury. The Navy should be seen as an effective steward of the ocean environment. The Navy should take positive steps forward to protect these magnanimous creatures by significantly reducing the level of harm that training and testing activities will inflict on marine life. Thank you for the opportunity to comment.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P177	I'm deeply concerned about the death and harm to marine mammals from the sonar project. Please take steps to reduce the harmful impacts to marine mammals, such as avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P178	I am completely against this. You people should be ashamed of yourself. You have no souls. Mother Nature [EXPLETIVE DELETED], and she will attack you first. I will no longer respect the Navy if you chose to kill innocent animals to train to kill innocent people.	Thank you for participating in the NEPA process.
P179	Stop testing and protect marine mammsals life.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P180	We can all appreciate the many jobs the U.S. Navy performs, national security and education in particular. Proposed exercises are known to cause great harm to marine life. While we are protecting the U.S.A., it seems we would want to protect the health of our oceans. My hope is the Navy will take all steps possible to minimize damage. The health of our oceans aids in keeping our country strong. Please take every marine life safety step you can. Thank You for your consistent hard work, Kate	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P181	As a concerned voting citizen, I strongly wish to register my wishes that no, repeat NO, whales, dolphins or fish be injured, impacted or killed by any actions of the US Navy or other military groups. Thank you!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P182	The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We are calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures. Thank you, Kathy McRory	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P183	Please protect marine mammals off the east coast. We don't have to sacrifice the health of the animals and ecosystem for national security.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P184	This heartless and cruel we are better than that what gives you the right to take all these beautiful creatures away from our children and maybe for ever	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P185	I am writing to voice my opposition to continued testing of underwater high-frequency, low-frequency, and high-power sound generating equipment. The damage to life in our our oceans is impossible to measure, and once done cannot be undone, killing or deafening	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	hundreds of cetaceans. In addition, this technology, while interesting, is of dubious practical use. Today's threats are very unlikely to be discovered by this kind of technology. Our nation's time, energy and money would be better spent elsewhere.	Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P186	Are they NUTS? Whatever would they be doing that for? Why near our coast? Why at all?	Thank you for participating in the NEPA process.
P187	Please consider steps to reduce the harmful impacts of high-intensity sonar on marine mammals. Avoid activities in areas used as calving grounds or migratory corridors and consider creating a larger “safety zone” around the exercises, among other changes. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We are calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P188	Consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P189	Please reconsider your training tactics along the east coast. Such exercises have been proven to cause great harm to the marine mammals living in the area.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P190	Please don't do any underwater testing in the oceans. Everything that lives there should have a peaceful life. You will be destroying marine mammals that can not escape the repercussions from testing bombs and other experiments.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P191	As a concerned citizen, I urge the Navy to act with responsibility and compassion, to perform its exercises in a manner that minimizes the horrific impact of sonar on whales and other sensitive marine life. Defense of our nation should not and must not come at the expense of some of the world's most vital and intelligent species - treasures that we cannot replace.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P192	My father was a tailgunner in the Korean confluct and was shot down, wounded in battle. My brother has the medal he was given and he carried shrapnel in his leg for the rest of his life. Perhaps in the last century, the kind of tests that the Navy contemplates might have made a difference. Perhaps when sonar was first being developed, the entire intellectual capacity of the U.S. military and the great thinkers in the Pentagon might have thought, at that time, that there was no other way to carry out these tests. As a proud daughter of a Naval veteran, I can	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	think of no other way to honor my father than to ask that useless torture and killing of thousands of whales and dolphins be prevented. Maybe this crude, harmful procedure would have been more appropriate in another era, in another century. But not now. We know better than this. We can do better than this. The entire might of the U.S. military, the safety of the entire United States does not depend on these tests. We know that is not the case. We can do better. American ingenuity depends on updating military strategies from the dusty battlefields of the last centuries. And so we can do better, and use that unique talent to bear on halting the slaughter and torture of innocent marine mammals. We deserve better; and so do they. Thank you, Kathy Braidhill daughter of James Vislavsky ("Ski") U.S. Navy veteran, Korean conflict	mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P193	Why is it ok for this gov'ment to do whatever they want, when they want. This is not money well spend.	Thank you for participating in the NEPA process.
P194	Please preserve our ocean wildlife!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P195	I am commenting to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I am calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P196	Please rethink your training exercises on the east coast, California and Hawaii. I know we need to protect our country, but why can't we protect marine life as well. Thank you, Keith	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P197	Why? Why? Why? Thats just ridiculous. Its not necessary. We have destroyed our planet and the wildlife and vegetation on it way too much already. The oceans and its inhabitants are not immune from our wicked ways either. It needs to stop or the planet will die, right along with us. What has already been done to this earth is a sin and cannot be fixed. There is no future for our children or their children. God help them. Just stop this nonsense now. Maybe the planet will last a little bit longer if we stop now. I can only hope... and pray to GOD! And dont you DARE tell me not to mention GOD either! Thats another story...	Thank you for participating in the NEPA process.
P198	I respectfully request that the Navy consider steps to reduce the harmful impacts to marine mammals as it considers conducting training exercises along the U.S. East Coast and off the coast of California and Hawaii. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. As the wife of a Navy veteran, I understand the need for protecting our country, but I also know the Navy can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P199	Regarding the U.S. Navy’s proposal to conduct training exercises along the U.S. East Coast involving the use of live explosives and high-intensity sonar. By your own estimates the exercises would kill up to 2,000 marine mammals, including a large number of animals from	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. If your statistics are correct these training exercises come at a high cost to marine life. It seems a pretty heartless thing to do if there are other methods available. I hope our U.S. Navy explores some less costly alternatives.	Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P200	Please refrain from sonar practices all together or at the very least make every attempt possible to protect and preserve all marine life at every level. We should strive to be a leader in the world in preserving and enriching life. We teach by example and thus we must take care of all of life.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P201	just stop it already with the killing of everything in sight. These marine animals are not a threat. I truly believe we already have enough ways to kill people and things. If you can't do your research without hurting living things, then don't do it.	Thank you for participating in the NEPA process.
P202	Please actively take steps to reduce sonor and other technologies' harmful impacts to marine mammals. These steps include avoiding harmful activities in calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P203	please dont harm whales and dolphins	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P204	With all our technology, it seems to me that the Navy should be capable of conducting its training without wiping out huge swaths of local marine ecosystems. The oceans have taken enough abuse from humans. This testing must not go forward.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable,

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P205	Protect the innocent marine life!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P206	I am saddened to hear that the U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. I urge you to please do just that.	Thank you for your comment.
P207	STOP!	Thank you for participating in the NEPA process.
P208	The Atlantic Fleet training is dreadful idea. It should not be carried out due to the extreme environmental harm it will cause. It would be terrible crime. The mankind should behave with humanity, otherwise fighting for it is useless. If we live in dreadful society with no respect to one another, including animals, vast amount of marine life as would be the case in this exerise, then we have lost everything. The army would be not only useless but actually does more damage than good.	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P209	Please help protect marine mammmals for the effects of sonar testing as recommended by the HSUS. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P210	The cost of these exercises is much too great. We have already lost thousands of marine animals to the actions of humans: oil spills, netting, ship propellers, garbage, etc. Please reconsider.	Thank you for participating in the NEPA process.
P211	The war is over and there will never be another one...stop the needless killing of our dolphins, whales and other marine life. Test in the dead sea or a deep lake anywhere else but in our oceans!	The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives.
P212	Good afternoon: It has come to my attention that the U.S. Navy is planning to schedule several training exercises along the east coast, California, and Hawaii. While I understand the importance of these exercises and the larger national security framework, I hope that you will consider certain measures to protect sea life from the harmful practices. As a citizen who lives just a couple of miles from the Atlantic Ocean, I'm particilarly sensitive to the negative effects that we have on sea creatures, and I hope that the Navy's use of sonar and explosive equipment can be used in such a manner that causes the least interference - and injury or death - to these magnificent creatures. Thank you for your consideration.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P213	No live explosives and sonar exercises, please! They kill thousands of animals that have right to live.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		injuries to marine mammals.
P214	Please work with the HSUS to do everything possible to minimize the loss of marine life. I understand the importance of protecting our country, but I also feel strongly about the loss of life for these creatures. If the Navy and the Humane Society can work together to prevent the loss of life for these creatures then, we would have a win, win situation. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P215	Please do not do testing off the East coast that would cause stress or koll marine animals in these waters!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P216	Please protect marine mammals from explosives and sonar	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P217	Please adjust your training exercises to protect marine mammals from explosives and sonar.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P218	Please don't do this, it harms too many creatures!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P219	Please take all reasonable measures to ensure your impact on marine wildlife is minimized by exploring less dense areas and employing some of the recommendations provided by those concerned about the threats to whales and dolphins.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of this Final EIS/OEIS.
P220	I object to the Navy's plan for sonar and weapons testing that is projected to deafen, maim and kill hundreds or thousands of cetaceans, and to disrupt undersea life in general. Cetaceans are as intelligent as humans. Their language is even more complex than ours. They rely on hearing to orient, navigate and communicate. To deafen them with extremely loud sonar is unbelievably cruel, and immoral at its core. It is unacceptable in a civilized society. The cold war is over. The Navy needs to rethink its plans, and come up with ways of testing sonar and weapons systems that does not savage undersea life. We as a species tread too heavily on the Earth, and damage the natural world with almost everything we do. It must stop. We cannot continue making war on the natural systems that sustain us, and must not brutalize the other species, some of them intelligent, with which we share the planet. Please do not make me ashamed to be an American. It is surely possible for the Navy to fulfill its national defense mission without trashing the environment like a bull in a china shop. Stop. Think. Search your conscience. Come up with a more gentle plan.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P221	Please do not complete sonar training exercises -- especially the ones currently proposed along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. Almost everybody agrees that we need a robust and strong Navy to protect national security. And almost all of us agree that whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. But a recent	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	proposal from the federal government tries to make Americans pick between these options, and it's a false choice. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Thank you for your time and attention.	EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P222	Please protect these wonderful creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P223	Atlantic Fleet Training and Testing activities should be designed for MINIMAL impact on marine mammal species, especially acoustic impact. Marine mammals are federally protected animals, and many are critically endangered.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P224	Hello, I have recently learned about intended testing exercises to be conducted on both coasts which involve methods that harm, kill and/or interfere with irreplaceable marine life. Surely national security objectives, which everyone believes is a priority, does not have to involve the death or destruction of living creatures so critical to our ecosystem and so valuable to the American people. Thank you very much for your consideration. Respectfully, Lauren Williams	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P225	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS,

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P226	I urge in the strongest terms that the Navy not conduct acoustic activities that in any way harm whales and dolphins. If it's a matter of defending the country against the possibility of attack, find another way that does not impact these majestic creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P227	Sirs and Madams: As the daughter and niece of military pilots, I support the Armed Forces and consider myself to be very patriotic. However, any sonar testing that harms one single whale is unacceptable to me. We are destroying our oceans and killing whales and marine life at a too rapid pace. I understand your need to test, but it cannot be at the expense of our precious whales. You must find a better way. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P228	There has to be a better way to test this equipment. There is no reason to endanger helpless animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P229	Please do not continue to harm innocent sea life with your life-threatening behaviors. Lee Channing	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P230	Please be sure to protect the dolphins and whales before doing your testing. They should not have to deaf in order for you to test your sonar and explosives. Thank you!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P231	STOP SONAR TESTING IN HAWAII. YOU ARE KILLING WHALES AND OTHER SEA CREATURES. GO SOMEWHERE ELSE AND TEST! TEST THE WATERS OF YOUR HOME AREA.	Thank you for participating in the NEPA process. However this comment is outside the scope of this EIS/OEIS.
P232	To whom it may concern: It has come to my attention the U.S. Navy plans to conduct training exercises along the U.S. East Coast coastline as well the Pacific and Hawaiian coastlines utilizing live explosives and high intensity sonar. Please reconsider the harmful and fatal impacts these training exercises are going to have on marine mammals! There must be a way for the U.S. Navy to remain trained and ready to answer the call to defend our nation WITHOUT harming marine wildlife. As a hard working American tax payer please I strongly urge the U.S. Navy to use every precaution necessary to avoid harming marine wildlife by taking sonar and explosives testing to areas away from marine mammals calving grounds and migratory corridors. Also, please create a safe-zone to ward off marine mammals who may stray into proving grounds. This CAN be a win-win situation for the U.S. Navy and members of God's creation if steps and precautions are taken. Yours sincerely, Ms. Leslie Porter [ADDRESS REMOVED]	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P233	I am strongly opposed to the current, ongoing and potential undersea testing off the coasts of Hawaii, Southern California, and the Atlantic and Gulf states, from 2014 to 2019. I am appalled at the projected damage	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	to whale and dolphin populations, 33 million instances of "take" over five years, a vast increase over existing estimates of harm for the same regions. Surely the US navy, with all its resources, both human and technological, can create a system which is both more effective and does not cause destruction of our sea creatures and the oceans upon which all our lives depend.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P234	There is no pressing reason in the world, that the Navy NEEDS to do sonar testing in order to be a strong, good Navy. There is no reason in the world that whales and other sea creatures lives need to be threatened, risked or harmed in order for the Navy to do the very good job it all ready does. What is going to be left to protect when you are through with it all?	Thank you for participating in the NEPA process.
P235	Please stop your plans that will harmfully impact the dolphins and whales on the east coast, west coast and Hawaiin coast. Thank you!!!	Thank you for participating in the NEPA process. The analysis and the science show that there is not a significant impact on marine species. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project.
P236	I am commenting to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I am calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		recommends in specific mitigation areas that are important to marine mammals.
P237	Please do everything possible within you power to protect marine mammals from the abuse of your training exercises. The ocean is their home and all living creatures merit our respect and compassion.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P238	protect marine mammals from explosives and sonar ! DO YOU HAVE TO KILL EVERYTHING? gulf of Mexico is destroyed the pacific is now nuclear waste so now you have to [EXPLETIVE DELETED]THE ATLANTIC TOO"?? WHAT THE [EXPLETIVE DELETED] IS WRONG WITH YOU PEOPLE? S T O P !	Thank you for participating in the NEPA process.
P239	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. Thank you for your time, The Wilkerson family	
P240	Please consider using a "virtual simulator" as opposed to live ammo to run your tests. I understand the maneuvers are needed, but I am sure we have the technology to avoid further damage to sea life, and the intelligence to understand the damage already done. The world and it's creatures are ours to care for, not destroy at whim. We do enough damage to each other. Think of the impact on the environment, the sea mammals and other sea life, and think of the generations to come; the consequences of our actions now, and how we treat the environment is quite poor. If you are not sure what I mean, then perhaps more research is needed before live explosives are used again on a regular basis. Thanks for your time. With Much Respect, Lise Guillet	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Use of simulation, as described in Section 2.5.1.3.1 (Simulated Training) of the Final EIS/OEIS, concludes today's simulation technology does not permit effective training and testing.
P241	I know this has to be done, but why not out further, where the water is deeper?	The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives.
P242	Don't kill millions of creatures in the sea with sonar. That would be cruel and outrageous. Act responsibly.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P243	Please take steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard

Table E-5: Responses to Comments from Private Individuals (Continued)

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	mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. It's 2012, implementing barbaric effects on the earth's animals and planet are not acceptable or necessary.	Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P244	I oppose the navy exercises that put whales, dolphins, and other sea animals at risk. To me, this is a simple issue. If the danger is real, cruel, and negatively impacts living animals and ecosystems, then nothing justifies carrying out the activity. Alternatives must be found. period. Thank you for considering my comment.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P245	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Louise Lilja	
P246	Please do not implement testing procedures that threaten marine life in our seas.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P247	Against the sonar testing which will disturb, possibly deafen and kill wildlife such as dolphins and whales. Why not set this aside for now in favor of a longer term approach that would use some of the tax dollars which support military research to find a more wildlife-friendly technology to accomplish these tasks? Seems like that would be a great application of American Ingenuity -- maybe even create jobs. There are so many impacts that we humans have on the environment -- many can't just be prevented by making a single choice. That's why I ask you to make a choice today that will prevent torture and harm to helpless intelligent animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P248	I believe we must have better protection for the marine life during these exorcises, or the exercises must not take place.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P249	(My voting address is in Massachusetts; I'm an ex-pat living in France.) Please stop the indiscriminate deafening and killing of marine mammals. There is no excuse — none whatsoever, not logistically, not tactically,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	absolutely no justification — for the Navy to sully itself by such wanton destruction of sea life. Surely we can defend ourselves without resorting to this kind of violence. Surely the Navy can develop better technologies that will not result in such slaughter.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P250	I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please protect marine mammals from explosives and sonar.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P251	I beg of you to please consider some other way of testing this equipment that will be harmful to the delicate marine life that is under siege by so many other environmental hazards. Surely your scientists can find a method of testing that will not cause pain and death to our fellow creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P252	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Annette vd Berg.	
P253	Please do not conduct this testing, US Navy. Protect our wonderful marine wildlife!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P254	Please do not kill living creatures in order to protect living creatures. Surely the intelligent human mind can come up with a better plan to perform your tests and not maim and kill the intelligent beings of the sea.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P255	The following letter has been sent and shared with us by our friend John Flynn, Founder and Conservation Director wildseas.org We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, M.Novak	
P256	*Duplicate comment to P255*	*See response to comment to P255*
P257	*Duplicate comment to P255*	*See response to comment to P255*
P258	we are facing a major collapse of biodiversity in the world actually, great cetaceans are important for life on earth, tey should be protected rather than kiled	Thank you for participating in the NEPA process.
P259	The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. The Navy estimates that the planned exercises would kill up to 2,000 marine mammals. Thousands of others would suffer permanent lung damage. Also, according to its own Environmental Impact Statements, the Navy estimates approximately 16,000 would be permanently deafened and 5 million would be temporarily deafened by these exercises. Can't we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures? Thank you for your attention.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P260	To Whom It May Concern: I am writing in opposition to the Navy's plan to increase underwater testing of missiles and torpedos, among other training, from 2014 through 2019 across the mileage from Maine to Texas, in general, and the area of Port Everglades in Fort Lauderdale, Florida, in particular. While I do understand that testing and training is a necessity to keep our country strong and our military ahead of everyone else, to do this while causing pain, injury and suffering to several other species, should not be a by-product of our military readiness. These animals have no voice and no alternative but to be where the Navy is testing. We really don't know how excruciating the pain and suffering is of these animals, only what is supposition. How fortunate we humans are that we have a choice, for the most part, in what happens to us. I am urging the government to find a humane alternative to the underwater testing. Acknowledging and accepting a certain amount of collateral damage to another species that has no voice should not be an option. This is the 21st century and there has to be some way of accomplishing the testing and training without harming the animals who don't know what is happening and cannot get away because they are prisoners in their environment. Thank you for your consideration and attention to this very important matter.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P261	As a concerned citizen, I am urging the U.S. Navy to reconsider it's use of explosives and sonar along the East coast. Please consider the effects of this testing on the animals living in these waters and work to find better alternatives.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable,

Table E-5: Responses to Comments from Private Individuals (Continued)

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		mitigation measures during its training and testing activities.
P262	We need to protect nature, not destroy it. Please save these wonderful animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P263	Hello, I would just like to voice my opposition to continued testing of underwater high-frequency, low-frequency, and high-power sound generating equipment. The damage to life in our our oceans is impossible to measure, and once done cannot be undone. In addition, this technology, while interesting, is of dubious practical use. The threat of underwater attack upon the US is a cold-war-era issue. Today's threats are very unlikely to be discovered by this kind of technology. Our nation's time, energy and money would be better spent elsewhere.	The Navy shares your concern for marine life. Section 2.5.1.3 (Simulated Training and Testing) discusses the need for sonar training and testing activities and the threats against which simulated activities would not be effective. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P264	I am appealing that you do not test explosives and sonars, I was made aware that some sea mammals are in the endangered species list. We need to protect these animals, it is a reflection on all human beings if we harm these beautiful creatures. Please treat the lives of these sentient beings with humane care and dignity. Thank You, Maria Vint	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P265	Please reconsider and do not conduct training exercises where there are so many sea animals to injure. There are ways to avoid harm by avoiding migratory routes, calving areas, using safety zones, and monitoring sea life activity in the area. We do not want to hear that whales, porpoises, or other animals are dying.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with

Table E-5: Responses to Comments from Private Individuals (Continued)

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		NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P266	These are senitent creatures who have souls - the caretakers of the sea. We don't need to practice our war tactics on them. If men weren't so greedy they wouldn't make money going to war and this would be a non-issue. Stop killing everything on the planet!	Thank you for participating in the NEPA process
P267	This is absolutely rediculous...what are you thinking? These are innocent, harmless, loving being created by God! No one has a right to destroy what God has created for all our good. This is completely unnecessary, ever! Please stop, NOW! TY.	Thank you for participating in the NEPA process
P268	Animals should be protected, not murdered. Stop this cruel training exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P269	I support the efforts of the Humane Society of the US, who have joined other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Please consider incorporating these additional measures in order to save marine life. Thank you, Martie Roberts	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P270	It is beyond cruelty that the U.S. Navy plans to conduct exercises that	The Navy shares your concern for marine life. The analysis and the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	will hurt marine mammals! Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Cordially, Maru Angarita	science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P271	Dear Sirs: My husband was in the Navy, so I really don't havy anything against the military. But, please do not harm the beautiful creatures that live in the waters around us. Please find a less harmful way to test your equipment. Thank you for your time and consideration in this matter. Sincerely, Mary De Mars	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P272	Please stop this madness. There are other ways of testing, please don't kill marine mamals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. Section 2.5.1.3 (Simulated Training and Testing) discusses the need for sonar training and testing activities and the threats against which simulated activities would not be effective. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P273	I just wanted to remind you that dolphins and whales are sentient beings. That means they can think and analyze and have emotions and feel pain. Some carry thousands of years of history in their songs, which change each year to incorporate new experiences. We must preserve and defend these creatures, not torture and kill them for a military advantage that we already have 10 times over. Please find another way to kill humans that doesn't involve marine mammals, which are protected in most places in the world.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P274	Please stop your sonar trainings!they are killing many creatures in the ocean!! you must understand that life is precious.. you do what ever you want, you must understand that you are not the only living thing in this planet so stop!. you got to find another way, its not fair for other living creatures to pay for you your cause!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P275	Re: Military training off the east and west coasts: Dear Sir or Ma'am, Please consider taking steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow your important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you for your thoughtful consideration, Mary Garrett	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P276	You've already done more damage to life on this planet than is acceptable by any standard of decency and no excuse is good enough to justify this. (CHEMTRAILS ARE BAD ENOUGH) The earth, its oceans, and the life they support are not your personal possessions to destroy wantonly. These things belong to all life on earth and are not meant merely for military war games. Expanding and initiating warfare testing in more areas of the Pacific, the Atlantic, and the Gulf of Mexico, is nothing less than criminal behavior and will spell disaster for millions of marine mammals, and fish, and their habitats. I do not elect to be the guinea pig for your experiments or to have the oceans used for massive warfare testing. NO NO NO, ENOUGH! STOP NOW! FIND SOME	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	OTHER WAY TO TRAIN AND STAY [EXPLETIVE DELETED] OUT OF OUR FRAGILE ENVIRONMENT.	
P277	Our marine mammals are already in severe stress from factors such as pollution, ocean warming, overfishing and harmful fishing practices, collision with ocean-going vessels, etc. To deliberately increase sonar use, which we know negatively affects and even kills marine mammals, is unconscionable. We are killing off our ocean inhabitants before we even know all of the positive benefits they could provide to mankind. Please consider DECREASING sonar use in ocean habitats where marine mammals are known to inhabit. To do otherwise will hasten the day when our oceans become dead zones devoid of life. Few studies have been done to truly ascertain what will happen to the human race when the circle of life becomes so disrupted that entire species disappear forever from planet earth. This is already happening. Each year more species become extinct and others become marginalized and/or forever altered. No government, including our own, has the right to deprive future generations of the bounty and diversity of the ocean in the name of upholding security or any other perceived benefit. It is simply immoral to heedlessly destroy and damage other life forms to the extent that they cannot rebound as a species. The United States is answerable to future generations for the harm we do in pursuit of our goals--and we are answerable to other nations who, like us, depend on ocean resources for survival. There surely must be ways to mitigate and prevent sonar-caused impacts to marine mammals. We need to refocus our energies on finding and implementing these ways and pull back from ocean sonar use that is currently so damaging. Thank you for your consideration.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P278	my name is marylou schmidt and i would like to know why the navy is doing the underwater testing that is killing and deafening thousand of whales and dolphins. in my opinion the testing is not worth the lives of these beautiful creatures. i am of the Wiccan faith and these animals are very sacred to me.i strongly request that the navy stop these test.like i stated before the tests in my opinion are not worth the lives of these very intelligent and gentle creatures. is there a telephone number i can call to talk to someone about the testing? i will give you mine. this is so important to me that you quit the testing. the navy has already done enough harm to the dolphins in the past. my cell phone no. is [NUMBER REMOVED]. again i ask PLEASE STOP THE	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	TESTING!!!!!!!!!!!!!!!!marylou schmidt	
P279	I am against the useless killing of marine mammals (or any other marine life) for the purpose of military testing and urge those that are able to stop this bararism at once.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P280	Hello, Protecting our nation can be done without loss to wildlife and the natural balance that we all need to survive. Please stop current plans to test explosives. Our family is in agreement with the Humane Society: The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P281	I concur with John Flynn: I too am saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. Please give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. I look forward to hearing from you with your views on the above. Sincerely Yours, Maureen Engh	
P282	NO SONAR USE IN OUR OCEANS! YOUR AGENDA IN NOT AS IMPORTANT AS THE LIFE YOU ARE HARMING AND ENDING. FIND ANOTHER WAY TO ACCOMPLISH WHAT YOU ARE TRYING TO ACCOMPLISH.	Thank you for participating in the NEPA process.
P283	stop destroying other species in the name of war. STOP.	Thank you for participating in the NEPA process.
P284	Dear Sir/Madam; Thank you for the opportunity to comment on the Atlantic Fleet Training and Testing EIS/OEIS. I do not believe the proposed project activities appropriately consider the the environmental impacts upon marine mammals (and all marine lifeforms), water quality, and the viability of marine ecosystems that are so vital to the health of our planet and the economic viability of marine resources. Dramatically impacting marine mammals and marine ecosystems to meet short term training goals indicates a less than prudent trade-off in terms of priorities. There is a substancial body of evidence gathered to date indicating that bomb blasts and sonar used in weapons training and testing create extreme stress, if not mortality, in marine mammals. I do not believe the military should be exempt from marine mammal protection laws; they were created for a good reason, and everyone, including all government departments, should voluntarily obey these laws, with the only exception being extreme emergency. Training is not an extreme emergency; it is expected and planned for. Destroying our own food base and coastlines for training makes no sense and is counter-productive to national security and the economic and environmental well being of our people. Because of the damage to the marine mammals that can be expected with the proposed training activities, the impacts on the overall marine environment, and the totally	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Regarding the use of simulation, as described in Section 2.5.1.3.1 (Simulated Training) of the Final EIS/OEIS, today's simulation technology does not permit effective training and testing. The Navy has complied with all applicable marine mammal protection federal laws, including the Marine Mammal Protection Act and the Endangered Species Act.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	inadequate mitigation measures proposed, I do not support the Atlantic Fleet Training proposal, or any of the options proposed as submitted. I would encourage the military to think of ways to defend our country without causing such unnecessary levels of destruction. Sincerely, Melinda McComb	
P285	Don't kill whales just for some stupid test.	Thank you for participating in the NEPA process.
P286	Your website talks about the Navy's commitment to marine health. I desperately hope that this is true but your actions speak otherwise. Whales and dolphins use sound frequency and echo location to communicate in every possible way. It is especially important that mothers are able to locate and communicate with their babies. You should know better than anyone that low frequency sound underwater can carry for hundreds of miles and how it can kill and painfully harm sea creatures. Your testing is reprehensible and threatens to torturously kill thousands of innocent creatures in unspeakable ways. I'm ashamed that my tax dollars would go to fund such a heinous and blatantly inhumane project.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P287	Please do not do testing that will further endanger our marine wildlife. With endangered species on the rise - I can't imagine adding to this crisis.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P288	Please for the love of God, do not perform these deadly explosions and sonar exercises that will kill and deafen dolphins, whales, and porpoises. These wonderful creatures are already subjected to humans' rampant pollution, fishing nets, hunting, boating, etc. Please have a heart for these animals who are so vital the ocean's ecosystem.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P289	Please don't kill a bunch of Animals just so you can be "prepared" for a fight.	Thank you for participating in the NEPA process.
P290	We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P291	tESTING IS BAD BECOUSE TOO MANY ANIMALS WILL GET HURT	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P292	Dear U.S. Navy, Please do not conduct sonar and explosives experiments along the East and West Coast of our country. Our marine mammals already include many endangered species...please let them live in peace. There must be another way to protect our country without endangering our wildlife. Thank you, Mimi	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P293	I read an article in the Cape Cod Times about the public hearing in Provience and would be very interested in seeing the 3D view of sound behavior in the water and how it affects different species. Can you please provide information on how I could view this model? Thank you, Mindy Sweeny	The poster on the Navy Acoustic Effects Model can be found on the project web site (www.AFTTEIS.com) under "Documents and References."
P294	stop the navy experiments as long it kills our all sea life.	Thank you for participating in the NEPA process.
P295	I understand the need for protecting our country, but can't we find a better way to ensure national security without sacrificing all of these whales, dolphins, and many other marine creatures. I don't know what else to say. It breaks my heart	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P296	We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please protect marine mammals from explosives and sonar along the East Coast and California/Hawaii. We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. This is unusually cruel. Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I am asking the	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	U.S. Navy to re-think its plans and to incorporate additional protective measures. Thank you, Barbara Fleming	Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P297	do not conduct these inhumane tests. animals are being tortured and subject to extreme pain.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P298	I live in a Coastal Community in Massachusetts. The Ocean and all of the animals and fish that live in the waters here are very important to us. They are part of New England culture, economy and tourism. On the East Coast we see what happens when these magnificent animals are stranded or loose their way. We are on the other end of your exercises. Dolphins, porpoises and whales are sentient beings and mammals, just like us. Their intelligence and communication skills are on a parallel to ours. We still don't know all the things we could learn about them. However, they tolerate us in spite of ourselves. I truly cannot believe that with all the funding, taxpayer's money and state of the art technology the United States Navy has at its disposal, it cannot find another model for its testing so as to not kill and/or deafen our magnificent wildlife that make their homes in these waters. We know that in the past, whales and dolphins have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. Whales beach themselves when they come into contact with the high level military sonar in an effort to escape the painful and damaging effects of the powerful sonar. For the ones that did not die immediately, their hearing was damaged.It then	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	becomes be more difficult for them to hunt and navigate, as they rely on echo-location. We know that loud electronic echoing noise causes dolphins and whales to stampede. All of these things have significant and adverse effect on pregnant females and calves who are vulnerable to injury or death. Whales are communal and if one whale gets sick or decides to beach, all of the remaining whales in the group will beach themselves to remain together as a group. The number of our whales are dwindling. And, yes, humans again had alot to do with their dwindling numbers in the past as they were hunted and killed by us. And still are in places today. We need to look to preserve and treasure these magnificent sentient beings. They could hunt us, or lift a boat out of water but they don't. They are tolerant and communicate with us. Surely as a species we can do better than we have done by them. I am not saying that the Navy should not do what it needs to do. What I am saying is that the Navy can do what it needs to do without deafening, maiming and/or killing part of America that it is supposed to be protecting. These animals matter. It is not acceptable for the Navy to say they are going to do exercises that involve the use of live explosives and high-intensity sonar that according to its own Environmental Impact Statements estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I ask you to consider steps to reduce the harmful impacts to marine mammals such as avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I am the daughter of a World War II Veteran and I believe that the Navy can accomplish everything it wants to without injuring or killing innocent, sentient beings that live in the waters that the Navy is using. To do anything less is unconscionable and indefensible and dehumanizes all of us. That is not the image I would like to have of the United States Navy. Please reconsider your plans and if you must test here on the East Coast, how you are handling your testing by incorporating additional protective measures. Thank you for your time	integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	and for reading my email.	
P299	I am concerned about the potential harmful effect on dolphins in the area of testing. I have read reports of problems with hearing following loud testing in areas where this has been done which dolphins rely very much on their hearing so I am against this testing in an area where dolphins are plentiful.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P300	In conducting your training exercises along the east coast I urge you to minimize the impact these activities have upon the marine life. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P301	I support the humane society (HSUS) in their request to the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P302	I am writing at the urging of the Humane Society of the U.S. to express my strong opposition to naval testing on the east and west coasts that could affect, hurt and even kill hundreds, even thousands, of marine mammals. Yes, naval operations are important, but not at the expense of so many animals, including some endangered species. Such an endeavor is wrong, plain and simple. And it should not be part of U.S. military exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P303	I urge for a moratorium on this plan, and continued testing, until a full congressional hearing can be undertaken. I do not want to see more marine life killed because of this or any similar program.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project.
P304	*Duplicate comment to P303*	*See response to comment to P303*
P305	Please stop hurting the animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P306	I truly do support our armed forces. I know that we need to conduct training exercises in order to further our technology, however, I do not approve of doing so in such a way that endangers wildlife. Please find an alternate solution. I know that you can find other means to ensure both our safety, and the safety of innocent lives. Thank you, A concerned and supportive citizen.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P307	You know your testing is killing whales and porpoises. You know there are ways to minimize that killing. Do so. The whales (of all sizes) are already threatened - by overfishing, "by catch" collateral damage, by ocean warming/acidification. Don't add to it. The small whales are top predators and help keep the prey species healthy the way wolves do on land. Humans are mucking up the chain of life to the extent that we are threatening our own future. The Navy needs to stop being a part of that threat. Modify your testing to stop killing whale species.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P308	Respect Earth.	Thank you for participating in the NEPA process.
P309	I urge to Navy to avoid the most harmful activities to cetaceans in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. These steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P310	Our oceans sustain life that should not be messed with or abused. No matter how important the reason these creatures cannot be killed and endagered. We have seen animals go extinct or become endangered before because of the choices of man. It is not worth it to let these animals die, if the ocean dies we die. Simple as that. Please make chan	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		(Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P311	PLEASE STOP THIS CRUEL AND UNNECESSARY TESTING. IF YOU CAN PREDICT THE NUMBER OF DEATHS AND DAMAGE TO MARINE MAMMALS ALREADY ISN'T THIS REDUNDANT??	Thank you for participating in the NEPA process.
P312	[EXPLETIVE DELETED] Navy.	Thank you for participating in the NEPA process.
P313	Karma and compassion are universal concepts. Treat others as you'd like to be treated. We urge you to cease military action that would kill and disfigure life in the ocean and elsewhere. Sincerely, P. Yushin Honolulu, HI	Thank you for participating in the NEPA process.
P314	Whales and dolphins communicate by sonar and your testing can kill them. NO MORE SONAR TESTING!! It kills whales and dolphins. DONE!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P315	Please do not harm or kill the whales and dolphins. These are beautiful magnificent creatures on our planet that need to be revered and protected.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P316	Please do not kill sea life because of the explosive testing you plan to do on the East Coast.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P317	I am saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations I believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. I would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. I look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, Sincerely, Paul A. Kelley, Ph.D.	Thank you for your comment.
P318	Please help protect dolphins and orcas from the sonar!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P319	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Paula	Thank you for your comment.
P320	This is insanity. There have to be other means of testing that will not destroy other mammals. What a shame. These tests should not be conducted, if they are devastating to the marine life. There simply have to be other ways of testing. Please stop this now! It is wrong.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		(Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P321	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P322	Please protect marine mammals from explosives and sonar along the East Coast! I understand the need for protecting our country, but can't we find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P323	Stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy’s permits are not exceeded. The revised estimates now

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P324	I urge you, in the proposal to conduct training exercises along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii, to please incorporate additional protective measures to reduce the harmful impacts to marine mammals from the use of live explosives and high-intensity sonar. Please do the right thing. Sincerely, Rebecca Portman	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P325	Please respect these animal's health and habitat. Sonar and loud explosives are life threatening and very dangerous for these creatures whose main sensory way of living is through sound. The outcome of thousands of dead and damaged dolphins and whales is not worth the Navy being able to conduct some training exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		Study Area with no documented proof of injuries to marine mammals.
P326	Please do not let our precious marine animals die from your experiments. Please have a conscious.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P327	The blatant disregard for life.....perpetrated by the US Federal Govt. must and will end. The only terrorist GLOBALLY IS the US Federal Govt and its corporate & banker Military Industrial Complex. Americans will not stand for the incremental destruction of human & animal life and rights.....the illegal, and Unconstitutional governance we are temporarily & currently enslaved by will soon be expelled by ALL humanity and respect for our planet.....SANITY! and THE RULE OF LAW RESTORED!	Thank you for participating in the NEPA process.
P328	The U.S. Navy should not be granted permissions for the Active sonar training and use of explosives that the Navy is requesting, based on the historical incidents of cetacean strandings, etc. and changes in marine mammal behavior that have documented in prior years. The terrorist threat that the United States faces is overblown. I also question the level of military activity that our country expends to maintain our safety. The number and size of areas in which the Navy intends to actively test sonar is completely out of proportion to the dangers faced by the Navy and by the United States in general.I would like to see definitive proof that these activities do not adversely impact marine mammal populations, as opposed to lack of proof.	The Navy shares your desire to preserve marine life. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P329	Stop... We need 2 start caring 4 all animals (land, air & sea)... Ur xperiment is harmful to sea life... Stop...	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P330	Please, the cost to marine life, the fragile eco systems and indeed our survival as a species is too great. These mad practices of war against each other and the degradation and destruction of our planet must cease and desist immediately. Thank you.	Thank you for participating in the NEPA process.
P331	As a citizen, I am very concerned about the Navy's activities which might impact marine life, particularly dolphins and whales. HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thanks Richard Pendarvis, Ph.D. (Chemistry)	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P332	This testing does nothing to make us safer. It will only be a black mark on the honor of the United States in general and of the U.S. Navy in particular.	Thank you for participating in the NEPA process
P333	Hello: I am writing because I strongly oppose sonic testing. Animals exist in their own right as individuals pursuing their way of being, which	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	is no more or less sacred and holy then yours or mine. My most recent concern is Decompression Related Embolism in Stranded Whales and Dolphins, which occurs exclusively due to the US Navy. I am a citizen. I do not support cruel and grievous conduct to human or non-human creatures. Moreover, means do not justify ends - even when those ends may seem justifiable to those employing unjust means. I do not support hurting or violence towards others, human or otherwise. I appreciate a strong defense but not one that disrupts, upsets or destroys others, human, non-human, plant, mineral, rock, water or soil. I look forward to your response. Thank you.	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P334	Please help the whales and dolphins. Do the RIGHT THING!!! I can't tell you how important it is for people like YOU in YOUR POSITION to step up and do something unselfish for a change. These peaceful, majestic, and innocent animals need YOUR HELP. PLEASE? DO THE RIGHT THING!!!!!!!!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P335	I believe aquatic wildlife should be protected however support national security that active SONAR provides. The SONAR VLF range (sub-grouped very low, mid,high and very high)should be further studied to understand impact to various marine species and use the subsequent frequencies that mitigate marine wildlife damage. This effort should mitigate damage to marine life while providing for our national security.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P336	*Duplicate comment to P335*	*See response to comment to P335*
P337	This should not be done. DO NOT DO THIS. The welfare of the animals is far more important than any test. STOP!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P338	All animals deserve to live on this planet and be safe from destruction of another species. Please do the right thing and make the necessary changes to protect whales and other sea animals. Thank you,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P339	Comments/Questions/ for Navy Atlantic Fleet Training and Testing EIS/OEIS July 9, 2012 RE: Aerosol sized chaff from 30,000 canisters Aluminium is oxidized by water to produce hydrogen and heat: 2 Al + 3 $H_2O \rightarrow Al_2O_3 + 3 H_2$ This conversion is of interest for the production of hydrogen. Challenges include circumventing the formed oxide layer which inhibits the reaction and the expenses associated with the storage	Discussion and analysis of chaff can be found in Sections 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions), 3.1.3.4.3 (Chaff), 3.1.3.4.6.2 (Chaff), and 3.2.1.3 (Approach to Analysis). The Navy has consulted with NMFS and U.S. Fish and Wildlife Service on federally protected species within the Study Area.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	of energy by regeneration of the Al metal. Question: What will be the impact to the atmospheric environment in the vicinity of all the aerosol sized Aluminum chaff to be dispensed from the 30,000 cannisters? Question: What will be the impact on human biological systems in the vicinity of all the aerosol sized Aluminum chaff to be dispensed from the 30,000 cannisters? The presence of aluminum oxide - a material not occurring in nature in humans and mammals in Monroe County, Fla. has been established - and a baseline has been established. Question: What agency of the Federal government or company who makes the material will be held accountable in the event of increased contamination? Non-naturally occurring Aluminum has been establish as the causative agent in a number of diseases. The aluminum aerosols dispersion program (chaff) may cause further widespread disease in the Florida Keys and downwind in Collier county. Question: Who will pay the long term health costs for any human exposures to the aluminum toxins? I am requesting you get a US Fish and Wildlife Service (1849 C Street, NW Washington, DC 20240) consultation re: unpermitted "take" of all the federally endangered and threatened species in Monroe County, Fla – including but not limited to the manatee, American crocodile, Florida panther, all of the listed birds and plants – from aerial dispersion of a known toxin, the direct, indirect and cumulative impacts of which have not been determined for any of those species. Respectfully LT. Ron Cole USNR	
P340	Please -- It is clear from your draft statement that you have not thought this matter through, and that you still have a great deal of research and planning to do before you are ready to RESPONSIBLY conduct these tests. You want to simply forge ahead, [EXPLETIVE DELETED] consequences! I used to be proud of the Navy. What [EXPLETIVE DELETED] has happened to it?	Thank you for participating in the NEPA process.
P341	May 25, 2012 TO: The Honorable Secretary of the U.S. Navy, Ray Mabus RE: Formal Request & Action by the U.S. Navy in the Final AFTT EIS document. Dear Secretary Mabus: I am formally requesting a hard copy and CD of the subsequent AFTT Final Environmental Impact Statement of the Atlantic Fleet Training & Testing Range Complex once prepared from your current draft AFTT EIS-OEIS document. I would also like notification of the dates when the final AFTT EIS/OEIS public comments are noticed in the U.S. Federal Register so that comments may be made in a timely manner. The following information was release by U.S. Senator McCain and U.S. Senator	Thank you for participating in the NEPA process. However this comment is outside the scope of this EIS/OEIS. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project. The commenter was provided a copy of the Final EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	Levin: http://startingpoint.blogs.cnn.com/2012/05/22/sen-carl-levin-counterfeit-military-parts-pose-significant-safety-risk/ CNN News & Video – May 22, 2012 Sen. Carl Levin: Counterfeit military parts pose 'significant safety risk' "…Because of a recent surge of counterfeit military parts– such as pieces of equipment used in aircrafts– the Senate Armed Services Committee has adopted new legislation to change the procedural laws for buying new or refurbished parts. Senator Carl Levin joins Starting Point this morning to explain the details of the new law, which he has been working on alongside Sen. John McCain. Levin explains that the news laws say that parts can only be bought from contracted, authorized distributors or certified suppliers and dictates that suppliers will be responsible for their own repairs. Regarding the threat posed by the counterfeit parts, Levin explains that the problem occurs almost exclusively with equipment produced in China, and poses a "significant" safety threat to the nation…" End The U.S. Navy is now conducting warfare testing in the Pacific, Atlantic, and the Gulf of Mexico. Nuclear submarines, aircraft, ships, missiles, drones, and a whole host of other warfare weapons are now being tested over land and ocean areas. What actions are you taking to address the issue of counterfeit and questionable refurbished parts being purchased by the U.S. Navy? These counterfeit and faulty parts not only cost the U.S. Navy money but they have the potential to cause injuries to our Naval personnel, civilians, and others when they subsequently fail. Secretary Mabus, I have seen you recently on television and on interview shows, speaking about the U.S. Navy, but never once demanding that action be taken to address the issue of counterfeit parts, especially from China. In addition, I didn't hear you state, for the record, that the Navy will refuse to use said parts, especially from China, in order to protect the sailors under your watch and the civilians that may be killed or injured when these counterfeit parts malfunction. It is time that military parts, software, and hardware be made in the United States where quality controls are in place. I expect that you will at the forefront in stopping the use of counterfeit parts from China and other foreign countries. I am looking forward to hearing from you in writing within the next few days on this critical issue and that you will require that those who prepare your final AFTT EIS/OEIS to address this critical issue in order to protect our troops and the U.S. civilian population. Sincerely, Rosalind Peterson [ADDRESS REMOVED] CC: U.S. Senator Barbara Boxer U.S. Senator Dianne Feinstein U.S. Congressman Mike Thompson (California)	

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P342	Please protect our marine mammals	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P343	Please stop testing in the ocean where ocean life is.	The alternatives carried forward meet the Navy's purpose and need to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P344	to whom is going to read this, I do NOT see the true reason to do these excersises. To thoughtlessly KILL and Injure ALL those animals for practice... REALLY? i would one day like to have my daughter and her kids know what marine life is... doing such training excersises that will hurt and kill animals on the endanger spieces list will further hinder our oceans and our future generations from enjoying the rich life they support. the whalers around the world atleast kill to eat the poor animals... not just for the heck of it... i understand the Navy HAS TO do somethings but the wildlife in the oceans around the US are still trying to come back from the BP oil spill that was now 2 yrs ago. i doubt we need dead animals washing up on our shores AGAIN! This is NOT ok and i dont support these actions the US millitary are willing to take in order to just have drills... there are so many species in the ocean and if we as	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	people are wreckless we will never even get to see and explore them. we only know 2% of what there is to know about our oceans. this is just wrong and as a millitary i will always support our troops BUT I DONT HAVE TO SUPPORT THE ACTIONS THE US GOVERNMENT MAKES THE TROOPS DO! I hope this reaches someone who can help stop this from happening. my daughter is 4. she started to cry as i read to her what the US NAVY wants to do. EVEN A 4 YR OLD KNOWS ITS WRONG! i am writting this as a plea from my heart and the heart of my daughter, PLEASE DONT DO IT! PLEASE HELP TO PROTECT THESE ANIMALS AND NOT DO THINGS SUCH AS TRAINING EXCERSISES THAT WILL ONLY FURTHER HURT THEM. Thank you.	
P345	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, ...	Thank you for your comment.
P346	Please stop any actions that torture and kill cetaceans now!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P347	There is no excuse for this genocide. Please look inside yourself and realize that this slaughter of cetacean life which could very well lead to the extinction of multiple species is cannot be justified by your project deliverables no matter the results.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P348	Hello There, Thank you for all that you do. PLEASE protect marine mammals from explosives and sonar along the East Coast as well as California and Hawaii. Thank you so much :)	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P349	To whom it may concern, Please protect marine mammals from explosives and sonar along the East Coast. I urge you to re-think the proposed plans for the use of sonar and explosives, and to incorporate additional protective measures. Thank you for your consideration, Samantha Novak	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P350	I am appalled that after your acknowledgement of the immeasureable injury and lethal impacts to marine life, that you would consider moving forward with your current oceanic testing programs, national security or not. If we survive at the cost of loosing site of the value of other forms of life besides human, then when we begin to feel the results of the loss of our delicate environmental balance - we will deserve every single misery it creates. Our natural earth balance is being threatened on all fronts. This is another very sad form of it and your children and children's children will suffer because of it. PLEASE REVISE YOUR PLANS TO OPTIMIZE CARE AND RESPECT OF OTHER LIVING AND LIKELY MORE INTELLIGENT THAN US.....BEINGS. PLEASE!!!!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P351	You are NOT really going to conduct your sonar exercises in the oceans, ARE YOU?! That is SO wrong - I advocated against it a decade ago, and I know it was proven that it's much too detrimental to whales and dolphins. If you do this, you have no heart, no soul. I don't care what your reasoning is, war on terror BS or whatever. God is watching you.	Thank you for participating in the NEPA process
P352	While I believe that we need a strong Navy for protect national security reasons, I also strongly believe that we need to be respectful and protect marine mammals and the oceans. I do not think we have to choose between these two options; we can have both. Because we can have both, I am writing today to ask the Navy to use training methods that do not kill or damage marine mammals such as whales, dolphins and other marine creatures. I understand that from your own Environmental Impact statements you estimate the current planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Damaging or killing these creatures is unacceptable and beneath us as a great country. A great country does not squander life of any kind when there are other ways to achieve what we need. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. I urge the Navy to protect marine mammals from explosives and sonar along	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	the East Coast and California and Hawaii. I urge the Navy to take steps to reduce the harmful impacts to marine mammals. Such steps to protect these magnificent creatures include: a) avoiding the most harmful activities in areas used as calving grounds or migratory corridors; b) avoiding seasonal high-use feeding areas; c) creating a larger "safety zone" around the exercises; and d) use aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Implementing these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Please do not go forward with activities that will maim or kill marine creatures without these mitigating steps to protect them. Thank you, Sandra Moreland	Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P353	NO to this destructive use of underwater sound system for military training...that then deafens huge numbers of whales & dolphins and kills 1,800+. These species are already hanging on by a thread. I am good friends with a Navy guy, Oscar, who served in WW II. He feels such PRIDE as a Navy guy. What does it say about the character and lack of compassion of the naval officers involved, the whole chain of command...to be SO DESTRUCTIVE in the name of training?? This must be creating morale issues up and down the chain of command...as it should. It is wrong to do this...and changing your decisions to stopping this will be reason for PRIDE. I saw a quote recently about ERASERS: an old man said, "Erasers are made for those who make mistakes." A youth replaced, "Erasers are made for those who are willing to correct their mistakes!" Please be wise and correct the mistake of even considering this destruction. Don't do it. Thank-you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P354	I am opposed to the proposed training exercises all along the U.S. East Coast. I understand that these exercises would involve the use of live explosives and high-intensity sonar. According to your estimates, the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Thank you for your time and consideration of this important matter.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P355	I believe the US Navy need not further endanger cetaceans in order to improve its prowess. The danger to sea creatures such as whales and dolphins has been scientifically documented repeatedly. The cost to the Navy of these installations and operations is also documented. That money could go to other uses and do more good for the US Navy, its personnel and its equipment. I am a US Air Force veteran. I believe the communications and tracking capabilities these systems promise can be had via other means at lower cost without endangering whales, dolphins, rays, manatees, other sealife, and non-Navy divers and boaters and fishers. Please discontinue these expensive and destructive programs before more harm is done. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P356	You have done to much destruction to our earth as it is,don't you have enough training facilities to train your killing mindless [EXPLETIVE DELETED] ? My country makes me sick !!!!	Thank you for participating in the NEPA process.
P357	You are ruining the planet. Explosives and testing is no where near as important as preserving the fragile ecosystems of such places as the ocean. The animal life found therein is necessary for the world to function as it has. We are all intertwined. We are supposed to be striving toward peaceful coexistence... not the petty wants of humans to outweigh the greater desire of animals to continue living. Are we so bent on removing the great creatures of our past and present that we place weapons testing above the value of lfe?	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P358	As humanity searches for the answer to the question of whether we are the only sentient species in the universe, those who crane their necks skyward too often skip making sure there aren't other sentient species on Earth first. In light of mounting evidence, we at least must consider the possibility that cetaceans (dolphins, whales, porpoises) satisfy the criteria. If there is even a chance this is the case, as virtually all evidence suggests, immediate steps should be taken to protect these intelligent,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	self-aware creatures, who aren't really mere "creatures" at all but instead the very answer to our search for non-human intelligence in the universe, and not just in the universe somewhere unknown or unreachable, but literally sharing with us a home we call Earth. The Navy's plans to test high frequency (et al.) sound equipment underwater will kill an estimated 1,800 cetaceans and deafen another 15,900 (a probable death sentence for beings which rely so heavily on echolocation) over the next five years alone. It is irresponsible and immoral of us to so casually discard the lives of so many intelligent beings, so close to extinction as it is (and that almost entirely our own doing as well), and especially so when the benefit to us is uncertain and of questionable importance to the security of our nation. If, as the evidence suggests, even one of these species affected is worthy of the "non-human person" descriptor, it would be unconscionable to knowingly take steps which kill and maim these unique beings. Orson Scott Card wrote of "genocide," the wiping out of an entire intelligent alien species, but in his work, the person who ultimately brought about this purposeful extinction was unaware of the affects of his actions and had been hoodwinked into doing this without his knowledge or consent. If the Navy proceeds with its plans, it will be fully culpable for the blood on its hands, facilitating the extinction of several species who we know are self-aware, with complex social structures and sophisticated minds. It is time humanity's shortsightedness is brought to an end. Although we face many challenges and have wrought much destruction on the natural world, the purposeful elimination of an entire intelligent Earth-born species would be among the most inhumane acts our species can commit, a blight on human history surpassed by no other. If we are as intelligent a species as we claim to be, it is imperative every action be taken to ensure the survival of other intelligent, sentient beings at our mercy. That means stopping this project now, and working henceforth to right our past wrongs by rehabilitating and protecting these under-appreciated and misunderstood beings.	using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P359	We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	very significant degree. The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We are calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures. This is not a dress rehearsal, ladies and gentlemen. We only have one chance to get this right so let's do so. Let's do the right thing and think of all the beautiful and wonderful creatures and do no harm, especially in the name of humanity.	potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P360	The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. PLEASE DO NOT ALLOW THIS TO HAPPEN! We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. This would be a travesty!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and

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Comment Identifier	Comment	Navy Response
		Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P361	The incredible disregard for life continuously displayed by those supposedly in the business of protecting life is breathtaking. May you get your ultimate wish, and find that there is no one left to play with except the Kochs and Waltons. I don't think there is enough alcohol on this planet to make that a fun day.	Thank you for participating in the NEPA process.
P362	I understand the necessity for testing new equipment. My son-in-law is in the Navy deployed on an aircraft carrier four times in four years. America's readiness for combat is vital to our survival. But at what price? War and actual combat is bad enough. Is there not some way to do this testing farther from shores? In space? In a testing vacuum? In seas less populated by people and defenseless animals who do no harm to us? They are God's gifts to us. They are an essential part of the ecosystem which gives us life on Earth. We must respect and protect them more than our need to kill our enemies. They are not our enemies. We will be judged by how we treat others. Harming these majestic beings will bring more harm to us no matter how much we test. Not all answers lie in statistics and tests and data when precious life is threatened. It's heart, soul and conscience that matters most.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P363	Dear People, I am writing as a concerned citizen and a taxpayer about the testing of sonar in areas where it would harm whales and dolphins - or anywhere at all, if dead or injured cetaceans is the result. We are stewards of the seas and you should be protecting the oceans and the wildlife there. I strongly object to these cruel and foolish practices. Please reconsider.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P364	I agree that we need a robust and strong Navy to protect national security. I also agree that whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. According to its own Environmental Impact Statements, the Navy estimates that the training exercises planned along the East Coast and in the rich marine	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard

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Comment Identifier	Comment	Navy Response
	environment off the coast of California and Hawaii involving live explosives and high-intensity sonar would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. In the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. I urge the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P365	Hello, I am commenting about upcoming training exercises that will affect marine life. I understand the need for protecting our country, but please find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Please consider steps to reduce the harmful impacts to marine mammals. These steps could include avoiding the most harmful activities in areas used as calving grounds or migratory corridors;	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area

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	avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you for your consideration.	with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P366	I am writing to you today to request that you make it a priority to protect marine mammals from tragedies which can be avoided in planned upcoming training exercises. The planned explosives and sonar along the East Coast and California/Hawaii may be horribly cruel to marine mammals. There are important steps that can be implemented to prevent inhumane conditions include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I urge the U.S. Navy to re-think its plans and to incorporate additional protective measures. Thank you for your attention to this important matter.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P367	Please find another way to conduct these tests, we don't need to kill innocents to protect innocents	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P368	To whom it may concern, Sometimes as an individual one feels very impotent to stop an exercise of this magnitude. All I want to remind the people behind this is that we are NOT alone on Earth. The continuance of life on Earth requires balance and respect to all those we share this planet with. In the name of progress we ignore the collateral damage we cause but we don't realize that the Earth has a pulse too and it has	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the

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Comment Identifier	Comment	Navy Response
	reminded us, through Tsunamis and Earthquakes and disasters of horrible magnitudes, that payback is tough. So lets respect non-humans on Earth and not inflict such damage on them. Best, Simran	EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P369	I am a live-aboard, world cruiser. I understand the need for protecting our country, but I strongly oppose destroying our marine environment to do it. We must find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures as would occur under the Navy's training exercises planned off the entire eastern US coast. Consider steps to reduce the harmful impacts to marine mammals: including avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. It just takes some thought and time. It doesn't have to increase costs. These marine animals are already struggling for their existence. Don't add this assault to their plight.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P370	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will	Thank you for your comment.

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Comment Identifier	Comment	Navy Response
	affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, sophie ebert	
P371	*Duplicate comment to P370*	*See response to comment to P370*
P372	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

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	be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us. Yours, Stacy Wagner & helpless animals of the ocean	
P373	In a time of mass extinction due to the greed and resource exploitation of humans, we need to do all that we can to bring balance back to our planet. My seven year old saw his first orca last week, and the joy he felt cannot be described. I want to believe that humans will do the right thing and protect the limited wildness that remains on land and in our oceans. I want to believe that my grandchildren will be able to experience what my son did and I did before him.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P374	Please consider the following steps to reduce the harmful impacts to marine mammals: avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P375	By the act of destructive sonar used, you are killing hundreds if not thousands of cetaceans among numerous other sea life. You cannot get these back, once they are gone, there is no more. The eco-system of the ocean is vital to the survival of MANY things, including humans. We cannot afford to have it disappear just b/c the military, etc. want to be irresponsible. What happened to saving the earth, and protecting what's in it? Because, the military definitely isn't doing that. It's sad to think, that killing animals and mammals important to the natural eco-system is	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

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	more important than protecting them. And to that I say, Shame on you government. Shame on you. I hope for the sake of the world, and the children in it, you change your minds, and begin to find a more safe way of using your sonar. Our children don't need to see dolphins, whales, etc. etc. etc. in books because they're extinct at the hands of the government! It's a sad sad day, to know that our government preaches earth day, and cleaning up the oceans, but the military (government ran) can kill thousands of mammals and animals. Shameful, and disgraceful.	mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P376	As a citizen of the United States I strongly, strongly object to the Navy's plan to conduct high-intensity sonar testing anywhere near marine mammals. I do not want you to protect me at the expense of killing wildlife that we are all responsible for and which I cherish. Such testing has been documented in the past to cause significant loss of marine life and cause thousands others to become deaf. The environmental impacts of your actions are simply too great. Please stop and desist.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P377	Please stop this senseless killing and deafening of these incredible creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P378	Please refrain from the planned bombing and explosive detonation in the ocean. This will cause irreparable harm to marine species. It is cruel and completely unnecessary. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P379	An estimated 1800 whales dying and another 16,000 deafened (a likely death sentence due to whales being dependent upon echolocation and vocalizations for food and socialization) by the US Navy deploying very high power high & low frequency sound generation technology, with dubious return on investment, is unacceptable, especially in an era of vanishing species, over-fishing, man-made pollution and climate change. The destruction of so many whales is not a legacy worthy of the US to leave in the wake of our civilization. Improve passive sonar and other technologies, without destroying the largest mammals sharing this earth with us.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P380	Once again the Navy plans to deploy sonar testing near whales and dolphins despite their own findings purporting that said cetaceans would suffer enormously in the process. This experimentation has already resulted in the beaching and deaths of numerous marine mammals. When do you plan to end these abominable practices? Perhaps when no marine mammals are left to torture? Several environmental groups have appealed to you and the Department of Fisheries, to take additional time to study the patterns of whales and dolphins to determine a safe time in which to employ the sonar. Apparently, common sense eludes you. "Animals with air filled lungs and swim bladders are especially vulnerable because of the large difference in impedance between air in the lungs or swim bladders and their body tissues or seawater. Submerged animals exposed to explosions at short range showed hemorrhage in the lungs and ulceration of the gastro-intestinal tract. The killing is largely due to resonance phenomena in the whales' cranial airspaces that are tearing apart delicate tissues around the brains and ears." The confusion and disorientation imposed upon these animals is despicable in itself; the fact that you would knowingly with	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	intent and malice, cause immense pain and suffering, frequently followed by death is atrocious and morally reprehensible. These animals are as intelligent as a four to five year old child, and infinitely more mentally acute than many who are mentally challenged. Would it then stand to reason that the navy would be willing to repeatedly puncture the eardrums of children and those who are mentally challenged? In what crazy world do you consider it acceptable to inflict such horrific pain on sentient beings? Are their lives of no value because they live in the water and are unable to convey the pain that they feel? You have the data and literature to make reasoned, sane, compassionate, and ethical choices. The Navy, as well as other branches of the U.S. military, has an abysmal record regarding their treatment of animals. The goats on San Clemente Island were destroying flora and fauna? Don't try to relocate them – instead the Navy brought in sharpshooters to kill without remorse. Is it possible to conduct trauma training without the use and grievous abuse of live animals – as many European countries already do? Not for the United States. The Navy has used dolphins for better than forty years for mine detection. No worries about loss of life. I resent my taxpayer dollars being utilized for the sanctioned killings of wildlife – on land and in the water, and any animals, for that matter. My taxes pay your salaries, your health insurance, your pensions, in fact, for your entire livelihood. The means by which you conduct business are truly a stain upon this country.	
P381	Please stop using explosives and sonar that kill dolphins and whales. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P382	Hello. I strongly object to the use of high frequency underwater sound testing in the waters off Hawaii, California, and the Atlantic Coasts. This testing will interfere, damage or kill marine animals that use sound to communicate. Please do not use my tax dollars for this destructive	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	purpose. Find another way to protect us without harming them and us. We do not know what the long term effects on ocean health will be and we are obligated to consider what future generations will be left with if we pursue this policy.	Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P383	I am urging you to consider alternative means to Naval training off of the East Coast, California, and Hawaii. The cost to marine life promises to be too great under current plans. At a time when the environment and our wildlife are facing so many challenges due to natural disasters and the by-products of our quality of life, we have to take any opportunities we can to minimize harm. I appreciate that National security is a priority. We are such an inventive and scientifically-advanced nation. It's time we make the choices within our power to protect the earth's resources before it's too late. Our oceans and the marine life within them hold scientific treasures and opportunity for medical and energy source breakthroughs. Please let's find another way to protect all that is precious for today and for generations to come. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P384	I'm a General Manager of a Holiday Inn Ft. Lauderdale Airport property. I read that you do testing off the coast of Ft. Lauderdale and was wondering if need a place to stay with the personel dealing with the operations. Please call or email a response. Thanks!	Thank you for your comment.
P385	Please re-think its plans and to incorporate additional protective measures. Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. I believe it is also your job to not only protect people but all living creatures. Thank you, Susan Snowball	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P386	The planned training exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please do not harm our marine populations.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P387	Stop. Stop stop stop. THINK. Explosives and sonar testing? Really? COME ON. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. Susan Woodward	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P388	We're Americans, we're supposed to be able to do what we have to with competence, with honesty, with integrity, with grit, and without screwing up everything around us. Whales and dolphins as collateral damage? To a US Navy undertaking? that's not competence. Your integrity demands that you go back and figure out how to do what you have to, with competence. Cheers.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P389	Please re-think your plans in order to protect the marine life from explosives and sonar.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P390	"We know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. The HSUS is joining other environmental and animal welfare groups to ask the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	dolphins, and porpoises might be harmed or killed." I am calling on the U.S. Navy to re-think its plans and to incorporate additional protective measures. Please don't go through with this plan. Sincerely, Sylvia Hlynsdottir	supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P391	I urge you to reconsider your training exercises which would use explosives and high intensity sonar, which, by the Navy's own estimates, will result in the death of 2,000 marine mammals -- and the injury of thousands more. Surely there is an alternative method that would prove as effective without causing this much damage. If you will not cancel these training exercises all together, please consider taking steps to reduce the impacts -- such as avoiding the most harmful activities in areas used as calving grounds or migratory corridors, avoiding seasonal high-use feeding areas, creating a larger "safety zone" around the exercises, and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Thank you for your consideration.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P392	Please protect the whales!	Thank you for participating in the NEPA process.
P393	How can you act like it's no big deal to knowingly slaughter thousands of animals for testing purposes? Shame on you, shame on the American Government for allowing you to conduct these bombing tests	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities.
P394	Please stop this unnecessary destruction. It is inhumane and revolting. What if anything are you leaving behind for your children?	Thank you for participating in the NEPA process.
P395	Please do not complete sonar training exercises -- especially the ones currently proposed along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. Almost everybody agrees that we need a robust and strong Navy to protect national security. And almost all of us agree that whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. But a recent proposal from the federal government tries to make Americans pick between these options, and it's a false choice. We understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Thank you for your time and attention.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P396	Greetings and with all due respect, Sir; My concern about your needed operations which I see personally as a precaution to any attacks against our great nation, is has there been any consideration for artifacts at sea, and known historical ship wrecks being covered up or even more destroyed by explosions at sea. R/S Ted Lewis USMC vet 1966-1969	All potential effects from Navy training and testing activities on cultural resources were analyzed in Section 3.10 (Cultural Resources) of the EIS/OEIS. This analysis includes information on artifacts and shipwrecks. Refer to Section 5.3.3.2.1.1 (Shallow Coral Reefs, Hard Bottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts to shipwrecks.
P397	This isn't right. There has to be another way to do what needs to be done and save the marine life. I do not condone this. Hurting our marine life is not the answer.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		(Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P398	what is going on with this country? must we kill every living creature? stop the nonsense. .enough already I am sick and tired of hearing how the government wants to injure and kill innocent wildlife. find something else to experiment on. my tax dollars at work? yeah right.	Thank you for participating in the NEPA process.
P399	Thank you for making the report and findings public via this website. It will be most instructive to summarize the findings and make those available as well as providing an impact statement to our local, state and federally elected officials. I will continue working to enhance the MMPA regulations, restrictions and guidelines to better manage testing and functioning of our equipment necessary for national and strategic security; while providing a humane level of protection to the world's wildlife. one question? What does the EIS/OEIS consider acceptable loss? What alternatives are under consideration to minimize or eliminate those risks? Sincerely, Terry Baresh, [ADDRESS REMOVED]	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P400-01	Per your paper: "Any mortality or serious injury for this stock should be considered significant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds potential biological removal and because the North Atlantic right whale is an endangered species." Yet these plans persist.	The Endangered Species Act conclusions in the Final EIS/OEIS state sonar and other active acoustic sources and explosives may affect and are likely to adversely affect the North Atlantic right whale. However, the analysis shows that no mortality or injury to North Atlantic right whales was predicted nor is it expected from any activity. All other stressors analyzed determined either no effect or may affect, not likely to adversely affect the North Atlantic right whale. In addition, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures to further reduce any potential impacts. Through consultation and permitting with NMFS, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P400-02	I also couldn't help but notice the statements that estimates of whales' hearing capacities and sensitivities are, in actuality, based on an extremely small and captive, i.e., non-wild and therefore non-representative, sample. Yet these plans persist.	The Navy shares your concern for marine life. The Navy has used the best available science in the development of this EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P400-03	Another thing I couldn't help but notice was the bizarre verbiage of "no *expected* impacts. Gentlemen, I'm sure you are amply familiar with the "best intentions" adage. When one reads your draft report, it quickly becomes clear it is based on assumptions, the lowest of lowball estimates, and hoping for the best.	The Navy shares your concern for marine life. The Navy has used the best available science in the development of this EIS/OEIS.
P400-04	"There are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures." Your paper goes on to acknowledge that "many other factors besides just the received level of sound may affect an animal's reaction such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound." We all know you cannot control such things. The draft paper cites the case where a pod of dolphins happened upon an explosion test site at precisely the wrong moment. You can't prevent that from happening. You don't really know, at any point in time, what animals are directly in the vicinity of your experimental blasts and noises. Face it, gentlemen: YOU JUST DON'T KNOW AND YOU CANNOT CONTROL ALL THE VARIABLES. Please get right with that understanding and set about the one thing you can control: abandoning plans that you yourself acknowledge pose a threat to "strategic" whale populations.	The Navy, in conjunction with NMFS, has determined what mitigation it can effectively use during its training and testing activities. Through careful exploration of all mitigation measures to determine which were the most effective (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), the Navy has chosen the existing measures to mitigate harm to marine mammals while still being able to meet its operational needs to train for real-world conditions.
P400-05	Another noticeable characteristic of your draft statement is that it does not seem very forward-thinking or holistic in its assessments of potential damage. By that I mean we are living in one of the most extreme weather cycles in human history. The Navy must be more familiar than most with the changes to ocean currents wrought by glacial melt. The sea levels are rising. The increased temperatures are thought to be pulling food sources and the whales who feed on them closer to shore. It is also suspected that plankton blooms are coming unseasonably early and that whale populations might miss the feeding if their migrations have not been adjusted apace. We are in wholly uncharted territory here. One thing that is abundantly clear is that there are currently, as I type, several risks posed to the world's whale populations right now. They might be able to weather one, maybe even two in succession. But it seems equally clear that they would not likely survive two challenges at once, and that, gentlemen, is a test we simply cannot afford to conduct.	The approach to analysis in the EIS/OEIS is described in Section 3.0.5 (Overall Approach to Analysis). Cumulative impacts have been considered in the EIS/OEIS (Chapter 4, Cumulative Impacts) where the Proposed Action is considered in the context of other activities in the region. As required under NEPA, the level and scope of the cumulative analysis is commensurate with the potential impacts of the Proposed Action as reflected in the resource-specific discussions in Chapter 3 (Affected Environment and Environmental Consequences). Chapter 3 provides the past and present impacts and environmental conditions that represent the baseline and the potential impacts from Navy activities; Chapter 4 (Cumulative Impacts) discusses the current impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P401	*Duplicate comment to P400*	*See response to comment to P400*
P402	*Duplicate comment to P400*	*See response to comment to P400*
P403	PLEASE protect our marine life. Do not allow the senseless injury to these gentle creatures that live in the sea!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P404	The US Navy has done an outstanding job in addressing and protecting the wide variety of environmental issues on our Atlantic Coast. Protecting our country comes first and testing and training to protect our country will not have a significant impact on our environment. I recommend no changes or additions to the EIS and approval of alternative 2, the best approach for our country.	Thank you for your comment.
P405	US Navy is properly balancing national defense requirements against environmental stewardship. Military actions and reactions are now measured in seconds and hours, not in days, months or years of preparedness. Deplyed fleet units must be ready within these time limits to respond to presidential calls for military responses. Readiness, which is the term for the naval ability to act or react, requires training and, in turn, training requires places at sea to train. Because of the uniqueness of War at Sea, training ashore in simulators leave a significant gap in readiness that only at-sea training can fill. The Navy has taken significant strides in lessening its environmental impacts. For decades it has made significant investments along these lines starting in the 1970's and 1980's with major investments in sanitiation and waste water treatment systems on ships. It invested in the 1990's in trash compacting, especially plastics and onboard incinerators. It pays close attention to whale migrations and avoids training when enviromental models, which they paid for in the early 2000's, indicate the potential for physically harming them or harrashing them exists, particularly during mating seasons. They have deployed software systems to provide naval	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	plannings staffs and commanding officers with environmental awareness information ranging from live corral formations to the legal boundaries of protected maritime wildlife sanctuaries. These training areas are vital for the readiness of the fleet to keep open the maritime sea lanes of commerce, which because of the inter-connection of world commerce, are vital to all nations. One bad acting nation can place not only the US economy but the world economy at risk. Many of these areas are in 'shallow' water, with submarine threats. The US coastline, while extensive, has only a few areas that can provide reasonably real-world training conditions where the US Navy will most likely fight its next battles at sea. The establishment and administraation of the areas presented in the documents posted are more than adequate to meet all reasonable expectations, concerns and requirements. Both as a 27 year Navy veteran with 17 years of those at sea and now a US citizen with strong environmental concerns, I am satisifed that this reasonable balance has been reached. If the nation and concerned environmental groups wish to make significant strides in both protecting the maritime eco-systems and allowing reasonable management of the oceans capability and capacity to feed a growning world population without a repeat of the Grand Banks tragedy, then they would do well to support the Navy's training and testing proposal in order to ask other government agencies to invest and emulate the plan in their areas of responsibilities.	
P406	THIS MUST STOP! NO MORE SONAR TESTS. NO MORE DEAD WHALES AND DOLPHINS!!!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P407	To whom it may concern, I am writing to voice my opposition to continued testing of underwater sound generating equipment. The damage to marine mammals and other ocean life is immeasurable. Future generations will look back and judge us for our disregard for our envirnoment and the creatures that share it with us. Please consider your own place in history. In addition, this technology, while interesting, is of dubious practical use. The threat of underwater attack upon the US is a cold-war-era issue. Today's threats are very unlikely to be discovered by this kind of technology. Our nation's time, energy and money would be better spent elsewhere. Thank you for your attention.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P408	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P409	PLEASE consider steps to reduce the terrible impacts your sonar exercises have to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow your important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. PLEASE, all life should be considered!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P410	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Tommy	Thank you for your comment.
P411	Please take these steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. sincerely, traci Hunt	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P412	as much sea life that we are killing by either hunting, or destroying their habitat, and so on. i find it hard to believe that among all the very smart, educated people that make decisions, that harming and potentially killing them is even an option. please do you small part to help in stop ruining their natural environment.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P413	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours,	
P414	According to your own estimates it will deafen more than 15,900 whales and dolphins and kill 1,800 more over the next 5 years. Whales and dolphins depend on sound to navigate and live. I refuse to live in a world where we have killed off every other living being just because we have no use for them.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P415	Please consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	harmed or killed.	NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P416	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Trina Lopatka	Thank you for your comment.
P417	Please do not conduct Navy exercises that harm marine animals. It is cruel and unnecessary to endanger the lives of these animals. Please do not do this.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P418	Respect our surroundings and those who inherited it. Respect Nature. Preserve what we can. Spend less on war and more on making friendships, it's possible.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P419	Alternatives must be found rather than inflicting this horrific misery to our precious & magnificent ocean animals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P420	Please find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please protect marine mammals from explosives and sonar along the East Coast and California/Hawaii. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P421	Please add additional protective measures for marine mammals before testing explosives and sonar!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P422	please do not test underwater equipment that harms marine creatures off the East Coast or the Hawaiian islands. This sounds like it just for your convience and if these tests are so terribly necessary you should be able to find a safer place to do them even if it takes a little more work on the part of the navy.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P423	It's been proven that whales have stranded and died in the wake of major military sonar exercises. Visible traumas have been documented such as bleeding from the ears and other tissue damage attributed to sonar, not to mention incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. Please help to protect these innocent lives, not to compromise them. Thank you	The Navy shares your desire to preserve marine life. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. In addition, the Navy implements protective measures during its training and testing events as developed with NMFS as a cooperating agency. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P424	The US Navy testing will be extremely harmful for the marine wildlife! I urge you not to conduct such training, which will have a tremendous negative impact on whales and dolphins!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P425	please don't allow this to happen!	Thank you for participating in the NEPA process.
P426	Please consider the marine mammals that will be in danger during your tests. consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P427	Whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. The U.S. Navy is proposing to conduct training exercises all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	I understand the need for protecting our country, but we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. In the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. Consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Re-think plans and incorporate additional protective measures.	years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P428	Please do not proceed with sonar testing that will impact cetaceans. Thank you, B. Duncan Hyde Park, VT	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P429	High frequency underwater testing will kill and deafen thousands of cetaceans, which depend on echolocation for their survival. It is unconscionable that these creatures should be destroyed by experiments with sound equipment — experiments of questionable value but unquestionable negative impact upon species which are already endangered. These experiments are appalling violations of core moral principles and should not be carried out.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P430	Don't screw up the marine mammals any further than everything else man is doing to the oceans already are. Please reconsider the explosives and sonar exercises that are being planned for military purposes--there's got to be a way you can conduct some of these exercises that doesn't impact wildlife to the extent that the current way does. I'm sure you're looking at this and other letters expressing similar concerns as a joke, but try not to laugh and actually consider what you're doing to the environment. I realize that you don't give much of a thought to the environment and view all conservationists & environmentalists as crack heads that you can sit back and laugh at, but please try to take this seriously. The animals are important too---it's not just humans who live on this planet, and some of the species that will be affected are endangered.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P431	It seems that humans have lost sight of what is important. I can't even imagine how horrific it must be for one of the sea mammals to die in this manner (under the high frequency sounds of sonar and loud explosions). Please, please, please, consider this before performing tests in this manner. We have to protect our oceans and all of the vulnerable creatures that live there. I am saddened beyond belief to think how careless we are in these matters.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P432	Please consider proposals from Humane Society of the United States and other organisations to take precautions to minimise the impact of these exercises on marine mammals and other sea life.	Thank you for participating in the NEPA process.
P433	I live on Bay Point Key(saddlebunch Key) and have asked the NAS to not have the F18s fly directly over our homes since we are 7-8 miles from the NAS. A quick look at a map will indicate the Atlantic and Gulf on both sides of our very small key. The noise when they are directly overhead prevent normal conversation--INSIDE our homes. We have written letters and personally spoken with the base commanders and chief of flight operation about having the F18s turn slightly on rotation so	Thank you for participating in the NEPA process. However this comment is outside the scope of this EIS/OEIS. Please see Chapters 1 (Purpose and Need) and 2 (Description of Proposed Action and Alternatives) of the Final EIS/OEIS for a clear definition of the scope of this project.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	the do not pass directly overhead. We have never been given a reason why they must go absolutely straight and our request are basically ignored. We have older sick folks here, people who work nights, children and so on. We accept jet noise as a part of pilot training, but cannot understand how inconsiderate and rude the Navy has been. The local attitude is they "just don't give a damn"! Why given such a huge expanse of ocean on both sides do they make our lives difficult? It almost seem like they enjoy what they do and do it on purpose. Needless to say, local opinion about the NAS is not good. As you must know when F18s take off "hot" they generate an amazing amount of noise. All we have ever asked for is a little courtesy. So far they have ignored us and not even responded the our letters. I hope the rest of our navy is more professional.	
P434	We urge the Navy to come up with alternative means in the upcoming tests on the east coast which will not result in the needless deaths of thousands of marine mammals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stock. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P435	We are capable of defending ourselves without resorting to the kind of violence that injures our sealife. Surely the Navy can develop better technologies that will not result in such slaughter. You listed the North Atlantic Right Whale as an endangered species under extreme threat. Per your paper: "Any mortality or serious injury for this stock should be considered significant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds potential biological removal and because the North Atlantic right whale is an endangered species." If you openly acknowledge this then why continue with this type of operation that harms them? Please reconsider and stop with the experiments and seek other less harmful ways of determining your data.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P436	Please stop killing and deafening the whales and dolphins.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P437	The video in the center of the rooms was short, to the point and very interesting on what the Navy does in a number of areas.	The Navy appreciates your comment, and considers public outreach very important.
P438	Please do not proceed with these exercises as planned at the expense of this large number of sea creatures. Maybe you could use your instruments to plan around where they are and still have the exercises? Some of these creatures are endangered and need to be protected. Your own estimates are that a high number would be injured, killed, or permanently maimed leading to their death. I agree that we need a strong Navy, able to protect our coasts and insure our safety, but please avoid harming other creatures to do these exercises. There must be some open ocean where they are not abundant for you to use. Thank you for your consideration.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P439	I ask, as a United States citizen and as someone who cares deeply about our oceans, and the marine life that exists there to please reconsider this testing that WILL kill and torture marine wildlife. You are well aware of the results of your previous testing on these creatures of the ocean and yet you persist in wanting to test again and again. In your environmental report I noticed it often mentioned that it may cause _____ but it is unlikely. This is a way to keep from watering down the significance of what can be caused by your actions so the reader would believe that it is unlikely anything would happen. Well, you can't fool this reader with those kind of statements and SHAME on you for trying. The Navy and science is full aware of the sound levels that are generated by the sonar that will be tested. If that sound level was used on humans we would surely bleed from our ear drums exploding and blood would come from our eyes like those of the beached whales and	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	dolphins found after other tests. How can you justify doing them again? You know it will happen again. This is UNCONSCIONABLE and would be considered CRIMINAL if it were not the Navy. I must insist you reconsider all of the factors and if you still need to test, have several marine biologists who work for reputable environmental groups, such as Ocean Conservancy or Center for Biological Diversity, aid in finding areas where the least harm will come of our marine wildlife and limit your testing to protect them. If we loose the life in our oceans we will also loose our own lives and we won't need a Navy to carry that out. Nature will.	
P440	This is clearly the best written document of all time. My congratulations to the professionals that tirelessly put their lives on hold while working toward this admirable achievement. Bravo Zulu!	Thank you for your comment.
P441	Stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P442	WHY continue to kill life? I don't understand, I ask you, the reader, to pass the message and all people involved in this "training operation" that they need to grow their conscious mind and seek spiritual growth. They are too alienated and hypnotize with BS stories about security and control. The need for guns and combat training comes from weak insecure and greedy minds. Please think about future generations, think about the consequences of this act, its not just that it is completely non-	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable,

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	sense by itself, but it will affect many other living beings, which makes this operation a tremendous illogical act. I understand you are following orders but it is time you all re-evaluate, re-think, the life you are living.	mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P443	This is not humane, it is an eco-crime in my opinion, we do not need to plunder every damn resource on the earth for our own benefit - I for one believe we need to do with less, consume less, buy less and so on - These creatures are sacred, and belong to the earth just as much as we do, and I do not want to see them tortured, exploited, or endangered. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P444	The continued use of sonar weaponry testing by the U.S. Navy is just cruel and ignorant. They are obliterating the hearing of and KILLING our endangered, majestic marine life!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P445	Hello, Please find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Please consider steps to reduce the harmful impacts to marine mammals. These steps could include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy’s permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you for your time and consideration.	testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. The Navy does not anticipate any mortality from its activities. Though the model estimates the potential for mortality based on very conservative criteria, with the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, mortalities are highly unlikely. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P446	We, the American people, are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	the above.	
P447	Please reconsider the explosive and sonar exercises. The military forces of the United States should be know to protect their people, but also protect their environment and animals within this environment.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P448	Please rethink your plans and incorporate more protective measures to protect marine mammals from explosives and sonar along the East Coast» and California/Hawaii. This is cruel, inhumane and unnecessary. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P449	It is not acceptable to endanger marine mammals by conducting training exercises using explosives and sonar in their habitats.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P450	I appreciate the extensive research conducted on behalf of the Navy and documented in the volumes of the Environmental Impact Statement submitted for the exemption from the Marine Mammal Protection and	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	Endangered Species Act. And I recognize the Navy's need to test technology for training, safety and security reasons. As a long-time resident of the Tidewater area, I know many current and retired service members and acknowledge that these citizens appreciate the marine environment that they work and live in. I feel confident that service members will do their utmost to protect our marine resources. Nevertheless, there have been reports of marine mammal strandings resulting from acoustic damage. Acoustic damage is one of the biggest concerns associated with sonar and weaponry testing. Mitigation measures are discussed, including temporal and spatial limits. Ecological data on each species inhabiting the expansive test area have been collected. Alternative testing systems are also mentioned. But when it comes down to it, in some situations, the only option for testing is in the marine environment. And the monitoring system relied upon to protect marine mammals from harm needs improvement. Relying on visual and some passive acoustic surveys to determine if marine mammals or endangered species are in the area is not always sufficient. To reduce worse case scenario odds, a better monitoring system needs to be developed. At the very least, monitoring should be conducted in the region for many hours before testing is to be undertaken. In addition, some kind of subtle warning system that encourages movement away from a potentially hazardous situation should be researched, tested and deployed. Such a system would be in demand in shipping lanes and for other marine based projects like wind farm development and oil and gas exploration. It is imperative that very specific language favoring better monitoring, mitigation, and alternative testing option requirements be incorporated into any final action. It should also be stipulated in the final document that any and all feasible subtle warning systems be researched, tested and if possible deployed. Since it is the Navy's mission to protect national security, and they are coordinating with the National Marine Fisheries Service, which is responsible for protecting marine mammals, I believe the NMFS should be continually involved and held responsible for ensuring that all the protections necessary are being provided.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes the proposed training and testing activities will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in Navy range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the Marine Mammal Stranding Report, which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. Navy and NMFS are working together to finalize this monitoring program. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing activities occurring there. In addition to monitoring, the Navy and NMFS developed an adaptive management process that allows for consideration and integration of new data collected through research and monitoring activities. Adaptive management allows for alternate mitigation actions if mitigation commitments originally made in the planning and decision documents fail to achieve projected environmental outcomes. The Navy and NMFS have and will continue to meet on an annual basis to review new information, discuss results of the previous year's monitoring work, and make refinements to mitigation and monitoring as necessary. The Navy will continue to be a leader in funding research to better understand the potential impacts of Navy training and testing activities and to operate with the least possible impacts while meeting training and testing requirements.
P451	There is not enough proof to establish that navy testing does not affect whales and as such no more should be undertaken	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report,* which has a full review of the scientific record concerning marine mammal strandings and sonar use.
P452	I am opposed to the U.S. Navy proposing to conduct training exercises along the east coast and off the coast of California and Hawaii that will harm the rich marine life. It is well known that these areas are rich in marine life as migratory routes and feeding areas. This proposal blatantly disregards marine animals particularly whales and dolphins that depend on the protection of these areas.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P453	Please think about what you are doing before you act. Much of the marine life will be needlessly destroyed if you proceed with these tests. Surely with your advanced technology you could find less destructive means to make your target. I ask that you please put an end to these training tactics.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P454	The U.S. Navy is proposing to conduct training exercises that invole explosives and high intensity sonar all along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. The planned exercises would kill up to 2,000 marine mammals, including a	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Please consider steps to reduce the harmful impacts to marine mammals. Please avoid the most harmful activities in areas used as calving grounds or migratory corridors. Avoid seasonal high-use feeding areas. Create a larger "safety zone" around the exercises. Use aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. These steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Whales, dolphins, and porpoises deserve to live and to have a healthy ocean environment. You can make this happen. Please take these steps to reduce the harmful impacts to marine mammals.	Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P455	Please adhere to the HSUS and other animal welfare groups' requests to prevent thousands of animals from being killed and injured from this excersise. Like most citizens I know that it is imperative to have a strong defense for our country but there are ways that would be less harmful.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P456	Please do not test along the ocean waters and kill our marine lives. That is invasion on their home and they deserve to love a long healthy life without having to worry about what humans are going to do. We do enough to animals already without doing this test. You should test out in the DESERT!	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P457	There have been objections raised to overuse of underwater sonar technologies for some years, many of them based on studies that show their comparative ineffectiveness and inefficiency. But even more important than the potential for cost-saving through eliminating a poorly designed program is the protection of thousands of marine mammals who will be jeopardized by these tests. The small potential gains are not worth that risk, when so many of these species are already under siege by other human-made conditions that are not so easy to address. The "collateral damage" suffered by non-human species is significant, too, and should be avoided whenever possible, as is possible now.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P458	I would just like to voice my opposition to continued testing of underwater high-frequency, low-frequency, and high-power sound generating equipment. The damage to life in our our oceans is impossible to measure, and once done cannot be undone. I think the research shows that we just don't know how much damage could be done. Please find a better way.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P459	I am saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. I would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. Cathy Pupo	
P460	Please, no more experiments like this, they kill the sea.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P461	While I have respect for the navy, I'm really concerned about all of the life that will be hurt/killed as a result of these exercises. Our marine life is already struggling and someday .. I believe .. we will learn how absolutely dependant human life is on other species.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P462	Once these animals are destroyed they are gone forever! Pls stop this testing! Find a way to test without destroying our water mammals.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P463	My comment is relatively simple, and should be understood by anybody considering an operation that DOES NOT have to kill so many living beings. Compassion for animals is common among the good guys, but not among the bad ones. One of the surest signs that a biblical figure is a player in God's redemptive plan is the person's decency to the beasts of the field. Humane treatment of animals is seen here with Noah and will be repeated by Moses, Rebecca, Laban, and a host of others. It is not a coincidence that Christ is referred to as the 'Good Shepherd'. As St. Francis of Assisi said: "If you have men who will exclude any of God's creatures from the shelter of compassion and pity, you will have men who will deal likewise with their fellow men." Respectfully, Charles Swanson USAFR Retired officer	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P464	Stop this, please	Thank you for participating in the NEPA process.
P466	After reading what documents were provided, I understand the need to protect our shorelines. But, how many times and at what time increments are these tests to be conducted. The killing and maiming of ocean life gives me pause to consider the necessity of human life being of far more importance then animal or sea animal life. Can our military not use such wide intended boundaries of ocean to conduct these tests? It is a most complex issue and one can see the importance and value of each -- the testing and the ocean life. We have come so far and yet, as a Native American, I cannot bear the thought of the erosion to our oceans and their sea life.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P467	Please protect animals during training exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P468	Please consider the impact to marine life and develop training exercises using explosives and sonar that do not damage and kill marine life. What's the point of protecting the planet if there is nothing left to protect?	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P469	I understand the need for protecting our country, but please find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. I know that in the past, whales have stranded and died in the wake of major military sonar exercises, with bleeding from the ears and other tissue damage attributed to sonar. These have included incidents of beaked whales dying in the Canary Islands following sonar exercises, the panicked flight of orcas and porpoises off Washington State in 2003, and dozens of whales (including pregnant females) from several species who died in North Carolina in 2005. These tragedies can be avoided to a very significant degree. I support the HSUS and other environmental and animal welfare groups in asking the Navy to consider steps to reduce the harmful impacts to marine mammals. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy believes that the proposed training and testing will not pose a significant risk to whales, fish, and other wildlife given that these same activities have been conducted for many years in other range complexes with no indications of broad-scale impacts that are either injurious or of significant biological impact on marine mammals, fish, or wildlife at those locations. Please see the recent results supporting this as presented in training ranges monitoring reports available at available at NMFS Office of Protected Resources web site. Please see the project web site (www.AFTTEIS.com) for the *Marine Mammal Stranding Report* which has a full review of the scientific record concerning marine mammal strandings and sonar use. An integrated monitoring plan for the activities in the AFTT Study Area is also planned as presented in Section 5.5.1.1 (Integrated Comprehensive Monitoring Program) of the Final EIS/OEIS. The Navy will continue to implement the monitoring and research programs where training and testing has been occurring to determine if there are determinable impacts as a result of those activities and will do so in the AFTT Study Area associated with future training and testing occurring there. The Navy will continue to be a leader in funding of research to better understand the potential impacts of Navy training and testing activities

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		and to operate with the least possible impacts while meeting training and testing requirements.
P470	Please consider steps to reduce the harmful impacts to marine mammals of the planned training exercises. These steps include avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that extraordinary numbers of whales, dolphins, and porpoises might be harmed or killed. Please re-think the training exercise plans as they are currently proposed and incorporate additional protective measures. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P471	Please rethink before you kill wildlife	Thank you for participating in the NEPA process.
P472	As the daughter of a fighter pilot, I understand the need for protecting our country, but I am hoping that we can find a way to ensure national security without sacrificing such an extraordinary number of whales, dolphins, and many other marine creatures. For that reason, I am writing ask the Navy to re-think its plans and to incorporate additional protective measures as it conducts training exercises involving explosives/sonar along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P473	Stop your training and testing it's hurting the environment!!! Please!!!	Thank you for participating in the NEPA process.
P474	You have to STOP doing this your killing everything stop this and stop HAARP this MUST STOP NOW!Look what your doing to this world our Oceans please safe the sea life do no harm ..	Thank you for participating in the NEPA process.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P475	This underwater testing by the Navy is CRUEL and We should not be treating fellow species traveling on Spaceship Earth to death and or deafness. THERE IS NO PLANET B.	Thank you for participating in the NEPA process.
P476	I am writing to request that the US Navy does all they can to cause no harm to marine animals when they test and train. I believe in today's day and age, the US Navy can come up with alternatives that don't harm animals. The US Navy should be able to protect our Nation in a manner that doesn't kill an astronomically high number of whales, dolphins and other sea creatures. If every nation did what the US is doing, we wouldn't have any animals and food left in the sea. The US Navy, as the most powerful Navy on this earth, is not setting an example to the rest of the world. Please reduce the number of marine animals that will be killed. No testing should be done in calving and feeding areas. I believe our US Navy can protect our national security and at the same time respect the Earth. They are not mutually exclusive. Be a leader, don't do what's easiest. Do what's right – Be a Global Force of Good for mankind and all creatures.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P477	I disagree with sonar testing and that the NAVY can responsibly do it with acceptable environmental impact. The calculated loss versus knowledge gain is not worth it in my opinion.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P478	Please rethink planned training exercises that use live explosives and high-intensity sonar. The impact on wildlife would be significantly damaging. I would rather these exercises stop altogether but another option is to take steps including avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	harmed or killed.	presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures that the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P479	Let's please lead by example, let's show the world we care (even if we don't).... Our oceans are already dying. They are polluted. Animals are dying because of the pollution and we don't need to contribute even more to this disaster. Let's show we care for these animals and for our ocean by stopping these type of exercises that are known to have bad ending for our world. .	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P480	Dear Navy, I understand the need for testing of our military devices, but if we are causing more harm then good, how can this be right? Lets take a step back and reconsider. If the Navy does the testing knowing the harm to the wildlife it causes, then how can anyone in their right mind do the testing? It isn't right. Please! Thank you, Colleen Johnson Sebastian, FL	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P481	I urge you to take into account the lives and well-being of the marine animals, especially dolphins and whales, when conducting training exercises. We can surely maintain national security and protect marine animals at the same time. I ask that you consider avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales,	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	dolphins, and porpoises might be harmed or killed. Thank you for your time and consideration.	
P482	I humbly request that the US Navy consider steps to reduce the harmful impacts to marine mammals including avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger "safety zone" around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P483	I am asking that the Navy protect marine mammals from explosives and sonar. These are precious animals that don't deserve to be abused and there are other ways for the Navy to test protective ways than killing in our waters. These exercises would involve the use of live explosives and high-intensity sonar. According to its own Environmental Impact Statements, the Navy estimates that the planned exercises would kill up to 2,000 marine mammals, including a large number of animals from endangered species, such as right whales. Thousands of others would suffer permanent lung damage. An additional 16,000 would be permanently deafened and 5 million would be temporarily deafened by the exercises. Please stop this action! Thank you, Curt Albright	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The impact analysis in the Final EIS/OEIS has been refined in coordination with NMFS. The number of marine mammal harassment exposures must be estimated scientifically using complex modeling, but it is only an estimate, not a prediction. This estimate needs to encompass the capacity of what could occur to ensure Navy's permits are not exceeded. The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P484	Stop!	Thank you for participating in the NEPA process.
P485	I grew up in the Norfolk, VA area where the Navy is a vital and respected part of the fabric of the community. My father was in the Naval Reserves and was away from home at least once a month. He was also a boater and a fisherman who had great respect for the ocean. The sea is critical to the U.S. Navy and our national security and is also critical to	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	the very survival of the dolphins and whales that must share it with our ships. I implore the Navy to find ways to lessen the impact on these amazing animals that already face survival challenges from so many man-made objects (i.e. trash, etc.) Surely there are intelligent scientists/biologists that can help our officers at the Pentagon come up with a strategy to fulfill the Navy's mission AND protect our sea life. To do anything less would be an abdication of responsibility as U.S. citizens and as caretakers of our fellow creatures. Thank you for the opportunity to comment.	(Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy employs hundreds of people whose sole or primary responsibility is environmental stewardship, and hires numerous contractors to assist with these programs. These personnel are involved on a daily basis in planning, implementing and monitoring stewardship programs to protect, preserve and/or conserve species and their habitats.
P486	No exercises of any kind are worth the lives and health of those creatures who live in the sea. Not only is protecting these animals the right thing to do, it benefits us as well. Because when the flora and the fauna of this world flourish, so, too, do we. But if they suffer and die, we are going to likewise be effected - by less food in the food chain, by dead animals washing up on shore thereby contaminating the beaches, etc. Please discontinue any testing or plans for testing which will harm the hearing and/or health of sea mammals. This includes sonar, radar, and explosive testing. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P487	Save the whales and dolphins! Do not allow training exercises along the U.S. East Coast and in the rich marine environment off the coast of California and Hawaii. Destroying wildlife and the environment is just plain wrong.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P488	USA STOP YOUR PLANS.MARINES MAMMALS NEED PROTECTION! DARIA GYEDU,POLAND	Thank you for participating in the NEPA process.
P489	*Duplicate to comment P106*	*See response to comment P106*
P490	Our lands were taken away, don't take our ocean life. It is with great concern that I address the U.S. Navy's AFTT. As a Vietnam naval wife, Marine Corp and 2 Navy son-in-laws mother as well as a 5th	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	generational and more Native American of the Creek triber there are three things that we must do to have peace in our hearts. #1 Respect the Great Spirit. #2 Respect you fellow human. #3 Respect and take care of what the Great Spirit has given on and of planet Earth. When these values are broken chaos occurs. I support national defence. I support protection of all living creatures. Please consider not doing testing during whale and dolphin migration to their feeding/spawing. Please do use the "deep" ravines and chasmisn in open ocean away from our coastal area.	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P491	We urge you to take into consideration the irreparable harm your testing will do to whales and dolphins. We respect the need for testing as part of our national security, but your own environmental studies point to severe, horrific injury to these animals, who are sentient, family-oriented creatures like us. Please, reduce the impact your testing will have; use alternative, more sensitive methodologies. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P492	I wholeheartedly agree with what the HSUS describes as a terrible outcome for sea life, especially that on the endangered species lists. There are other ways and means to ensure our country's safety without destroying our oceans and sea creatures. Thank you.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P493	We are saddened to hear that the Navy is considering conducting exercises involving the use of live explosives and high-intensity sonar. Do you feel that it is really necessary to conduct this testing that will affect such a volume of marine life? It would be a great pity to see so much of the conservation work the USA has undertaken towards its marine environment over the last number of years being undermined by these proposed exercises. These conservation initiatives deserve to be	Thank you for your comment.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	applauded and have made the USA one of the leaders in marine conservation. To conduct these exercises flies in the face of all the good work and progress that has been achieved to date. There is also the issue of sound channels in the oceans that can carry sounds over vast distances, so not only local populations may be affected but also populations in areas seemingly far removed from the testing activities. As these activities could potentially affect endangered species on both the high seas and possibly in the territorial waters of other nations we believe that any other nations that could potentially be affected should be fully consulted, and the findings of any such consultations made public, prior to any decision being made on whether these activities should progress to the next stage. We would ask you to give serious consideration to just how necessary these proposed exercises are and where the benefits of them lie versus the destruction of marine life that so many dedicated citizens have worked tirelessly to preserve and enhance for both current and future generations. We look forward to hearing from you with your views on the above, if you have any queries please do not hesitate to contact us, yours, Brian Hurley Controller, Sullivan Miranda S.C.	
P494	As a tax-payer, small business owner and ocean conservationist, I am deeply concerned about the potential for death and harm to marine mammals from the sonar project. My business is Washington, DC caters to scuba divers, snorkelers and other underwater enthusiasts who spend a lot of time and money to see these beautiful, threatened animals in their natural environments. Animal deaths or injuries from these exercises would cause a massive public outcry and potentially harm many other businesses who depend on income from marine mammal-related tourism. Please take steps to reduce the harmful impacts to marine mammals, such as avoiding the most harmful activities in areas used as calving grounds or migratory corridors; avoiding seasonal high-use feeding areas; creating a larger “safety zone” around the exercises; and using aerial or acoustic monitoring to determine whether marine mammals are nearby and may be harmed. Taking these steps would allow important military training exercises to go forward, while minimizing the likelihood that whales, dolphins, and porpoises might be harmed or killed. Thanks for the opportunity to comment.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures that the Navy recommends in specific mitigation areas that are important to marine mammals. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.
P495	We understand the need for protecting our country, but this carnage and killing is reprehensible beyond measure. As you are very well aware there are ways to ensure national security without sacrificing such an	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	extraordinary number of whales, dolphins, and many other marine creatures. Citizens want this to STOP!	analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P496-01	Please consider the reality of need not only from the standpoint of the Navy but from the standpoint of we the people you are presuming to protect, and our very deep concerns for the animals we so treasure in the areas you are invading. This person's most sincere plea is that you will use both compassion and redeeming human judgment when you decide about the necessity, the intensity, and the repetition of the very painful and lethal sonar testing you are intending to do.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P496-02	If you question the terrible effect you are having on these animals with your tests, you might contract to have this type of torture applied to a "laboratory" sample.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P497	Our neighborhood is overflown daily by training planes. We are always pleased to hear them and frequently try to see them, and sometimes wave if they are low passing over us. Your planes are as welcome as patrolling police car cruising by. "The sound of freedom" and the vision of protection. Keep 'em up! F and N. JAX FL 32257	Thank you for your comment.
P498	Please use all precautions and protective measures while carrying out the sonar and explosive activities to ensure marine mammals are	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	protected.	of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P499	How can you even begin to believe killing innocent animals is ok? You guys need to visualize what the results will be from these ocean tests. Stop it now (over) please.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P500-01	The analysis fails to present and analyze reasonable alternatives that would significantly reduce the unprecedented level of harm to marine life.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, and comments received via the EIS/OEIS public participation process.
P500-02	The mitigation scheme that the Navy principally relies upon, centered on the ability of lookouts to detect whales and dolphins, will not result in an appreciable decrease in marine mammal injuries.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
P500-03	I urgently and respectfully call on the Navy to identify and set aside areas of high marine mammal density acknowledged to be the most effective means of reducing marine mammal injury. The Navy should and must take common sense precautions -- like keeping training out of key whale habitat -- before launching this sonic assault. Such precautions will not compromise the nation's military readiness.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. The Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P501-01	Just how many individuals do you think can be harmed before a population is affected?	All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the Final EIS/OEIS and it was determined that population-level impacts would not occur. If long-term consequences for a few animals in populations that number in the tens of thousands do occur, they are unlikely to have measurable long-term consequences for marine mammal populations. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities that reduce the potential for impacts to occur.
P501-02	The mitigation scheme that the Navy principally relies upon, centered on the ability of lookouts to detect whales and dolphins, will not result in an appreciable decrease in marine mammal injuries.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
P501-03	set aside areas of high marine mammal density….	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
		effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, with regard to marine mammals, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS. Specifically, Section 5.3.3.1 (Marine Mammal Habitats) discusses measures the Navy recommends in specific mitigation areas that are important to marine mammals.
P502	Please stop the killing and harming of our animal and human populations, and stop destroying the environment that these are dependent upon for their survival.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P503	This letter is written to tell the US Navy that inflicting such far-reaching harm on marine mammals is simply unacceptable….I am urging the US Navy to reexamine and reevaluate their potential ocean sonar and explosive testing as this potential harm and destruction of our endangered marine wildlife will threaten their ability to survive and must be reevaluated. These actions are inhumane and unacceptable.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements, to the maximum extent practicable, mitigation measures during its training and testing activities. The Navy has conducted active sonar training and testing activities for decades in the seaspace depicted in the Study Area with no documented proof of injuries to marine mammals.
P504	Good morning. Good afternoon. This is Beverly Bernice Hartley Wilhite, [ADDRESS REMOVED]. I've come to say thank you to the U.S. Navy for all the representatives, admirals, commanders, and foot soldiers that you have located everywhere throughout the world. As a mother of the United States Marine Corps who went over to Desert Storm, as a wife of a Navy man, as the mother also of two sons-in-law Ethan Abbot and Nicholas Duane Wood, we thank the Navy for the opportunity to say that you're doing a great job. With those thoughts in mind I'd like to say my peace in regards to	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. Also, as described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy implements the most practical mitigation measures with the aim of achieving the least practicable adverse impacts to marine mammal species or stocks.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	protecting the seas through science. As well al the things listed above, I'd like to make mention that I am a fifth-generation Native American. With that in mind fifth-generation Native American came from Creek Indians who subbranched from the Cherokee. So as you well know, there's been a lot of things going in and out throughout centuries of time. And with those things in mind, going out throughout the centuries in time mind I'd like to share with you the facts of what our people on my mother's side believes in. There's three very important facts. Number one: if we can have peace in our hearts and lives and lands we do these three things. Honor your great spirit wherever your great spirit, whoever your great spirit is. Number two: respect your fellow man or woman or gender-selected whatever you want to choose. Number three: protect the Earth. With these three thoughts in mind, we are to do and establish those things that are before us. With those things in mind, we come to this oral presentation that I'd like for all to hear and share and I thank you for your time and diligence in putting this together. In Jacksonville where I live, we have a president Andrew Jackson that established us here. And I'd like to share what he had to say. And Andrew Jackson wrote on March 3, 1837: "You have the highest form of human trust committed to your care. Providence has shown on this favored land, blessings without number and has chosen you as the guardians of freedom to preserve it for the benefit of the human race. May he who hold in his hand the destinies of nations make you worthy of the favors he has bestowed and enabled you with pure hearts and hands and sleepless vigilance to guard and to defend to the end the great charge he's committed you." And this is from the annals of six on 310. With that in mind Andrew Jackson speaking his peace about guarding and preserving, that covers the man. But also we need to cover those forces of nature that has been established by, like I said, my people's great spirit. How do we do that? That's the question. You don't disagree with me, I know that. But also we have got to find a way of protecting our nation. In protecting the seas, my suggestion and thought is that we do a little bit of research. Find out what's happening with the nature. Is nature going to be hurt or harmed? Some say "yes" and some say "no". My Navy son who works in radar… he says "yes, they can distinguish between whales". But I suggest highly that our technology be so advanced and so minutely tuned to definitely distinguish a herd of whales, a herd of those environmental animals that we need to protect.	

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	Our technology be so advanced that we do not detonate and destroy and kill off the pathways and the avenues and the birthing canals of those great animals. You say, is she a whale and fish lover? Let me tell you I am a lover of all things. It gives me life, it gives me breath, and it gives you life and it gives you breath. To love those things that give you the peace of mind, to look and see, to hear. So with this in mind I strongly ask and request that this input would be considered in the highest order even to the president, the next presidential and all the representatives to consider a time span when exercises need to be established… Not, not, not during the season of travel for the migrating whales and not, not, not in the intercoastal waterways that need to be preserved for our environment. The reefs, the underwater reefs… Some people say are not important. Hello, I live in Jacksonville. Have you ever heard of a hurricane and water surges? Water surges come up from the ocean. By detonating and destroying our underground reefs and our protective stabilizers underneath, in the ocean floorboard. We're also setting Jacksonville up and all of the coastline up for destruction. Please consider these thoughts. I thank you. Once again I thank you for your time, your attention. I ask that you consider the timing of when things are done, when things are done, what locations – away. Please consider having it away from the coastal areas. Just have it out in the middle of the ocean. Why not play out there where the deep chasms are. If things need to be blown up, blow them up in the deep chasms that are down in the bottom of the ocean. You know where they're at. I don't. So if you'll take time and just look at that and consider that, you know what? I think everybody will along, be just fine and be happy. Well I appreciate your time and you have a good day or night whatever the situation may be. Thank you.	
P505	I've become aware of the training exercises that are planned to be conducted off of the east coast of the U.S. and also off of the coast of California and Hawaii that will involve the use of live explosives and high-intensity sonar. According to the Navy itself, these practices will kill thousands of marine animals, and leave thousands more injured with lung damage, bleeding from ears and deafness. Instead, please consider avoiding those areas where the animals are known to be calving, migrating or feeding. Please have a large safety area around the exercise areas and use aerial or acoustic monitoring to determine where the mammals are and so to avoid them. Please keep the welfare of the mammals as a priority when these training exercises are done, and	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

Table E-5: Responses to Comments from Private Individuals (Continued)

Comment Identifier	Comment	Navy Response
	protect them from being harmed or killed as has happened in the past. Thank you for your attention to my letter.	
P506	Please reconsider the plan to do sonar work. I am outraged that this work will cause unnecessary suffering and/or death to many species of sea turtles, whales, and dolphins. The Navy ought to be ashamed.	The Navy shares your concern for marine life. The analysis and the science show that there is not a significant impact on marine species. All of the potential effects from Navy training and testing activities were analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of the EIS/OEIS. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

E.2.2.1 Form Letter

The Navy received a CD from the Natural Resources Defense Council containing approximately 76,000 versions of a letter from their activists. Table E-6 provides the Navy's responses to the comments in the letter. Table E-7 provides the Navy's response to amendments to the basic letter. Responses to these comments were prepared and reviewed for scientific and technical accuracy and completeness.

Table E-6: Responses to Comments in the Form Letter from the Natural Resources Defense Council

Comment Identifier	Comment	Navy Response
O12-01	Your analysis fails to present and analyze reasonable alternatives that would significantly reduce the unprecedented level of harm to marine life.	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, and comments received via the EIS/OEIS public participation process. Further, the USEPA has reviewed the EIS/OEIS and stated "the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- "Lack of Objections.""
O12-02	The mitigation scheme that the Navy principally relies on centered on the ability of lookouts to detect whales and dolphins will not result in an appreciable decrease in marine mammal injuries. Federal courts have found this same scheme inadequate and ineffective for good reason: it is largely useless in conditions (common at sea) that impair visual surveillance, it is unsuitable for detecting cryptic and deep-diving species that spend little time at the surface, and, even if it were fully effective at detecting whales and dolphins, would only protect species form the most serious injuries.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.
O12-03	I call on the Navy to identify and set aside areas of high marine mammal density acknowledged to be the most effective means of reducing marine mammal injury.	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. Through consultation and permitting with NMFS and U.S. Fish and Wildlife Service, the Navy refined the mitigation measures, which are now presented in Chapter 5 of this Final EIS/OEIS.

Individuals who submitted the form letter made their own amendments, additions, changes, and editorial remarks. Most expressed general opposition to the Proposed Action; others were related to the topics described below. The Navy has responded to these additional comments in Table E-7.

Table E-7: Responses to the Additions and Changes to the Form Letter as Submitted by the Natural Resources Defense Council

Comment Topic	Response
Concern for harm to marine mammals/ marine life	The Navy is committed to protecting the marine environment during the conduct of its training and testing activities. As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the EIS/OEIS, the Navy has used extensive measures to protect the marine environment while training and testing for nearly a decade.
Requests or suggestions for different alternatives	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives. The Navy complied with NEPA requirements in the development and consideration of alternatives. This EIS/OEIS analyzes all alternatives in Section 2.5.2 (Alternatives Carried Forward) and explains why the Navy has eliminated other alternatives in Section 2.5.1 (Alternatives Eliminated from Further Consideration). The selection of an alternative by the decision maker will be based on a review of all relevant facts, impact analyses, and comments received via the EIS/OEIS public participation process. Further, the USEPA has reviewed the EIS/OEIS and stated “the draft EIS/OEIS provides an adequate discussion of the potential environmental impacts and we have not identified any potential environmental impacts requiring substantive changes. EPA has rated the draft EIS as LO- "Lack of Objections."”
Requests or suggestions for additional or other mitigation	As described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the Final EIS/OEIS, the Navy evaluated the effectiveness and practicability of numerous potential mitigation measures. The Navy, in conjunction with NMFS, has determined what mitigation it can effectively use during its training and testing activities. Through careful exploration of all mitigation measures to determine which were the most effective (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), the Navy has chosen the existing measures to mitigate harm to marine mammals while still being able to meet its operational needs to train for real-world conditions.
General misunderstanding for the need for the Proposed Action	The alternatives carried forward meet the Navy's purpose and need (Section 1.4, Purpose and Need) to ensure that it can fulfill its obligation under Title 10. See Section 2.5 (Alternatives Development) for more detailed information on the development of alternatives.

E.2.2.2 Petition

The Navy received a petition circulated by MoveOn.org containing approximately 477,000 signatures. Table E-8 provides the Navy’s response to the petition itself. The response to the petition was prepared and reviewed for scientific and technical accuracy and completeness. Individuals who signed the petition added their own remarks. Most expressed general opposition to the Proposed Action; other additions were similar to the topics described above for the Natural Resources Defense Council form letter (Table E-7).

Table E-8: Response to the Petition from MoveOn.Org

Comment Identifier	Comment	Navy Response
O13	Stop the killing of 1,800 whales and dolphins and the deafening of 15,900 more by ceasing the operation of the Navy's underwater sound system in the Hawaiian Islands, the California and Atlantic Coasts, and the Gulf of Mexico.	Below is a summary of the facts and analyses related to the AFTT EIS/OEIS: • The Navy employs extensive mitigation measures during training and testing activities, which the Navy believes significantly minimizes the risk to marine mammals. • During several decades of training and testing with explosives, only four marine mammals are known to have died during one training accident. Following this incident and in accordance with standard operating procedures, the Navy ceased all similar training, reviewed its protective measures, worked with regulators, and has revised its mitigation measures. • There is evidence of fewer than 40 marine mammal stranding deaths worldwide connected to Navy sonar training, and no such incidents have occurred since 2006. There has never been a recorded marine mammal stranding in which Navy training or testing was a causal factor along the East Coast, West Coast, Gulf of Mexico, or Hawaii. • The modeling, which does not account for mitigation efforts, estimates there is a possibility marine mammals may be exposed to sound levels in certain frequencies that could result in a loss of hearing sensitivity. Using mitigation measures, actual numbers of marine mammals affected by Navy training and testing are expected to be much lower. See the Final EIS/OEIS for the refined analysis (refined in coordination with NMFS). The revised estimates now account for mitigation and avoidance, to provide a more holistic approach to analysis. Additionally, loss of hearing sensitivity at certain frequencies does not mean marine mammals will become deaf—they will still be able to hear, hunt for food, and perform other normal activities.

E.3 NATIONAL MARINE FISHERIES SERVICE PROPOSED RULE

As part of the EIS/OEIS process, the Navy has applied to NMFS for authorization to take marine mammals incidental to Navy training and testing activities in accordance with the Marine Mammal Protection Act (MMPA). On 31 January 2013, NMFS published in the Federal Register the MMPA Proposed Rule for public comment.

Since the Draft EIS/OEIS was released, adjustments were made to the quantified results of the marine mammal acoustic effects analysis. These changes were presented in the Navy's Letter of Authorization application to NMFS and are reflected in the Final EIS/OEIS. Modifications to the requested take numbers outlined in the Draft EIS/OEIS were presented in the Proposed Rule and are a result of consultation with NMFS, as well as refinements to training and testing modeling inputs and minor changes to Navy training and testing as a result of emerging requirements. In consultation with NMFS, the Navy made post-model adjustments to further refine the numerical analysis of acoustic effects by considering animal avoidance of sound sources, avoidance of areas of activity before use of a sound source or explosive, and implementation of mitigation. Section 3.4.3.1.5.5 (Marine Mammal Avoidance of Sound Exposures) and Section 3.4.3.1.5.6 (Implementing Mitigation to Reduce Sound Exposures) describe in detail the post-model adjustments made to further refine the numerical analysis of acoustic effects.

Because of the changes since the Draft EIS/OEIS, the Navy ensured that the public had the opportunity to review and comment on the changes before the issuance of the Final EIS/OEIS. The Navy sent out letters to stakeholders (Section 8.3) and e-mails to interested parties; in addition, the Navy posted a link to the Proposed Rule on the public web site (www.AFTTEIS.com). The Navy advised NMFS and the public that all comments received on the Proposed Rule that address (1) changes to the tempo or location of certain proposed activities, (2) refinement to the modeling inputs for training and testing, and (3) additional post-model analysis of acoustic effects and implementation of mitigation would be reviewed and addressed by the Navy in the Final EIS/OEIS. Comments on the Proposed Rule and the Navy's responses can be found in Table E-10.

E.3.1 COMMENTERS, COMMENTS, AND RESPONSES

This section contains a list of the agencies and organizations that elected to comment on the NMFS Proposed Rule pertaining to the three topics outlined above (Table E-9). During the 45-day public comment period, comments were received from one federal agency and two non-governmental organizations pertaining to the three topics outlined above. The Commenter Identifier is used to identify the comments and responses in the comment response matrix (Table E-10). For example, a comment letter from a federal agency could have 10 comments within it. To organize responses, each commenter received a Commenter Identifier and each comment within the letter was numbered (e.g., F01-01 is the first comment in the letter from the Marine Mammal Commission).

Table E-9: Agencies and Organizations Who Commented on the Proposed Rule

Commenter Identifier	Commenting Agency/Organization
Federal Agencies (F)	
F01	Marine Mammal Commission
Organizations (O)	
O01	Natural Resources Defense Council
O02	Cetacean Society International

E.3.2 COMMENTS AND RESPONSES

Table E-10 provides a listing of all comments received on the NMFS Proposed Rule pertaining to the three topics outlined above, and the Navy's responses. Responses to these comments were prepared and reviewed for scientific and technical accuracy and completeness. Comments appear as they were submitted and have not been altered. Table E-10 contains comments from a federal (F) and non-governmental organization (O) received during the public comment period pertaining to the three topics outlined above, and the Navy's responses.

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations

Commenter Identifier	Comment	Draft Response
F01-01	The Navy assumed that marine mammals likely would avoid repeated high level exposures to a sound source that could result in injuries (i.e., PTS). It therefore adjusted its estimated numbers of takes to account for marine mammals swimming away from a sonar or other active source and away from multiple explosions to avoid repeated high-level sound exposures. The Navy did not provide a basis for this assumption or the details of its adjustment. The Navy also assumed that harbor porpoises and beaked whales would avoid certain training and testing activity areas because of high levels of vessel or aircraft traffic before the activity. It based that assumption on various publications indicating those species swim away from or avoid vessels (Barlow 1988, Polacheck and Thorpe 1990, Evans et al. 1994, Jaramillo-Legorreta et al.1999, Palka and Hammond 2001, Pirotta et al.2012). But, again, it did not explain how it adjusted the take estimates to reflect the degree of avoidance by harbor porpoises and beaked whales. Depending on conditions, marine mammals may avoid areas of excessive sound or activity. Indeed, one of the concerns regarding sound-related disturbance is that it causes marine mammals to abandon important habitats on a long-term or even permanent basis. That being said, the Commission knows of no scientifically established basis for predicting the extent to which marine mammals will abandon their habitat, which would seem to be essential information for adjusting the estimated numbers of takes. Absent the relevant information, the Commission and public cannot comment on the appropriateness of such adjustments—in essence, the regulatory process would not be sufficiently transparent.	The quantitative analysis of acoustic impacts is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.5 (Quantitative Analysis), as well as in Section 6.1.5 (Quantitative Analysis), in the Navy's Request for Letter of Authorization submitted to NMFS (77 FR 60679). Specifically, post-model analysis taking into account sensitive species' avoidance of anthropogenic activity is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.5.5, Marine Mammal Avoidance of Sound Exposures. Background information on harbor porpoise and beaked whale sensitivity to vessels and aircraft is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions. Reactions due to repeated exposures to sound-producing activities are discussed in AFTT Final EIS/OEIS Section 3.4.3.1.2.6, Repeated Exposures. The model-estimated effects (without consideration of avoidance or mitigation) are provided in the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles* technical report available at www.AFTTEIS.com. The Navy Acoustic Effects Model does not currently take into account avoidance behavior by sensitive species when estimating acoustic effects on marine mammals; that is, even for activities in which there is a high level of vessel or low-altitude aircraft activity prior to the start of explosive or sonar activities, sensitive animals are modeled as if they would remain stationary and tolerate any very close anthropogenic encounters. Harbor porpoises and beaked whales, however, are known to avoid anthropogenic activity (see AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions). Therefore, the model-estimated effects provide an unrealistic estimate of impacts close to sound sources during certain activities. Marine mammals are not assumed to avoid or abandon important habitats on a long-term or permanent basis. Before use of explosives, sonar, or other acoustic sources, harbor porpoises and beaked whales are conservatively estimated to only avoid a region that would encompass the range to onset mortality for explosives (less than 600 yd., except for full ship shock trials) or PTS for sonar and other active acoustic sources (less than 110 yd.), only if the activity is preceded by multiple vessel movements or hovering helicopters. Example ranges to these effects for specific sources are provided in AFTT Final EIS/OEIS Tables 3.4-20 and 3.4-21 (explosives, for mid- and high-frequency cetaceans, respectively) and Table 3.4-9 (sonar and other active acoustic sources). Therefore, the model-estimated onset mortalities (due to explosives) and PTS (due to sonar and other active acoustic sources) for harbor porpoises and beaked whales are instead assumed to be recoverable injuries (i.e., onset slight lung injury) and TTS, respectively, for the activities described above.

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
		In addition to the information already contained within the AFTT EIS/OEIS, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com.
F01-02	The Navy also indicated that its post-model analysis considered the potential for highly effective mitigation to prevent Level A harassment from exposure to sonar and other active acoustic sources and Level A harassment and mortalities from exposure to explosives. Clearly, the purpose of mitigation measures is to reduce the number and severity of takes. However, the effectiveness of the Navy's mitigation measures has not been demonstrated and remains uncertain. This is an issue that the Commission has raised many times in the past, and the Navy has recognized the need to assess the effectiveness of its mitigation measures in its ICMP and even in its recent DEIS, which states that although the use of lookouts is expected to increase the likelihood that marine species would be detected at the water's surface, it is unlikely that using those lookouts would help avoid impacts to all species because of the inherent limits of visual monitoring. The Navy has now proposed to adjust its take estimates based on both mitigation effectiveness scores and g(0)—the probability that an animal on a vessel's or aircraft's track line will be detected. According to its proposed approach, for each species the Navy would multiply a mitigation effectiveness score and a g(0) to estimate the percentage of the subject species that would be observed by lookouts and for which mitigation would be implemented, thus reducing the estimated number of marine mammal takes for Level A harassment and mortality (explosives only). The Navy then would decrease the estimated numbers of Level A harassment and mortality takes for that species to Level B or Level A harassment takes, respectively. The difficulty with this approach is in determining the appropriate adjustment factors. Again, the information needed to judge effectiveness has not been made available. In addition, the Navy did not provide the criteria (i.e., the number and types of surveillance platforms, number of lookouts, and sizes of the respective zones) needed to elicit the three	The Navy Acoustic Effects Model currently does not have the ability to account for mitigation or horizontal animal movement either as representative animal movements or as avoidance behavior (see AFTT Final EIS/OEIS Section 3.4.3.1.5.4, Model Assumptions and Limitations). While the Navy will continue to incorporate best available science and modeling methods into future versions of the Navy Acoustic Effects Model, it was necessary to perform post-model analysis to account for mitigation and avoidance behavior. A summary of the current status of the Navy's Lookout effectiveness study and why the data cannot be used in the analysis has been added in Section 5.3.1.2.4, Effectiveness Assessment for Lookouts. The Navy believes consideration of marine mammal sightability and activity-specific mitigation effectiveness in its quantitative analysis is appropriate in order to provide decision makers a reasonable assessment of potential impacts under each alternative. A comprehensive discussion of the Navy's quantitative analysis of acoustic impacts, including the post-model analysis to account for mitigation and avoidance, is presented in the Navy's Request for Letter of Authorization under the MMPA submitted to NMFS (77 FR 60679). The assignment of mitigation effectiveness scores and the appropriateness of consideration of sightability using detection probability, g(0), when assessing the mitigation in the quantitative analysis of acoustic impacts is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures. Additionally, the activity category, mitigation zone size, and number of Lookouts is provided in AFTT EIS/OEIS Tables 5.3-2 and 5.4-1. In addition to the information already contained within the AFTT EIS/OEIS, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com. Any marine mammal detection within the mitigation zones results in implementation of the appropriate mitigation measures. Details on implementation of mitigation can be found in the annual exercise reports provided to NMFS and briefed annually to NMFS and the Marine Mammal Commission. The annual exercise reports can be found at http://www.navymarinespeciesmonitoring.us/. For more information on how mitigation is implemented see AFTT EIS/OEIS Chapter 5, Standard Operating

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
	mitigation effectiveness scores. Moreover, the simple detection of a marine mammal does not guarantee that mitigation measures will be effective. That is, measures of effort (i.e., numbers of lookouts and surveillance platform (s)) are not necessarily measures of effectiveness, and the Navy has not yet demonstrated that such measures of effort are reliably linked to effectiveness. Therefore, the use of those scores is unsubstantiated.	Procedures, Mitigation, and Monitoring.
F01-03	In addition, this approach is confusing because the Navy is inconsistent in its use of the terms “range to effects zone” and “mitigation zone,” which are not the same (see Table 11-1 of the application). More importantly, some of the mitigation zones are smaller than the estimated range to effects zones. For example, the Navy proposed a mitigation zone of 183 m after a 10 dB reduction in power for its most powerful active acoustic sources (e.g., source bin/type MF1: AN/SQS-53C) and assumed that marine mammals would leave the area near the sound source after the first three to four pings. However, for a single ping, the predicted average range to PTS is 257 m and could be as large as 267 m. That distance would increase if the activity involves multiple pings, which most do. But even with a single ping, PTS may occur well outside of the mitigation zone. In such cases, mitigation based on those zones cannot be deemed effective, no matter how many observers or observer platforms are involved. That being the case, assigning mitigation effectiveness scores based on zones that do not cover the full range to which PTS may occur is inappropriate.	The terms "range to effects zone" and "mitigation zone" are used appropriately in the discussion of mitigation in both the Navy's Request for Letter of Authorization under the MMPA submitted to NMFS (77 FR 60679) and in AFTT Final EIS/OEIS Section 5.3.2, Mitigation Zone Procedural Measures. In summary, the range to effects zone is the distance over which the specific effects would be expected, and the mitigation zone is the distance that the Lookout will be implementing mitigation within and is developed based on the range to effects distance for injury (i.e., PTS). In all cases except ship shock trials, the proposed mitigation zones encompass the ranges to PTS for the most sensitive marine mammal functional hearing group (see AFTT Final EIS/OEIS Table 5.3-2), which is usually the high-frequency cetacean hearing group. Therefore, the mitigation zones are even more protective for the remaining functional hearing groups (i.e., low-frequency cetaceans, mid-frequency cetaceans, and pinnipeds), and likely cover a larger portion of the potential range to onset of TTS. The Navy believes that ranges to effect for PTS that are based on spherical spreading best represent the typical range to effects near a sonar source; therefore, the ranges to effects for sonar presented in Table 11-1 of the Navy's Request for Letter of Authorization have been revised as shown in Table 5.3-2. The predicted ranges to onset of PTS for a single ping are provided for each marine mammal functional hearing group in Table 3.4-9. The single ping range to onset of PTS for sonar in sonar bin MF1 (i.e., AN/SQS-53), the most powerful source bin analyzed, is no greater than 100 m for any marine mammal functional hearing group. Furthermore, as discussed in Section 3.4.3.1.8.1 (Range to Effects), there is little overlap of PTS footprints from successive pings, indicating that in most cases, an animal predicted to receive PTS would do so from a single exposure (i.e., ping). Additional discussion regarding consideration of mitigation in the quantitative analysis of sonar and other active acoustic sources is provided in AFTT Final EIS/OEIS Section 3.4.3.1.8.2, Avoidance Behavior and Mitigation Measures as Applied to Sonar and Active Acoustic Sources.

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
F01-04	The Navy used numerous references to estimate species-specific g(0)s. Those sources were based on scientific surveys of marine mammals that used both vessels and aircraft. It also indicated that various factors are involved in estimating g(0), including sightability and detectability of the animal (e.g., species-specific behavior and appearance, school size, blow characteristics, dive characteristics, and dive interval), viewing conditions (e.g., sea state, wind speed, wind direction, sea swell, and glare), the observer's ability to detect animals (e.g., experience, fatigue, and concentration), and platform characteristics (e.g., pitch, roll, yaw, speed, and height above water). In the DEIS, the Navy noted that due to the various detection probabilities, levels of experience, and dependence on sighting conditions, lookouts will not always be effective at avoiding impacts to all species. Yet it based its g(0) estimates on seasoned researchers conducting the associated surveys, not Navy lookouts whose observer effectiveness has yet to be determined. The Commission recommended earlier in this letter that the Navy supplement its mitigation and monitoring measures because the observer effectiveness study has yet to be completed or reviewed. It therefore would be inappropriate for the Navy to reduce the numbers of takes based on the proposed post-analysis approach because, as the Navy has described it, it does not address the issue of observer effectiveness in developing mitigation effectiveness scores and g(0).	A summary of the current status of the Navy's Lookout effectiveness study and why the data cannot be used in the analysis has been added in Section 5.3.1.2.4, Effectiveness Assessment for Lookouts. The Navy believes consideration of marine mammal sightability and activity-specific mitigation effectiveness in its quantitative analysis is appropriate in order to provide decision makers a reasonable assessment of potential impacts under each alternative. A comprehensive discussion of the Navy's quantitative analysis of acoustic impacts, including the post-model analysis to account for mitigation and avoidance, is presented in the Navy's Request for Letter of Authorization under the MMPA submitted to NMFS (77 FR 60679). Additional discussion regarding the use of detection probability, g(0), in the consideration of mitigation in the quantitative analysis is provided in AFTT Final EIS/OEIS Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures.
F01-05	Based on all of these concerns, the Marine Mammal Commission recommends that the National Marine Fisheries Service authorize in the regulations the total numbers of model-estimated Level A harassment and mortality takes rather than reducing the estimated numbers of Level A harassment and mortality takes based on the Navy's proposed post-model analysis. The Navy's general approach has merit and warrants further investigation, but it cannot be deemed reliable at this point.	The post model assessment process was developed using the best available science and in coordination with NMFS, and is necessary to account for mitigation and avoidance behavior. Relying solely on the output of the Navy Acoustic Effects Model presents an overestimate of acoustic impacts for higher order effects such as injury or mortality, for the following reasons: (1) Sensitive species (i.e., beaked whales and harbor porpoises) are modeled as if they would remain stationary and tolerate any very close anthropogenic encounters, although these species are known to avoid anthropogenic activity (see AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions). (2) Implementation of mitigation is not currently modeled; however, the Navy has developed mitigation measures in cooperation with NMFS that are considered effective at reducing environmental impacts while being operationally feasible (see AFTT Final EIS/OEIS Chapter 5, Standard

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
		Operating Procedures, Mitigation, and Monitoring). (3) Animals are assumed to remain horizontally stationary in the model and tolerate any disturbing or potentially injurious sound exposure, although animals have been observed to avoid sound sources with high source levels (see AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions). (4) The model estimates the potential for mortality based on very conservative criteria (see AFTT Final EIS/OEIS Section 3.4.3.1.4.1, Mortality and Injury from Explosions). With the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, the likelihood of mortality is very low. Additional discussion of the model-estimated impacts is in AFTT Final EIS/OEIS Section 3.4.3.1.5.4, Model Assumptions and Limitations. A comprehensive discussion of the Navy's acoustic impact analysis, including modeling and the post-model analysis, is in AFTT Final EIS/OEIS Section 3.4.3.1.5 (Quantitative Analysis), as well as in Section 6.1.5 (Quantitative Analysis), of the Navy's Request for Letter of Authorization submitted to NMFS (77 FR 60679). In addition to the information already contained within the AFTT EIS/OEIS and the Navy's Request for Letter of Authorization, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com.
O01-01	If the Proposed Rule is adopted, the Navy will be allowed to harm whales, dolphins, and other marine mammals nearly 22 million times over five years, which equates to almost 12,000 instances of take every day, nearly 500 takes every hour, more than 8 takes every minute for five years. NMFS's proposal includes authorizing the Navy to kill 186 marine mammals, subject more than 25 species to more than 11,000 instances of permanent hearing loss, lung injury, or other serious physiological harm, and subject almost 40 marine mammal species to millions of instances of temporary hearing loss over the life of the rule. Authorization of this amount of take would be unprecedented.[2] [2]Authorizing the Navy's activities would also likely result in greater take than predicted. The Navy's application to NMFS reflects a marked decline in its DEIS estimate of severe injury (e.g., permanent hearing loss and lung injury) and death after the application of a "post-model analysis" it derived for use in	The post-model analysis process was developed using the best available science and in coordination with NMFS, and is necessary to account for the mitigation and avoidance behavior. Relying solely on the output of the Navy Acoustic Effects Model presents an overestimate of acoustic impacts for higher order effects such as injury or mortality, for the following reasons: (1) Sensitive species (i.e., beaked whales and harbor porpoises) are modeled as if they would remain stationary and tolerate any very close anthropogenic encounters, although these species are known to avoid anthropogenic activity (see AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions). (2) Implementation of mitigation is not currently modeled; however, the Navy has developed mitigation measures in cooperation with NMFS that are considered effective at reducing environmental impacts while being operationally feasible (see AFTT Final EIS/OEIS Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring). (3) Animals are assumed to remain horizontally stationary in the model and tolerate any disturbing or potentially injurious sound exposure, although animals have been observed to avoid sound sources with high source levels

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
	its application. Unfortunately, as discussed in more detail below, the Navy's post-model analysis is fraught with problems ranging from unjustified assumptions regarding the "sightability" of different species using observation rates of marine mammals specialists from differently situated platforms in ideal conditions (e.g., not at night) to questionable and unsupported assumptions regarding marine mammal avoidance behavior.	(see AFTT Final EIS/OEIS Section 3.4.3.1.2.5, Behavioral Reactions). (4) The model estimates the potential for mortality based on very conservative criteria (see AFTT Final EIS/OEIS Section 3.4.3.1.4.1, Mortality and Injury from Explosions). With the implementation of proven mitigation and decades of historical information from conducting training and testing in the Study Area, the likelihood of mortality is very low. Additional discussion of the model-estimated impacts is in AFTT Final EIS/OEIS Section 3.4.3.1.5.4, Model Assumptions and Limitations. A comprehensive discussion of the Navy's acoustic impact analysis, including modeling and the post-model analysis, is in AFTT Final EIS/OEIS Section 3.4.3.1.5 (Quantitative Analysis), as well as in Section 6.1.5 (Quantitative Analysis), of the Navy's Request for Letter of Authorization submitted to NMFS (77 FR 60679). In addition to the information already contained within the AFTT EIS/OEIS and the Navy's Request for Letter of Authorization, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com.
O01-02	Indeed, NMFS' estimates represent a very significant decrease from the numbers originally presented in the Navy's DEIS, which were several times those presented here and included several thousand cases of lung injury. To justify the decrease, the agency cites certain corrections made by the Navy to its modeling, the potential for marine mammals to vacate the area upon exposure to harassing noise, and—perhaps most relevant—the ability of Navy lookouts to spot marine mammals in the water. Yet none of these factors, least of all the Navy's ineffective monitoring scheme, can account for the magnitude of the adjustment. Furthermore, since NMFS does not indicate how much of a reduction each factor represents, it is impossible for the public to fully comment on this important issue, rendering notice and comment deficient under the Administrative Procedure Act ("APA"). 5 U.S.C. § 553(b), (c); 5 U.S.C. § 706(2)(D).	A comprehensive discussion of the Navy's acoustic impact analysis, including modeling and the post-model analysis, is in Section 3.4.3.1.5 (Quantitative Analysis) of this EIS/OEIS. Furthermore, within NMFS Proposed Rule (78 FR 7050), NMFS refers to Section 6.1.5 (Quantitative Analysis) of the Navy's Request for Letter of Authorization submitted to NMFS (77 FR 60679) for additional details. This information is sufficient to notify the public of the post-modeling analysis and provide the public an opportunity to comment. In addition to the information already contained within the AFTT EIS/OEIS and the Navy's Request for Letter of Authorization, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com. This report demonstrates that the differences in predicted impacts due to the post-modeling analysis and the corrections in modeling the Proposed Action made after publication of the Draft EIS/OEIS were not substantial changes in the Proposed Action that will significantly affect the environment in a manner not already considered in the Draft EIS/OEIS.
O01-03	The take estimates NMFS presents in its Proposed Rule, although high, represent a significant reduction from those set forth in the Navy's DEIS, both in the lower numbers of Level B take and in the conversion of the majority of mortalities and lung injuries into non-injurious harm. Yet the agency provides	A summary of the current status of the Navy's Lookout effectiveness study and why the data cannot be used in the analysis has been added in Section 5.3.1.2.4, Effectiveness Assessment for Lookouts. A comprehensive discussion of the Navy's acoustic impact analysis, including modeling and the post-model analysis is in AFTT Final EIS/OEIS Section 3.4.3.1.5, Quantitative

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
	only summary explanations for these significant changes, pointing to three methodological differences—some corrections for prior modeling assumptions, a discount in some types of harm for animals fleeing the area, and incorporation of mitigation into the analysis—without specifying how each factor influenced the total. NMFS' failure to provide any specific information has prevented the public from effectively commenting on this significant change in the agencies' analysis, in contravention of the APA. 5 U.S.C. § 553(b), (c); 5 U.S.C. § 706(2)(D). Moreover, insofar as the Navy has provided any information on any of these factors, it tends to suggest that the agencies have grossly overstated the effectiveness of the Navy's primary mitigation measure. Both the DEIS and the consistency determinations submitted to the California and Hawaii state coastal authorities appear to use the species-specific g(0) factors used in professional marine mammal abundance surveys—primarily undertaken by NMFS biologists—as their basis of analysis for the Navy's safety zone mitigation. It should go without saying that the Navy's sighting effectiveness is likely to be much poorer than that of experienced biologists dedicated exclusively to marine mammal detection, operating under conditions aimed at maximizing sightings. Any reliance on survey data for this purpose would clearly be arbitrary and capricious. In any case, the extraordinary size of the reduction in estimated mortalities and lung injuries suggests that NMFS has overinflated one or another of the three discounting factors mentioned above.	Analysis. Furthermore, within NMFS' Proposed Rule (78 FR 7050), NMFS refers to Section 6.1.5 (Quantitative Analysis), of the Navy's Request for Letter of Authorization submitted to NMFS (77 FR 60679) for additional details. The assignment of mitigation effectiveness scores and the appropriateness of consideration of sightability using detection probability, g(0), when assessing the mitigation in the quantitative analysis of acoustic impacts is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures. In addition to the information already contained within the AFTT EIS/OEIS and the Navy's Request for Letter of Authorization, and in response to public comments, the Navy has prepared a technical report which describes the process for the post modeling analysis in further detail. This report is available at www.AFTTEIS.com. It should be noted that the estimates of acoustic impacts presented in the AFTT Draft EIS/OEIS did consider marine mammal avoidance of potentially injurious exposures to sonar and other active acoustic sources. The additional post-model analysis documented in the Navy's Request for Letter of Authorization and in this Final EIS/OEIS incorporates the following: (1) the reduction of higher-order exposures (mortality due to explosives and injury due to sonar and other active acoustic sources) due to likely avoidance of anthropogenic activity by sensitive species, (2) the potential for effective mitigation to reduce impacts, and (3) the reduction of PTS due to animal avoidance of multiple detonations, with any reduction in quantified impacts being added to the next highest category of impact in all cases (e.g., reductions in predicted PTS are added to the predicted TTS). Additionally, minor adjustments were made to the number of activities modeled to ensure the number of events modeled matched the number of training and testing events proposed by the Navy; these adjustments are reflected in the acoustic impacts quantified in the Navy's Request for Letter of Authorization and in this Final EIS/OEIS.

Table E-10: Responses to Comments on the Proposed Rule from Agencies and Non-Governmental Organizations (Continued)

Commenter Identifier	Comment	Draft Response
O02	CSI requests that the AFTT FEIS include the current status, database, conclusions and recommended improvements of the Navy's Lookout Effectiveness Study. The Navy and the NMFS know there is no way a naval vessel's lookouts can reliably and consistently locate a cetacean or sea turtle at a kilometer, in fog, darkness, and moderate seas, especially while the vessel is maneuvering at high speed. Since 1996, when the one kilometer radius was adopted because it was close to the 180 dB isopleth of the SURTASS LFA, the Navy has made believe that visual mitigation was adequate. If the revised acoustic model was an effort to be more realistic about impacts then why not be realistic about the reliance on lookouts?	A summary of the current status of the Navy's Lookout effectiveness study and why the data cannot be used in the analysis has been added in Section 5.3.1.2.4, Effectiveness Assessment for Lookouts. The assignment of mitigation effectiveness scores and the appropriateness of consideration of sightability using detection probability, g(0), when assessing the mitigation in the quantitative analysis of acoustic impacts is discussed in AFTT Final EIS/OEIS Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures. Additional discussion regarding consideration of mitigation in the quantitative analysis of sonar and other active acoustic sources is provided in AFTT Final EIS/OEIS Section 3.4.3.1.8.2, Avoidance Behavior and Mitigation Measures as Applied to Sonar and Active Acoustic Sources. Additional discussion regarding consideration of mitigation in the quantitative analysis of explosives is provided in AFTT Final EIS/OEIS Section 3.4.3.1.9.2, Avoidance Behavior and Mitigation Measures as Applied to Explosives.

E.4 FINAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The public has the opportunity to review the Navy's responses to their comments when the Final EIS/OEIS is available for review. All public comments are considered by the decision maker before making a decision.

APPENDIX F

TRAINING AND TESTING ACTIVITIES MATRICES

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APPENDIX F TRAINING AND TESTING ACTIVITIES MATRICES

F.1 STRESSORS ASSOCIATED WITH NAVY ACTIVITIES BY TRAINING ACTIVITY

Table F-1: Stressors by Training Activity

Atlantic Fleet Training Activity	Biological Resources																	Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors		Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials		Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-AIR WARFARE (AAW)																															
Air Combat Maneuver (ACM)						✓				✓								✓	✓					✓			✓	✓			
Air Defense Exercise (ADEX)						✓	✓			✓	✓							✓	✓								✓	✓			
Gunnery Exercise (Air-to-Air) – Medium-Caliber						✓				✓		✓				✓		✓	✓		✓				✓	✓	✓	✓			✓
Missile Exercise (Air-to-Air)				✓		✓				✓		✓			✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
Gunnery Exercise (Surface-to-Air) – Large-Caliber				✓	✓	✓	✓			✓	✓	✓				✓		✓	✓	✓	✓				✓	✓	✓	✓			✓
Gunnery Exercise (Surface-to-Air) – Medium-Caliber				✓	✓	✓	✓			✓	✓	✓				✓		✓	✓		✓				✓	✓	✓	✓			✓
Missile Exercise (Surface-to-Air)				✓	✓		✓			✓	✓	✓				✓		✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
AMPHIBIOUS WARFARE (AMW)																															
Naval Surface Fire Support Exercise – Land-Based Target					✓		✓				✓						✓	✓	✓						✓	✓					✓
Naval Surface Fire Support Exercise – At Sea			✓		✓		✓				✓	✓				✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Marine Expeditionary Unit (MEU) Certification Exercise (CERTEX)**						✓	✓			✓	✓						✓	✓	✓						✓	✓	✓				✓
Amphibious Assault						✓	✓			✓	✓						✓	✓	✓						✓	✓	✓	✓			✓
Amphibious Raid/Humanitarian Assistance Operations							✓			✓	✓						✓	✓	✓						✓	✓	✓	✓			✓
STRIKE WARFARE (STW)																															
High-Speed Anti-Radiation Missile Exercise (Air-to-Surface) (HARMEX [A-S])				✓		✓	✓			✓	✓	✓				✓		✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓

Note: ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-1: Stressors by Training Activity (Continued)

Atlantic Fleet Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SURFACE WARFARE (ASUW)																														
Maritime Security Operations						✓	✓			✓	✓	✓				✓	✓	✓							✓	✓	✓			✓
Maritime Security Operations – Anti-Swimmer Grenades			✓				✓				✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Surface-to-Surface) Ship – Small-Caliber							✓				✓	✓				✓	✓	✓		✓					✓	✓	✓			✓
Gunnery Exercise (Surface-to-Surface) Ship – Medium-Caliber			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Surface-to-Surface) Ship – Large-Caliber			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Surface-to-Surface) Boat – Small-Caliber							✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise (Surface-to-Surface) Boat – Medium-Caliber			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Missile Exercise (Surface-to-Surface)			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Air-to-Surface) – Small-Caliber						✓				✓		✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise (Air-to-Surface) – Medium-Caliber			✓			✓				✓	✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Missile Exercise (Air-to-Surface) Rocket			✓			✓				✓	✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Missile Exercise (Air-to-Surface)			✓			✓				✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Bombing Exercise (Air-to-Surface)			✓			✓				✓		✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Laser Targeting						✓	✓			✓	✓						✓	✓							✓	✓	✓		✓	✓
Sinking Exercise (SINKEX)			✓		✓	✓	✓			✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
ANTI-SUBMARINE WARFARE (ASW)																														
Tracking Exercise/Torpedo Exercise – Submarine	✓					✓	✓			✓	✓	✓		✓						✓				✓		✓	✓	✓		✓
Tracking Exercise/Torpedo Exercise – Surface	✓					✓	✓				✓	✓					✓	✓		✓				✓	✓	✓	✓	✓		✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-1: Stressors by Training Activity (Continued)

Atlantic Fleet Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SUBMARINE WARFARE (ASW) (Continued)																														
Tracking Exercise/Torpedo Exercise – Helicopter	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys	✓		✓			✓				✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tactical Development	✓	✓				✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
Integrated Anti-Submarine Warfare Course (IAC)	✓	✓				✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
Group Sail	✓	✓	✓			✓	✓			✓	✓	✓			✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Submarine Command Course (SCC) Operations	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
ASW for Composite Training Unit Exercise (COMPTUEX)	✓	✓	✓			✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
ASW for Joint Task Force Exercise (JTFEX)/Sustainment Exercise (SUSTAINEX)	✓	✓	✓			✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
ELECTRONIC WARFARE (EW)																														
Electronic Warfare Operations (EW Ops)						✓	✓			✓	✓						✓	✓							✓	✓	✓			✓
Counter Targeting Flare Exercise						✓				✓						✓	✓	✓		✓		✓		✓	✓	✓	✓			✓
Counter Targeting Chaff Exercise – Ship							✓				✓					✓	✓	✓		✓		✓			✓	✓				✓
Counter Targeting Chaff Exercise – Aircraft						✓				✓						✓	✓	✓		✓		✓				✓				✓
MINE WARFARE (MIW)																														
Mine Countermeasures Exercise (MCM) – Ship Sonar	✓						✓				✓		✓				✓	✓							✓			✓		✓
Mine Neutralization – Explosive Ordnance Disposal (EOD)			✓			✓	✓			✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-1: Stressors by Training Activity (Continued)

Atlantic Fleet Training Activity	Biological Resources															Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors										
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
MINE WARFARE (MIW) (Continued)																													
Underwater Mine Countermeasures (UMCM) Raise, Tow, Beach, and Exploitation Operations**						✓	✓			✓	✓		✓				✓	✓						✓	✓	✓	✓			✓
Airborne Mine Countermeasures (AMCM) – Towed Mine Neutralization						✓	✓	✓		✓	✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
Airborne Mine Countermeasures (AMCM) – Mine Detection	✓					✓	✓			✓	✓		✓				✓	✓						✓	✓	✓	✓	✓	✓	✓
Mine Countermeasures (MCM) – Mine Neutralization – Small and Medium-Caliber					✓	✓	✓			✓	✓	✓	✓			✓	✓	✓		✓				✓	✓	✓	✓		✓	✓
Mine Countermeasures (MCM) – Mine Neutralization – Remotely Operated Vehicle			✓			✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Mine Laying**						✓				✓		✓					✓	✓		✓				✓	✓	✓	✓			✓
Coordinated Unit Level Helicopter Airborne Mine Countermeasure Exercises**	✓					✓		✓		✓	✓		✓	✓			✓	✓		✓				✓	✓	✓	✓	✓		✓
Civilian Port Defense**	✓		✓			✓	✓	✓		✓	✓		✓				✓	✓	✓				✓	✓	✓	✓	✓	✓		✓
OTHER TRAINING EXERCISES																													
Search and Rescue (SAR)						✓	✓			✓	✓						✓	✓						✓	✓	✓	✓			✓
Precision Anchoring							✓				✓		✓				✓	✓						✓	✓	✓	✓			✓
Elevated Causeway System (ELCAS)**		✓																										✓		
Submarine Navigation	✓										✓																✓	✓		✓
Submarine Under Ice Certification**	✓										✓																✓	✓		✓
Surface Ship Object Detection	✓						✓				✓													✓		✓	✓	✓		✓
Surface Ship Sonar Maintenance (in OPAREAs and Ports)	✓						✓				✓													✓		✓	✓	✓		✓
Submarine Sonar Maintenance (in OPAREAs and Ports)	✓										✓													✓			✓	✓		✓
Undersea Warfare Training Range	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓		✓					✓			✓

Note: ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

F.2 STRESSORS ASSOCIATED WITH NAVY ACTIVITIES BY TESTING ACTIVITY

Table F-2: Stressors by Testing Activity

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Naval Air Systems Command																														
ANTI-AIR WARFARE (AAW)																														
Air Combat Maneuver (ACM)						✓				✓							✓	✓								✓	✓			✓
Air Platform/Vehicle Test						✓				✓		✓					✓	✓		✓						✓	✓		✓	✓
Air Platform Weapons Integration Test						✓				✓		✓				✓	✓	✓	✓	✓					✓	✓	✓			✓
Air-to-Air Weapons System Test						✓				✓		✓				✓	✓	✓		✓				✓		✓	✓			✓
Air-to-Air Missile Test						✓				✓		✓			✓	✓	✓	✓		✓				✓	✓	✓	✓			✓
Air-to-Air-Gunnery Test – Medium-Caliber					✓	✓				✓		✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Intelligence, Surveillance, and Reconnaissance Test						✓				✓							✓	✓								✓	✓			✓
ANTI-SURFACE WARFARE (ASUW)																														
Air-to-Surface Missile Test			✓			✓				✓		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Air-to-Surface Gunnery Test			✓		✓	✓				✓		✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Rocket Test			✓			✓				✓		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air-to-Surface Bombing Test						✓				✓		✓					✓	✓		✓				✓	✓	✓	✓			✓
Laser Targeting Test						✓				✓							✓	✓								✓	✓		✓	✓
High Energy Laser Weapons Test						✓			✓	✓	✓					✓	✓	✓				✓		✓	✓	✓	✓		✓	✓
ELECTRONIC WARFARE (EW)																														
Electronic System Evaluation						✓				✓							✓	✓								✓				✓
Chaff Test						✓				✓						✓	✓	✓				✓				✓				✓
Flare Test						✓				✓						✓	✓	✓				✓				✓				✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SUBMARINE WARFARE (ASW)																														
ASW Torpedo Test	✓					✓				✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Kilo Dip	✓					✓				✓							✓	✓							✓	✓	✓	✓		✓
Sonobuoy Lot Acceptance Test**	✓		✓			✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
ASW Tracking Test – Helicopter	✓		✓			✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
ASW Tracking Test – Maritime Patrol Aircraft	✓		✓			✓				✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
MINE WARFARE (MIW)																														
Airborne Mine Neutralization Systems (AMNS)Test			✓			✓				✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Airborne Projectile-Based Mine Clearance System			✓			✓				✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Airborne Towed Minesweeping Test			✓			✓		✓		✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Airborne Towed Minehunting Sonar Test	✓					✓				✓							✓	✓							✓	✓	✓	✓		✓
Airborne Laser-based Mine Detection System Test						✓				✓							✓	✓							✓	✓	✓		✓	✓
Mine Laying Test						✓				✓			✓				✓	✓		✓				✓	✓	✓	✓			✓
OTHER TESTING ACTIVITIES																														
Test and Evaluation (T&E) Catapult Launch						✓	✓			✓	✓						✓	✓							✓	✓	✓			✓
Air Platform Shipboard Integration Test						✓				✓							✓	✓							✓	✓	✓			✓
Shipboard Electronic Systems Evaluation						✓				✓							✓	✓								✓	✓			✓
Maritime Security						✓	✓			✓	✓						✓	✓								✓	✓			✓

Note: ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Naval Sea Systems Command																														
SHIP CONSTRUCTION AND MAINTENANCE																														
NEW SHIP CONSTRUCTION																														
Surface Combatant Sea Trials – Pierside Sonar Testing**	✓	✓																									✓			
Surface Combatant Sea Trials – Propulsion Testing							✓				✓						✓	✓							✓		✓			✓
Surface Combatant Sea Trials – Gun Testing					✓		✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Surface Combatant Sea Trials – Missile Testing				✓	✓		✓			✓	✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Surface Combatant Sea Trials – Decoy Testing							✓				✓	✓				✓	✓	✓				✓			✓		✓			✓
Surface Combatant Sea Trials – Surface Warfare Testing- Large-Caliber					✓		✓				✓	✓					✓	✓		✓				✓	✓	✓	✓			✓
Surface Combatant Sea Trials – Anti-Submarine Warfare Testing	✓	✓					✓				✓						✓	✓		✓	✓	✓			✓	✓	✓	✓		✓
Aircraft Carrier Sea Trials – Propulsion Testing**							✓				✓						✓	✓							✓	✓	✓			✓
Aircraft Carrier Sea Trials – Gun Testing – Small-Caliber**							✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Aircraft Carrier Sea Trials – Gun Testing – Medium-Caliber**			✓		✓	✓	✓			✓	✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Aircraft Carrier Sea Trials – Missile Testing**				✓			✓			✓	✓	✓				✓	✓	✓		✓			✓	✓	✓	✓	✓	✓		✓
Aircraft Carrier Sea Trials – Bomb Testing**						✓	✓			✓	✓	✓					✓	✓		✓				✓	✓	✓	✓			
Submarine Sea Trials – Pierside Sonar Testing**	✓	✓																									✓			
Submarine Sea Trials – Propulsion Testing**											✓																✓			✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Naval Sea Systems Command (Continued)																														
SHIP CONSTRUCTION AND MAINTENANCE (Continued)																														
NEW SHIP CONSTRUCTION (Continued)																														
Submarine Sea Trials – Weapons System Testing**											✓																✓			✓
Submarine Sea Trials – Anti-Submarine Warfare Testing**	✓	✓									✓											✓					✓	✓		✓
Other Class Ship Sea Trials – Propulsion Testing							✓				✓						✓	✓							✓	✓	✓			✓
Other Class Ship Sea Trials – Gun Testing – Small-Caliber							✓				✓	✓				✓	✓	✓		✓					✓	✓	✓			✓
ASW Mission Package Testing**	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
SUW Mission Package Testing – Gun Testing – Small-Caliber**							✓				✓	✓				✓	✓	✓		✓					✓	✓	✓			✓
SUW Mission Package Testing – Gun Testing – Medium-Caliber**			✓		✓		✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓	✓		✓
SUW Mission Package Testing – Gun Testing – Large-Caliber**				✓	✓		✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓	✓		✓
SUW Mission Package Testing – Missile/Rocket Testing**			✓		✓	✓	✓			✓	✓	✓				✓	✓	✓		✓			✓	✓	✓	✓	✓	✓		✓
MCM Mission Package Testing**	✓		✓			✓	✓			✓	✓	✓				✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
Post-Homeporting Testing (All Classes)**							✓				✓						✓	✓							✓		✓			✓
SHOCK TRIALS																														
Aircraft Carrier Full Ship Shock Trial**			✓				✓				✓					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓
DDG 1000 Zumwalt Class Destroyer Full Ship Shock Trial**			✓				✓				✓					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓
Littoral Combat Ship Full Ship Shock Trial**			✓				✓				✓					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓

Note: ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Naval Sea Systems Command (Continued)																														
SHIP CONSTRUCTION AND MAINTENANCE (Continued)																														
LIFECYCLE ACTIVITIES																														
Ship Signature Testing**							✓				✓						✓	✓									✓			✓
Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)**	✓	✓					✓				✓						✓	✓									✓	✓		✓
Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)**	✓	✓									✓																✓	✓		✓
Combat System Ship Qualification Trial (CSSQT) – In-port Maintenance Period**	✓																											✓		
Combat System Ship Qualification Trial (CSSQT) – Air Defense (AD)**				✓	✓		✓			✓	✓	✓				✓	✓	✓		✓		✓		✓		✓	✓	✓			✓
Combat System Ship Qualification Trial (CSSQT) – Surface Warfare (SUW)**				✓	✓		✓				✓	✓				✓	✓	✓		✓		✓		✓		✓	✓	✓			✓
Combat System Ship Qualification Trial (CSSQT) – Undersea Warfare (USW)**	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓		✓		✓		✓	✓	✓	✓		✓
NAVSEA RANGE ACTIVITIES																														
Naval Surface Warfare Center, Panama City Division																														
Air Operations*						✓				✓							✓	✓							✓	✓	✓			✓
Surface Operations*							✓				✓						✓	✓							✓	✓	✓			✓
Subsurface Operations*							✓				✓		✓											✓		✓	✓			✓
Sonar Operations*	✓						✓				✓						✓	✓								✓	✓	✓		✓
Electromagnetic Operations*						✓	✓	✓		✓	✓						✓	✓								✓	✓			✓
Laser Operations*																												✓		
Ordnance Operations*			✓			✓	✓			✓	✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓				✓

Note: *No Action Alternative only. ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
NAVSEA RANGE ACTIVITIES (Continued)																														
Naval Surface Warfare Center, Panama City Division (Continued)																														
Projectile Firing**					✓		✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Unmanned Underwater Vehicles Demonstrations**	✓						✓				✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
Mine Detection and Classification Testing**	✓					✓	✓			✓	✓						✓	✓						✓	✓	✓	✓	✓	✓	✓
Mine Countermeasure/Neutralization Testing**			✓			✓	✓	✓		✓	✓	✓				✓	✓	✓		✓			✓	✓	✓	✓	✓	✓		✓
Stationary Source Testing**	✓	✓					✓				✓		✓				✓	✓						✓		✓	✓	✓		✓
Special Warfare Testing**		✓									✓																✓	✓		✓
Unmanned Underwater Vehicle (UUV) Testing**	✓						✓				✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
Ordnance Testing – Line Charge Testing**			✓				✓				✓					✓			✓				✓	✓	✓	✓	✓	✓		✓
Ordnance Testing – Gun Testing – Small-Caliber**						✓	✓			✓	✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Ordnance Testing – Gun Testing – Medium-Caliber**					✓	✓	✓			✓	✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Ordnance Testing – Gun Testing – Large-Caliber**			✓		✓	✓	✓			✓	✓	✓				✓	✓	✓		✓			✓	✓	✓	✓	✓	✓		✓
Naval Undersea Warfare Center Division, Newport																														
Launcher Testing							✓				✓					✓	✓	✓		✓		✓		✓	✓	✓	✓			✓
Torpedo Testing	✓						✓				✓			✓			✓	✓		✓		✓			✓	✓	✓	✓		✓
Towed Equipment Testing	✓						✓				✓						✓	✓							✓	✓	✓	✓		✓

Note: * No Action Alternative only. ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
NAVSEA RANGE ACTIVITIES (Continued)																														
Naval Undersea Warfare Center Division, Newport (Continued)																														
Unmanned Underwater Vehicle (UUV) Testing	✓						✓				✓						✓	✓							✓	✓	✓	✓		✓
Unmanned Surface Vehicle (USV) Testing							✓				✓						✓	✓							✓	✓	✓			✓
Unmanned Aerial System Testing							✓			✓	✓						✓	✓							✓	✓	✓			✓
Semi-Stationary Equipment Testing	✓	✓					✓				✓						✓	✓							✓	✓	✓	✓		✓
Unmanned Underwater Vehicles Demonstrations	✓						✓				✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
Pierside Integrated Swimmer Defense	✓	✓											✓											✓		✓		✓		✓
South Florida Ocean Measurement Facility Testing Range																														
Signature Analysis Activities**	✓						✓				✓						✓	✓								✓	✓	✓		✓
Mine Testing Activities**	✓					✓	✓	✓		✓	✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
Surface Testing Activities**	✓						✓				✓						✓	✓							✓	✓	✓	✓		✓
Subsurface Testing Activities**							✓				✓		✓											✓		✓	✓			✓
Unmanned Underwater Vehicle Demonstrations**	✓						✓				✓		✓				✓	✓						✓	✓	✓	✓	✓		✓
ACTIVITIES AT LOCATIONS OUTSIDE OF NAVAL UNDERSEA WARFARE TESTING RANGES																														
ANTI-SURFACE WARFARE/ANTI-SUBMARINE WARFARE TESTING																														
Missile Testing**					✓		✓			✓	✓	✓					✓	✓		✓	✓			✓	✓	✓	✓			✓
Kinetic Energy Weapon Testing**					✓		✓				✓	✓					✓	✓		✓	✓			✓	✓	✓	✓			✓
Electronic Warfare Testing**											✓																✓			✓
Torpedo (Non-Explosive) Testing	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ACTIVITIES AT LOCATIONS OUTSIDE OF NAVAL UNDERSEA WARFARE TESTING RANGES (Continued)																														
ANTI-SURFACE WARFARE/ANTI-SUBMARINE WARFARE TESTING (Continued)																														
Torpedo (Explosive) Testing	✓		✓			✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Countermeasure Testing	✓	✓					✓				✓				✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓		✓
Pierside Sonar Testing	✓																											✓		
At-sea Sonar Testing	✓	✓					✓				✓	✓					✓	✓								✓	✓	✓		✓
MINE WARFARE TESTING																														
Mine Detection and Classification Testing**	✓					✓	✓			✓	✓						✓	✓							✓	✓	✓	✓		✓
Mine Countermeasure/Neutralization Testing**	✓		✓			✓	✓	✓		✓	✓			✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																														
Pierside Integrated Swimmer Defense	✓	✓					✓				✓		✓											✓		✓	✓	✓		✓
Shipboard Protection Systems Testing							✓				✓	✓				✓	✓	✓		✓						✓	✓	✓		✓
Chemical/Biological Simulant Testing						✓	✓			✓	✓						✓	✓			✓	✓			✓	✓	✓			✓
UNMANNED VEHICLE TESTING																														
Underwater Deployed Unmanned Aerial System Testing**										✓	✓	✓								✓				✓	✓		✓			✓
Unmanned Vehicle Development and Payload Testing**	✓						✓				✓		✓				✓	✓						✓	✓	✓	✓	✓		✓

Note: ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

Table F-2: Stressors by Testing Activity (Continued)

Research, Development, Test, and Evaluation Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ACTIVITIES AT LOCATIONS OUTSIDE OF NAVAL UNDERSEA WARFARE TESTING RANGES (Continued)																														
OTHER TESTING (Continued)																														
Special Warfare	✓	✓					✓				✓						✓	✓								✓	✓	✓		✓
Radio-Frequency Communications Testing**							✓				✓						✓	✓								✓	✓			✓
Hydrodynamic Testing**											✓																✓			✓
At-Sea Explosive Testing**			✓													✓			✓				✓		✓					

Note: ** Alternative 1 and Alternative 2 only; 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

F.3 STRESSORS ASSOCIATED WITH NAVY ACTIVITIES BY RESOURCE

Table F-3: Stressors by Resource

Stressors vs. Resources		Biological Resources															Physical Resources						Human Resources							
		Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
		Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosives	In-Air Explosives	Weapons Firing Noise	Aircraft Noise	Vessel Noise	Electromagnetic Devices	High Energy Lasers	Aircraft and Aerial Target Strikes	Vessel and In-Water Device Strikes	Military Expended Materials	Seafloor Devices	Fiber Optic Cables and Guidance Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosion Byproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics [1,4]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Physical	Sediments and Water Quality																			✓	✓	✓	✓								
	Air Quality																	✓	✓												
Biological	Marine Habitats			✓								✓	✓	✓																	
	Marine Mammals	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Sea Turtles and Other Marine Reptiles	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Birds	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓	✓	✓												
	Marine Vegetation			✓								✓	✓	✓						✓	✓	✓	✓								
	Marine Invertebrates	✓	✓	✓					✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Fish	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
Human	Cultural Resources																							✓	✓						
	Socioeconomic Resources																									✓	✓	✓			
	Public Health and Safety																												✓	✓	✓

Note: 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor; 4: Acoustics Stressor only includes underwater explosives and airborne sonic booms

APPENDIX G

STATISTICAL PROBABILITY ANALYSIS FOR ESTIMATING DIRECT STRIKE IMPACT AND NUMBER OF POTENTIAL EXPOSURES

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APPENDIX G STATISTICAL PROBABILITY ANALYSIS FOR ESTIMATING DIRECT STRIKE IMPACT AND NUMBER OF POTENTIAL EXPOSURES

This appendix discusses the methods and results for calculating the probability of a direct strike of an animal from any military items from the proposed training and testing activities falling toward (or directed at) the sea surface. For the purposes of this appendix, military items include non-explosive practice munitions, sonobuoys, acoustic countermeasures, targets, and high-energy lasers. Only marine mammals and sea turtles will be analyzed using these methods because animal densities are necessary to complete the calculations, and density estimates are currently only available for marine mammals and sea turtles within the Study Area. Furthermore, the analysis conducted here does not account for explosive munitions because impacts from explosives are analyzed within the Navy Acoustic Effects Model.

G.1 DIRECT IMPACT ANALYSIS

A statistical probability was calculated to estimate the impact probability (P) and number of exposures (T) associated with direct impact of military items on marine animals on the sea surface within the specified training or testing area (R) in which the activities are occurring. The statistical probability analysis is based on probability theory and modified Venn diagrams with rectangular "footprint" areas for the individual animal (A) and total impact (I) inscribed inside the training or testing area (R). The analysis assumes: (1) that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend the majority of their time underwater, and (2) that the animals are stationary, which does not account for any movement or any potential avoidance of the training or testing activity.

1. A = length*width, where the individual animal's width (breadth) is assumed to be 20 percent of its length for marine mammals and 112 percent of its length for sea turtles. This product for A is multiplied by the number of animals N_a in the specified training or testing area (i.e., product of the highest average seasonal animal density [D] and training or testing area [R]: $N_a = D*R$) to obtain the total animal footprint area ($A*N_a = A*D*R$) in the training or testing area. As a worst case scenario, the total animal footprint area is calculated for the species with the highest average seasonal density in the training or testing area with the highest use of military items within the entire Study Area.

2. $I = N_{mun}$*length*diameter, where N_{mun} = total annual number of military items for each type, and "length" and "diameter" refer to the individual military equipment dimensions. For each type, the individual impact footprint area is multiplied by the total annual number of military items to obtain the type-specific impact footprint area ($I = N_{mun}$*length*diameter). Each training or testing activity uses one or more different types of military items, each with a specific number and dimensions, and several training and testing activities occur in a given year. When integrating over the number of military items types for the given activity (and then over the number of activities in a year), these calculations are repeated (accounting for differences in dimensions and numbers) for all military items types used, to obtain the type-specific impact footprint area (I). These impact footprint areas are summed over all military items types for the given activity, and then summed (integrated) over all activities to obtain the total impact footprint area resulting from all activities occurring in the training or testing area in a given year. As a worst case scenario, the total impact footprint area is calculated for the training or testing area with the highest use of military items within the entire Study Area.

Though marine mammals and sea turtles are not randomly distributed in the environment, a random point calculation was chosen due to the intensive data needs that would be required for a calculation that incorporated more detailed information on an animal's or military item's spatial occurrence.

The analysis is expected to provide an overestimation of the probability of a strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest seasonal density, (2) it does not take into account the possibility that an animal may avoid military activities, (3) it does not take into account the possibility that an animal may not be at the water surface, (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets, and so only a very small portion of those projectiles that miss the target would hit the water with their maximum velocity and force, and (5) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures.

The likelihood of an impact is calculated as the probability (P) that the animal footprint (A) and the impact footprint (I) will intersect within the training or testing area (R). This is calculated as the area ratio A/R or I/R, respectively. Note that A (referring to an **individual** animal footprint) and I (referring to the impact footprint resulting from the **total** number of military items N_{mun}) are the relevant quantities used in the following calculations of single-animal impact probability [P], which is then multiplied by the number of animals to obtain the number of exposures (T). The probability that the random point in the training or testing area is within both types of footprints (i.e., A and I) depends on the degree of overlap of A and I. The probability that I overlaps A is calculated by adding a buffer distance around A based on one-half of the impact area (i.e., 0.5*I), such that an impact (center) occurring anywhere within the combined (overlapping) area would impact the animal. Thus, if L_i and W_i are the length and width of the impact footprint such that $L_i*W_i = 0.5*I$ and $W_i/L_i = L_a/W_a$ (i.e., similar geometry between the animal footprint and impact footprint), and if L_a and W_a are the length and width (breadth) of the individual animal such that $L_a*W_a = A$ (= individual animal footprint area), then, assuming a purely static, rectangular scenario (Scenario 1), the total area $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$, and the buffer area $A_{buffer} = A_{tot} - L_a*W_a$.

Four scenarios were examined with respect to defining and setting up the overlapping combined areas of A and I:

1. **Scenario 1**: Purely static, rectangular scenario. Impact is assumed to be static (i.e., direct impact effects only; non-dynamic; no explosions or scattering of military items after the initial impact). Hence the impact footprint area (I) is assumed to be rectangular and given by the product of military items length and width (multiplied by the number of military items).
   $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.

2. **Scenario 2**: Dynamic scenario with end-on collision, in which the length of the impact footprint (Li) is enhanced by Rn = 5 military items lengths to reflect forward momentum.
   $A_{tot} = (L_a + (1 + R_n)*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.

3. **Scenario 3**: Dynamic scenario with broadside collision, in which the width of the impact footprint (W_i) is enhanced by R_n = 5 military items lengths to reflect forward momentum.
   $A_{tot} = (L_a + 2*W_i)*(W_a + (1 + R_n)*L_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.

4. **Scenario 4**: Purely static, radial scenario, in which the rectangular animal and impact footprints are replaced with circular footprints while conserving area. Define the radius (R_a) of the circular

individual animal footprint such that $\pi*R_a^2 = L_a*W_a$, and define the radius (R_i) of the circular impact footprint such that $\pi*R_i^2 = 0.5*L_i*W_i = 0.5*I$. Then $A_{tot} = \pi*(R_a + R_i)^2$ and $A_{buffer} = A_{tot} - \pi*R_a^2$ (where $\pi = 3.1415927$).

Static impacts (Scenarios 1 and 4) assume no additional areal coverage effects of scattered military items beyond the initial impact. For dynamic impacts (Scenarios 2 and 3), the distance of any scattered military items must be considered by increasing the length (Scenario 2) or width (Scenario 3), depending on orientation (broadside versus end-on collision), of the impact footprint to account for the forward horizontal momentum of the falling object. Forward momentum typically accounts for five object lengths, resulting in a corresponding increase in impact area. Significantly different values may result from these two types of orientation. Both of these types of collision conditions can be calculated each with 50 percent likelihood (i.e., equal weighting between Scenarios 2 and 3, to average these potentially different values).

Impact probability P is the probability of impacting one animal with the given number, type, and dimensions of all military items used in training or testing activities occurring in the area per year, and is given by the ratio of total area (A_{tot}) to training or testing area (R): $P = A_{tot}/R$. Number of exposures is $T = N*P = N*A_{tot}/R$, where N = number of animals in the training or testing area per year (given as the product of the animal density [D] and range size [R]). Thus, $N = D*R$ and hence $T = N*P = N*A_{tot}/R = D*A_{tot}$. Using this procedure, P and T were calculated for each of the four scenarios, for Endangered Species Act (ESA)-listed marine mammals and the marine mammal and sea turtle species with the highest average seasonal density (used as the annual density value) and for each military item type. The scenario -specific P and T values were averaged over the four scenarios (using equal weighting) to obtain a single scenario -averaged annual estimate of P and T.

G.2 PARAMETERS FOR ANALYSIS

Impact probabilities (P) and number of exposures (T) were estimated by the analysis for the following parameters:

1. **Three proposed alternatives**: No Action Alternative, Alternative 1, and Alternative 2. Animal densities, animal dimensions, and military item dimensions are the same for the three alternatives.

2. **Two Training or Testing Areas**: Virginia Capes (VACAPES) and Jacksonville (JAX) Range Complexes. Areas are 94,996 kilometers $(km)^2$ and 172,024 km^2, respectively. These two training areas were chosen because they constitute the areas with the highest estimated numbers and concentrations of military expended materials for each alternative, and would, thus, provide a reasonable comparison for all other areas with fewer expended materials.

3. **The following types of munitions or other items**:

    a) **Small-caliber projectiles:** up to and including .50 caliber rounds
    b) **Medium-caliber projectiles:** larger than .50 caliber rounds but smaller than 57 millimeters (mm) projectiles
    c) **Large-caliber projectiles:** includes projectiles greater than or equal to a 57 mm projectile
    d) **Missiles:** includes rockets and jet-propelled munitions
    e) **Bombs:** Non-explosive practice bombs and mine shapes, ranging from 10 to 2000 lbs
    f) **Torpedoes:** includes aircraft deployed torpedoes

g) **Sonobuoys:** includes aircraft deployed sonobuoys
h) **Targets:** includes airborne, surface, and subsurface targets, as well as mine shapes
i) **Lightweight torpedo accessories:** includes all accessories that are dropped along with the torpedo (nose cap, air stabilizer, etc.)
j) **Anchor blocks:** includes blocks used to anchor mine shapes to the seafloor
k) **Acoustic countermeasures:** includes aircraft deployed acoustic countermeasures
l) **High Energy Lasers:** includes high energy laser weapons that are directed at a surface target

4. **Animal species of interest:** the six species of Endangered Species Act (ESA)-listed marine mammals and the non-ESA listed marine mammal species with the highest average seasonal density in the training and testing areas of interest. The sea turtle species with the highest average seasonal density in the training and testing areas of interest.

G.3 INPUT DATA

Input data for the direct strike analysis include animal species likely to be in the area and military items proposed for use under each of the three alternatives. Animal species data include: (1) species ID and status (i.e., threatened, endangered, or neither), (2) highest average seasonal density estimate for the species of interest, and (3) adult animal dimensions (length and width) for the species with the highest density. The animal's dimensions are used to calculate individual animal footprint areas (A = length*width), and animal densities are used to calculate the number of exposures (T) from the impact probability (P): T = N*P. Military items data include: (1) military items category (e.g., projectile, bomb, rocket, target), (2) military items dimensions (length and width), and (3) total number of military items used annually.

Military items input data, specifically the quantity (e.g., numbers of guns, bombs, and rockets), are different in magnitude among the three proposed alternatives (No Action Alternative, Alternative 1, and Alternative 2). All animal species input data, the military items identification and category, and military items dimensions are the same for the three alternatives, only the quantities (i.e., total number of military items) are different.

G.4 OUTPUT DATA

Estimates of impact probability (P) and number of exposures (T) for a given species of interest were made for the specified training or testing area with the highest annual number of military items used for each of the three alternatives. The calculations derived P and T from the highest annual number of military items used in the Study Area for the given alternative. Differences in P and T among the alternatives arise from different numbers of events (and therefore military items) for the three alternatives.

Results for marine mammals and sea turtles are presented in Tables G-1 through G-4.

Table G-1: Probability of a High Energy Laser Strike for Representative Marine Mammal Species by Alternative

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area			
VACAPES Range Complex			
Species	Testing		
	No Action	Alternative 1	Alternative 2
North Atlantic Right Whale	0.00%	0.00%	0.00%
Humpback Whale	0.00%	0.00%	0.00%
Sei Whale	0.00%	0.00%	0.00%
Fin Whale	0.00%	0.00%	0.00%
Blue Whale	0.00%	0.00%	0.00%
Sperm Whale	0.00%	0.00%	0.00%
Atlantic Spotted Dolphin	0.00%	0.03%	0.03%

VACAPES: Virginia Capes Range Complex

Table G-2: Probability of a High Energy Laser Strike for a Representative Sea Turtle Species by Alternative

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area			
VACAPES Range Complex			
Species	Testing		
	No Action	Alternative 1	Alternative 2
Loggerhead Sea Turtle	0.00%	0.01%	0.01%

VACAPES: Virginia Capes Range Complex

Table G-3: Probability of a Military Expended Material Strike for Representative Marine Mammal Species by Area and Alternative

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
VACAPES Range Complex						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
North Atlantic Right Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Humpback Whale	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%
Sei Whale	0.02%	0.05%	0.05%	0.04%	0.06%	0.06%
Fin Whale	0.01%	0.03%	0.03%	0.03%	0.04%	0.05%
Blue Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sperm Whale	0.08%	0.18%	0.18%	0.16%	0.23%	0.25%
Atlantic Spotted Dolphin	1.84%	4.42%	4.42%	3.76%	5.69%	6.01%
Southeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
JAX Range Complex						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
North Atlantic Right Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Humpback Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sei Whale	0.01%	0.02%	0.02%	0.00%	0.01%	0.01%
Fin Whale	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
Blue Whale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sperm Whale	0.01%	0.02%	0.02%	0.00%	0.01%	0.01%
Atlantic Spotted Dolphin	0.45%	0.94%	0.94%	0.15%	0.25%	0.28%

JAX: Jacksonville Range Complex; VACAPES: Virginia Capes Range Complex

Table G-4: Probability of a Military Expended Material Strike for a Representative Sea Turtle Species by Area and Alternative

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
VACAPES Range Complex						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Loggerhead Sea Turtle	0.74%	1.78%	1.78%	1.51%	2.29%	2.42%
Southeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area						
JAX Range Complex						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Loggerhead Sea Turtle	0.50%	1.04%	1.04%	0.17%	0.28%	0.31%

JAX: Jacksonville Range Complex; VACAPES: Virginia Capes Range Complex

APPENDIX H

IMPACTS DUE TO ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES AT THE UNDERSEA WARFARE TRAINING RANGE

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APPENDIX H IMPACTS DUE TO ATLANTIC FLEET TRAINING AND TESTING ACTIVITIES AT THE UNDERSEA WARFARE TRAINING RANGE

H.1 PURPOSE

The Undersea Warfare Training Range is within the Atlantic Fleet Training and Testing (AFTT) Study Area. The first phase of construction is estimated to be completed in 2018. Some of the training and testing activities described within this AFTT Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the Jacksonville (JAX) Range Complex may be conducted within the Undersea Warfare Training Range sea space beginning in 2018. Therefore, the analysis of impacts due to training and testing activities that could take place on the Undersea Warfare Training Range are included in the comprehensive analysis of impacts due to training and testing activities in this AFTT EIS/OEIS. In order to facilitate public understanding of impacts due to the subset of AFTT activities that would occur on the Undersea Warfare Training Range, these impacts are extracted from the comprehensive AFTT EIS/OEIS environmental consequences analysis and described within this appendix.

The Undersea Warfare Training Range OEIS/EIS (Record of Decision signed on 31 July 2009) included an analysis of the potential effects of both constructing and training on the Undersea Warfare Training Range. The proposed training activities analyzed in the Undersea Warfare Training Range OEIS/EIS were reanalyzed in this AFTT EIS/OEIS to account for updated science and refinements to analytical methods. In addition, the AFTT EIS/OEIS analyzes proposed testing activities that would be similar to proposed anti-submarine warfare training activities at the Undersea Warfare Training Range.

H.2 DESCRIPTION OF THE UNDERSEA WARFARE TRAINING RANGE

The Undersea Warfare Training Range will be located approximately 57 nautical miles (nm) from shore in the JAX Range Complex (see Figure H-1). The Undersea Warfare Training Range will consist of no more than 300 nodes, or underwater acoustic transducer devices, spread on the ocean floor over an area of approximately 500 square nautical miles (nm^2). The distance between nodes will vary from 1 nm to 3 nm, depending on water depth. The nodes will be connected by cable to each other and to a landside facility where shallow water training and testing activities will be evaluated. Additional details regarding the construction of the Undersea Warfare Training Range are provided in the Undersea Warfare Training Range OEIS/EIS.

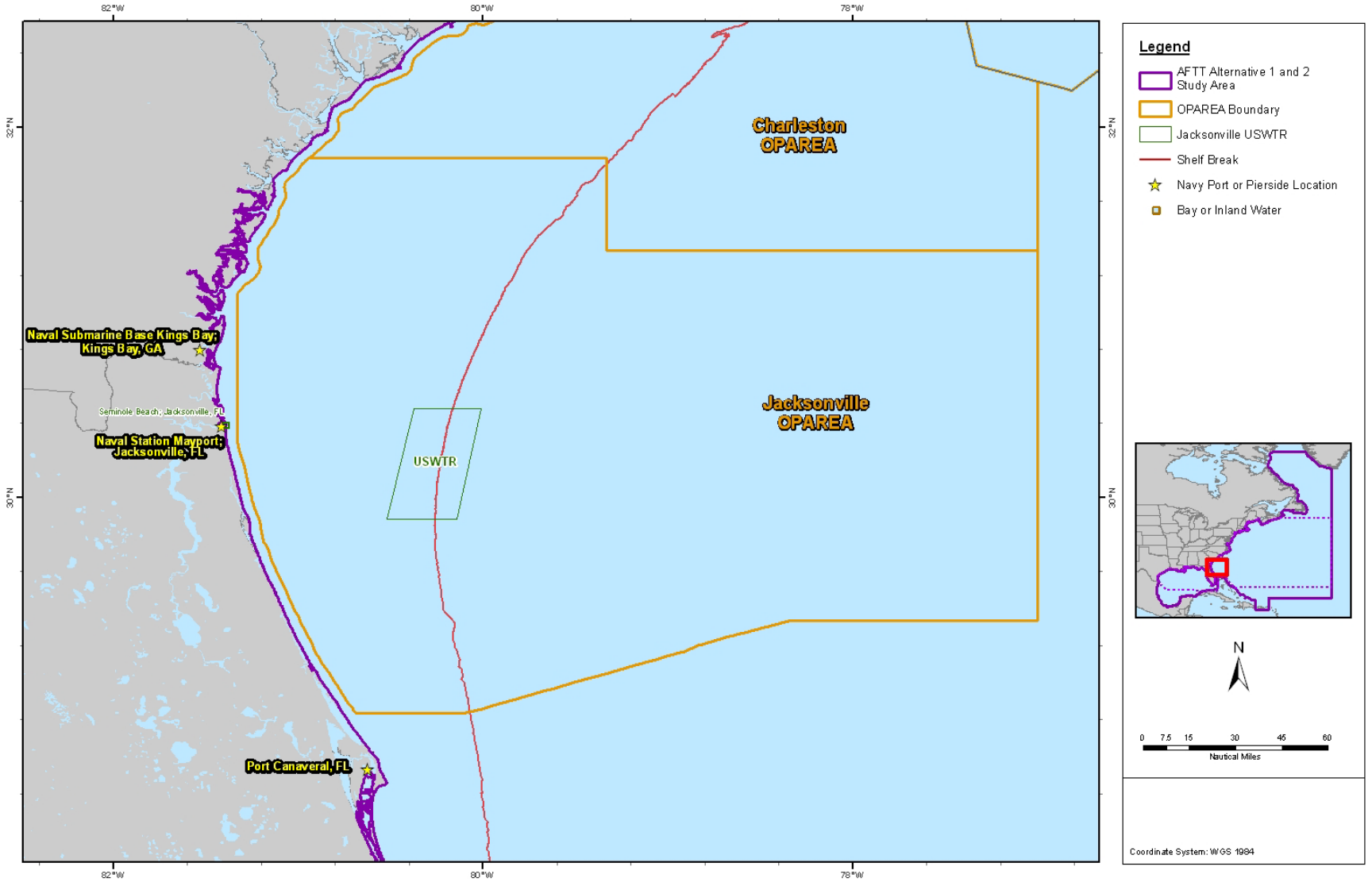

Figure H-1: Location of the Undersea Warfare Training Range within the AFTT EIS/OEIS Study Area

AFTT: Atlantic Fleet Training and Testing; FL: Florida; GA: Georgia; OPAREA: Operating Area; USWTR: Undersea Warfare Training Range

H.3 ACTIVITIES TAKING PLACE ON THE UNDERSEA WARFARE TRAINING RANGE

The training and testing activities which may take place on the Undersea Warfare Training Range that are proposed within this AFTT EIS/OEIS under Alternative 2 (Preferred Alternative) are outlined below.

Table H-1: Training Activities on the Undersea Warfare Training Range Analyzed in the AFTT EIS/OEIS

Training	Anti-submarine warfare training activities that may occur on the Undersea Warfare Training Range in the JAX Range Complex.
Long Description	Anti-submarine warfare training will occur on the Undersea Warfare Training Range in the JAX Range Complex. The Undersea Warfare Training Range is an instrumented sea space, equipped with cables and hydrophones. This capability allows for real time tracking of anti-submarine warfare exercise participants and the assessment of tactics employed and crew proficiency. The ability to provide detailed feedback to the trainees greatly improves the training value of the anti-submarine warfare exercise.
Information Typical to the Event	**Platform:** Fixed-wing aircraft, helicopters, surface ships, submarines **Systems:** Mid-frequency helicopter dipping, hull-mounted, and towed sonars; sonobuoys; acoustic countermeasures **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK 39, MK 30, submarine **Duration:** Not Applicable
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Various sonar systems (sonobuoy, dipping sonar, torpedo guidance, hull-mounted, and towed), aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, aircraft strike (birds only), vessel and in-water device strike **Entanglement:** Parachutes, guidance wires **Ingestion:** Parachutes
Detailed Military Expended Materials Information	MK 39 Expendable Mobile Anti-Submarine Warfare Training Targets Torpedo accessories (ballast weights) from exercise torpedoes, sonobuoys, parachutes
Assumptions Used for Analysis	Torpedoes are recovered. Guidance wire has a low breaking strength. Weights sink rapidly. **Typical Undersea Warfare Training Range Events (Alternative 2):** Approximate number of anti-submarine warfare tracking exercises/torpedo exercises annually: • Helicopter, 214 events (14 torpedoes) • Maritime patrol aircraft, 100 events (14 torpedoes) • Maritime patrol multi-static active coherent sonobuoys, 43 events • Surface, 102 events (12 torpedoes) • Submarine, 16 events (24 torpedoes)

JAX: Jacksonville

Table H-2: Testing Activities on the Undersea Warfare Training Range Analyzed in the AFTT EIS/OEIS

Testing	Anti-submarine warfare testing activities that may occur at the Undersea Warfare Training Range in the JAX Range Complex
Long Description	Anti-submarine warfare testing will occur on the Undersea Warfare Training Range in the JAX Range Complex. The Undersea Warfare Training Range is an instrumented sea space, equipped with cables and hydrophones. This capability allows for the evaluation of anti-submarine warfare systems, including systems onboard rotary-wing and fixed-wing aircraft and on in-water vehicles and vessels, and the ability to search for, detect, classify, localize, and track a submarine or similar target. The instrumented range provides data that confirms whether systems are operating as designed.
Information Typical to the Event	**Platform:** Fixed-wing aircraft, helicopters, surface ships, submarines, support craft **Systems:** Mid-frequency helicopter dipping, hull-mounted, and towed sonars; sonobuoys; acoustic countermeasures; torpedo guidance; underwater communication systems **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK 39, MK 30, submarines **Duration:** Not Applicable
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Various sonar systems (sonobuoy, dipping sonar, torpedo guidance, hull-mounted, and towed); aircraft noise; vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, aircraft strike (birds only), vessel and in-water device strike **Entanglement:** Parachutes, guidance wires **Ingestion:** Parachutes
Detailed Military Expended Materials Information	MK 39 Expendable Mobile Anti-Submarine Warfare Training Targets Torpedo accessories (ballast weights) from exercise torpedoes, sonobuoys, parachutes
Assumptions Used for Analysis	Torpedoes are recovered. Guidance wire has a low breaking strength. Weights sink rapidly. **Typical Undersea Warfare Training Range Events (Alternative 2):** Approximate number of Naval Air Systems Command tracking and torpedo testing events annually: • Helicopter, 83 events (45 torpedoes) • Approximate number of Naval Sea Systems Command events annually: • Combat system ship qualification trial– undersea warfare, 6 events (48 torpedoes) • Torpedo (non-explosive) testing, 13 events (347 torpedoes) • At-sea sonar testing, 1 event

JAX: Jacksonville

H.4 ENVIRONMENTAL CONSEQUENCES

The organization and analysis of environmental consequences differ between the Undersea Warfare Training Range OEIS/EIS and this AFTT EIS/OEIS. Since the issuance of the Undersea Warfare Training Range Final OEIS/EIS and Record of Decision, the Navy has progressively refined its impact analysis methodologies based on the best available science; therefore, the analysis of the same activity may lead to slightly different predictions of impacts. Furthermore, the Navy has organized the analysis differently in this AFTT EIS/OEIS, evolving into a more detailed analysis which is conducted stressor-by-stressor for each specific resource. Finally, while the activities on the Undersea Warfare Training Range proposed in the AFTT EIS/OEIS are the same or similar in scope and intensity as what was analyzed in the Undersea Warfare Training Range OEIS/EIS, additional testing activities which may be conducted on the Undersea Warfare Training Range are included in the AFTT analysis and described here.

The following sections describe the impacts specific to the Undersea Warfare Training Range that are also included in the comprehensive analysis of impacts for Alternative 2 (Preferred Alternative) in this AFTT EIS/OEIS. It is important to emphasize that 2018 is the earliest activities would begin on the Undersea Warfare Training Range.

H.4.1 SEDIMENTS AND WATER QUALITY

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on sediments and water quality.

H.4.1.1 Explosives and Explosion Byproducts

There are no proposed training or testing activities in the AFTT EIS/OEIS which involve explosives on the Undersea Warfare Training Range.

H.4.1.2 Metals

Military expended materials with metal components on the Undersea Warfare Training Range would include expendable subsurface targets, sonobuoys, and torpedo accessories. Other military expended materials with metal components would not be expended during training and testing activities on the Undersea Warfare Training Range. The potential impacts on water quality from metals in military expended materials are analyzed in Section 3.1.3.2 (Metals). The quantified predicted impacts at the Undersea Warfare Training Range shown in Table H-3 are included in the overall total impacts due to training and testing activities presented in Section 3.1.3.2 (Metals). The potential impacts on water quality from metals on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

Table H-3: Military Expended Materials on the Undersea Warfare Training Range with Metal Components under Alternative 2 (Preferred Alternative)

Type of Military Expended Material	Training	Testing
Expendable Subsurface Targets[1]	459	308
Sonobuoys	3,000	1,689
Torpedo Accessories[2]	64	440

[1] Includes acoustic countermeasures
[2] Includes guidance wires, flex hoses, ballast, protective nose covers, suspension bands, air stabilizers, and propeller baffles used with air-launched torpedoes

H.4.1.3 Chemicals Other than Explosives

Chemicals other than explosives that could be released on the Undersea Warfare Training Range during training and testing activities include Otto Fuel II propellant and its combustion byproducts. Other chemicals would not be released during training and testing on the Undersea Warfare Training Range. The potential impacts on water quality from chemicals other than explosives are analyzed in Section 3.1.3.3 (Chemicals other than Explosives). The potential impacts on water quality from chemicals on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.1.4 Other Materials

Other materials that could be expended on the Undersea Warfare Training Range during training and testing activities include miscellaneous components of military expended materials consisting of nonreactive or slowly reactive materials (e.g., glass, carbon fibers, and plastics) or materials that break down or decompose into benign byproducts (e.g., rubber, steel, and iron). The potential impacts on water quality due to other materials are analyzed in Section 3.1.3.4 (Other Materials). The potential impacts on water quality due to other materials on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.2 AIR QUALITY

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on air quality.

H.4.2.1 Criteria Air Pollutants

Criteria air pollutants would be emitted during combustion of fuel and propellants during training and testing activities on the Undersea Warfare Training Range. The potential impacts from emission of criteria air pollutants are analyzed in Section 3.2.3.1 (Criteria Air Pollutants). Criteria air pollutant emissions at the Undersea Warfare Training Range would be a sub-set of the criteria air pollutant emissions predicted to be emitted on the JAX Range Complex, as shown in Section 3.2.3.1.3 (Alternative 2 – Preferred Alternative). Emissions due to activities at the Undersea Warfare Training Range would be distant from shore, reducing the likelihood that regional air quality and receptors ashore would be affected.

H.4.2.2 Hazardous Air Pollutants

Hazardous air pollutants would be emitted during combustion of fuel and propellants during training and testing activities on the Undersea Warfare Training Range. The potential impacts from emission of hazardous air pollutants are analyzed in Section 3.2.3.2 (Hazardous Air Pollutants). The potential impacts from emission of hazardous air pollutants on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.3 MARINE HABITATS

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on marine habitats.

H.4.3.1 Acoustic Stressors

The potential impacts of acoustic stressors on marine habitats by explosives are analyzed in Section 3.3.3.1.1 (Impacts from Explosives). There are no proposed activities in the AFTT EIS/OEIS which involve explosives while training or testing on the Undersea Warfare Training Range. As discussed in Section 3.3.3.1 (Acoustic Stressors), other acoustic stressors do not have the potential to affect marine habitats.

H.4.3.2 Physical Disturbance and Strike Stressors

Physical disturbance of bottom substrates due to military expended materials (i.e., expendable subsurface targets, sonobuoys, and torpedo accessories) could occur during training and testing activities at the Undersea Warfare Training Range. The potential impacts on marine habitats due to physical disturbance are analyzed in Section 3.3.3.2 (Physical Disturbance and Strike Stressors).

The impact of the expended material on the seafloor is assumed to be twice the size of its actual footprint. This assumption accounts for any displacement of sediments at the time of impact as well as any subsequent movement of the item on the seafloor due to currents or other forces. This should more accurately reflect the potential disturbance to soft bottom habitats, but should overestimate disturbance to hard bottom habitats since no displacement of the substrate would occur.

Once the impact footprints were calculated, two analyses were performed: (1) potential impact on the soft bottom habitats within the Undersea Warfare Training Range if all expended materials settled in areas with unconsolidated sediments, and (2) potential impact on the hard bottom habitats in the Undersea Warfare Training Range if all expended materials settled in areas containing hard substrates. Based on a Navy-funded survey of the range, the Undersea Warfare Training Range contains approximately 1,811 square kilometers (km^2) of soft substrates (e.g., sand, silt, clay) and 544 km^2 of hard substrates (e.g., rock outcrop, pavement, rubble). Figure H-2 illustrates how these substrate types are distributed throughout the range. The quantified predicted impacts at the Undersea Warfare Training Range shown in Table H-4 and Table H-5 are included in the overall total impacts due to training and testing activities presented in Section 3.3.3.2 (Physical Disturbance and Strike Stressors). Since it is unlikely that all military expended materials would impact only one type of bottom substrate, the actual impact of military expended materials within the range on either hard or soft bottom substrates would be less than shown for each substrate in Table H-5. The potential impacts from physical disturbance of bottom substrates on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

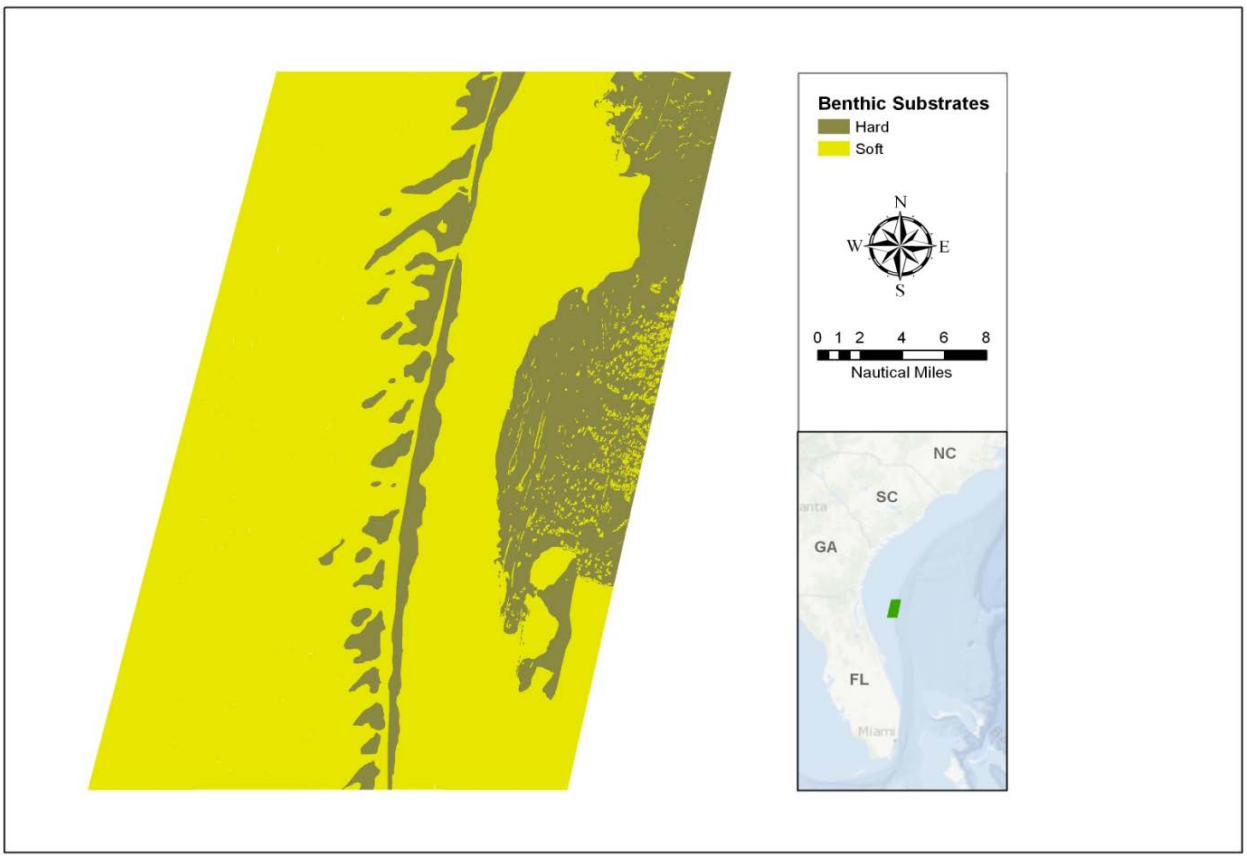

Figure H-2: The Distribution of Hard and Soft Substrates within the Undersea Warfare Training Range

Table H-4: Numbers and Estimated Annual Impacts of Military Expended Materials Due to Training and Testing Activities on the Undersea Warfare Training Range under Alternative 2 (Preferred Alternative)

Military Expended Materials	Size (m^2)	Impact Footprint (m^2)	Training		Testing	
			Number	Impact (m^2)	Number	Impact (m^2)
Sub-surface targets	0.1134	0.2268	459	104	126	29
Acoustic countermeasures	0.0289	0.1155	0	0	182	21
Lightweight torpedo accessories	0.0939	0.1879	40	8	169	32
Heavyweight torpedo accessories	0.0150	0.3007	24	7	271	81
Sonobuoys (non-explosive)	0.1134	0.5669	3,000	1,701	1,689	957
Parachutes - large	0.8400	1.6800	28	47	93	156
Parachutes - small	0.2642	0.5284	3,459	1,828	1,815	959
Total			**7,010**	**3,695**	**4,345**	**2,235**

m: meter

Table H-5: Annual Possible Maximum Impact of Military Expended Materials under Alternative 2 (Preferred Alternative) as Percent of Habitat within the Undersea Warfare Training Range

Bottom Type	Maximum Area Impacted (Percent of Total Area of Each Bottom Type)		
	Training	Testing	Total
Soft substrates	0.0004	0.0003	0.0007
Hard substrates	0.0013	0.0008	0.0021

H.4.4 MARINE MAMMALS

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on marine mammals.

H.4.4.1 Acoustic Stressors

The only acoustic stressors that would be present at the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise. There are no planned activities on the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The potential impacts of acoustic stressors on marine mammals from sonars and other active acoustic sources, vessel noise, and aircraft noise during training and testing activities are analyzed in Section 3.4.3.1 (Acoustic Stressors).

The potential impacts from vessel and aircraft noise on marine mammals during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

Sonars and other active acoustic sources that would be used for training and testing on the Undersea Warfare Training Range after construction are within the mid- and high-frequencies. Predicted impacts due to training and testing activities at the Undersea Warfare Training Range are shown in Table H-6. The quantified predicted impacts at Undersea Warfare Training Range shown in Table H-6 are included in the total predicted impacts due to annual training and annual testing activities presented in Section 3.4.3.1.8 (Impacts from Sonar and Other Active Acoustic Sources).

Table H-6: Predicted Acoustic Impacts per Year on Marine Mammals from Annually Recurring Sonar and Other Active Acoustic Training and Testing Activities under Alternative 2 (Preferred Alternative)

Species1	Training			Testing		
	Behavioral Reaction	TTS	PTS	Behavioral Reaction	TTS	PTS
Mysticetes						
Blue whale*	0	0	0	0	0	0
Bryde's whale	7	6	0	1	2	0
Minke whale	837	562	0	154	165	0
Fin whale*	39	23	0	6	8	0
Humpback whale*	19	14	0	4	5	0
North Atlantic right whale*	11	9	0	2	3	0
Sei whale*	18	13	0	3	4	0
Odontocetes – Delphinids						
Atlantic spotted dolphin	8,308	464	0	2,333	155	0
Atlantic white-sided dolphin	1	0	0	0	0	0
Bottlenose dolphin	6,637	259	0	1,710	92	0
Clymene dolphin	358	12	0	59	4	0
Common dolphin	5,484	205	0	1,302	71	0
False killer whale	2	0	0	1	0	0
Fraser's dolphin	11	0	0	2	0	0
Killer whale	173	7	0	46	3	0
Melon-headed whale	64	2	0	18	1	0
Pantropical spotted dolphin	688	28	0	164	11	0
Pilot whale	1,040	25	0	243	15	0
Pygmy killer whale	13	0	0	2	0	0
Risso's dolphin	2,625	93	0	686	40	0
Rough-toothed dolphin	20	1	0	5	0	0
Spinner dolphin	207	5	0	38	2	0
Striped dolphin	702	20	0	185	9	0
Odontocetes – Sperm Whales						
Sperm Whale*	41	1	0	10	0	0
Odontocetes – Beaked Whales						
Blainville's beaked whale	71	0	0	22	0	0
Cuvier's beaked whale	172	1	0	31	0	0
Gervais' beaked whale	360	2	0	67	1	0
Northern bottlenose whale	0	0	0	0	0	0
Sowerby's beaked whale	117	0	0	18	0	0
True's beaked whale	39	0	0	13	0	0
Odontocetes – *Kogia* Species and Porpoises						
Dwarf and pygmy sperm whales (*Kogia* spp.)	6	57	0	1	16	0

PTS: permanent threshold shift; TTS: temporary threshold shift
* ESA-listed species
[1] Species potentially present within the potential zone of impacts.

It should be noted that the analytical methods and data used to predict acoustic impacts on marine mammals differ between the Undersea Warfare Training Range OEIS/EIS and the AFTT EIS/OEIS due to emerging science and progressive refinements to modeling and analytical methods. As a result, the quantified acoustic impacts on marine mammals due to training and testing activities at the Undersea Warfare Training Range differ between the Undersea Warfare Training Range OEIS/EIS and the AFTT EIS/OEIS, even though the activities analyzed in both documents are the same or similar in scope and intensity. The differences are due to the following factors implemented in the AFTT EIS/OEIS acoustic analysis:

- *Animal density estimates*: Additional and emerging data have been incorporated into estimates of marine mammal densities (see Section 3.4.3.1.5.1, Marine Mammal Density). As a result, prior marine mammal density estimates have been refined, and densities have been estimated for all species potentially present in the zone of acoustic impacts around the Undersea Warfare Training Range. Density estimates were previously unavailable for some species.
- *Marine mammal auditory weighting functions*: Additional and emerging data have been incorporated into estimates of marine mammal hearing abilities. As a result, auditory weighting functions were developed for marine mammal functional hearing groups to emphasize frequencies of greater sensitivity and de-emphasize frequencies of lesser sensitivity in the acoustic impact analysis (see Section 3.4.3.1.4.2, Frequency Weighting). Auditory weighting functions were not previously applied.
- *Behavioral response threshold for beaked whales*: The threshold for behavioral response for beaked whales due to exposure to sonar and other active acoustic sources was set at 140 dB re 1 µPa sound pressure level (see Section 3.4.3.1.4.5, Behavioral Responses). Previously, the behavioral response function (i.e., "risk function") was used to assess potential for behavioral response by beaked whales.
- *Acoustic modeling*: The Navy Acoustic Effects Model was developed to estimate the number of marine mammals exposed to underwater sounds produced during training and testing (see Section 3.4.3.1.5.3, Navy Acoustic Effects Model). The Navy Acoustic Effects Model considers multiple simultaneous sound sources, animal depth, and site-specific environmental and bathymetric characteristics. Previous estimates of exposures used area-density models.
- *Consideration of Avoidance*: The potential for marine mammals to avoid repeated high level sound exposures after an initial exposure and the potential for beaked whales to avoid high levels of naval activity (i.e., multiple ship traffic) associated with some activities was considered in the acoustic impact analysis (see Section 3.4.3.1.5.5, Marine Mammal Avoidance of Sound Exposures). The previous quantitative acoustic impact analysis assumed animals would tolerate high-level sound exposures and not exhibit any avoidance reactions.
- *Consideration of Mitigation*: The potential for mitigation to reduce high-level exposures was analyzed for certain activities based on ability to continuously observe mitigation zones (see Section 3.4.3.1.5.6, Implementing Mitigation to Reduce Sound Exposures). The previous quantitative acoustic impact analysis in the Undersea Warfare Training Range OEIS/EIS did not account for implementation of mitigation.

H.4.4.2 Energy Stressors

There are no proposed activities on the Undersea Warfare Training Range in the AFTT EIS/OEIS which involve energy stressors.

H.4.4.3 Physical Disturbance and Strike Stressors

The potential impacts on marine mammals due to physical disturbance and strike from Navy vessels, military expended materials, and in-water devices are analyzed in Section 3.4.3.3 (Physical Disturbance and Strike Stressors). Military expended materials would include subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories on the Undersea Warfare Training Range. The potential impacts on marine mammals due to physical disturbance and strike on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.4.4 Entanglement Stressors

The potential for entanglement to marine mammals as a result of proposed training and testing activities is analyzed in Section 3.4.3.4 (Entanglement Stressors). Military expended materials due to training and testing activities on the Undersea Warfare Training Range that were analyzed for entanglement include: (1) fiber optic cables and guidance wires and (2) parachutes.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of approximately 1 cable every 21 nm^2 due to training and 1 cable every 2 nm^2 due to testing (1 cable every 1.7 nm^2 combined) on the Undersea Warfare Training Range. There would also be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on marine mammals due to entanglement on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.4.5 Ingestion Stressors

The potential impacts on marine mammals due to ingestion stressors used during proposed training and testing activities are analyzed in Section 3.4.3.5 (Ingestion Stressors). Parachutes are the only military expended material during training and testing activities planned on the Undersea Warfare Training Range that have the potential to be ingested by marine mammals.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on marine mammals due to ingestion on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.4.6 Secondary Stressors

Secondary stressors that may occur on the Undersea Warfare Training Range due to training and testing are metals and chemicals. The potential impacts on marine mammals due to secondary stressors are analyzed in Section 3.4.3.6 (Secondary Stressors). The potential impacts on marine mammals due to metals and chemicals as secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.5 Sea Turtles and Other Marine Reptiles

Sea turtles are the only marine reptiles that would be present within the Undersea Warfare Training Range. The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on sea turtles.

H.4.5.1 Acoustic Stressors

The only acoustic stressors that would be present at the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise. There are no planned activities on the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The potential impacts of acoustic stressors on sea turtles from sonars and other active acoustic sources, vessel noise, and aircraft noise during training and testing activities are analyzed in Section 3.5.3.1 (Acoustic Stressors).

The potential impacts from vessel and aircraft noise on sea turtles during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

Sonars and other active acoustic sources that would be used in the Undersea Warfare Training Range after construction are within the mid- and high-frequencies. Most of these sources are above the known hearing range of sea turtles. As a result, there are no model-predicted impacts on sea turtles (permanent threshold shift [PTS] or temporary threshold shift [TTS]) due to sonar and other active acoustic sources during training or testing activities on the Undersea Warfare Training Range.

H.4.5.2 Energy Stressors

There are no proposed activities on the Undersea Warfare Training Range in the AFTT EIS/OEIS which involve energy stressors.

H.4.5.3 Physical Disturbance and Strike Stressors

The potential impacts of physical disturbance and strike stressors on sea turtles from military expended materials, in-water devices, and Navy vessels are analyzed in Section 3.5.3.3 (Physical Disturbance and Strike Stressors). Military expended materials would include subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories on the Undersea Warfare Training Range. The potential impacts on sea turtles due to physical disturbance and strike stressors during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.5.4 Entanglement Stressors

The potential impacts on sea turtles due to entanglement as a result of training and testing activities are analyzed in Section 3.5.3.4 (Entanglement Stressors). Military expended materials due to training and testing activities on the Undersea Warfare Training Range that were analyzed for entanglement include: (1) fiber optic cables and guidance wires and (2) parachutes.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of approximately 1 cable every 21 nm^2 due to training and 1 cable every 2 nm^2 due to testing (1 cable every 1.7 nm^2 combined) on the Undersea Warfare Training Range. There would also be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on sea turtles due to entanglement on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.5.5 Ingestion Stressors

The potential for impacts on sea turtles as a result of various types of ingestion stressors used during proposed training and testing activities are analyzed in Section 3.5.3.5 (Ingestion Stressors). Parachutes

are the only military expended material during training and testing activities planned on the Undersea Warfare Training Range that have the potential to be ingested by sea turtles.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on sea turtles due to entanglement on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.5.6 Secondary Stressors

Secondary stressors that may occur on the Undersea Warfare Training Range due to training and testing are metals and chemicals. The potential impacts on sea turtles due to secondary stressors are analyzed in Section 3.5.3.6 (Secondary Stressors). The potential impacts on sea turtles due to metals and chemicals as secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.6 BIRDS

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on birds.

H.4.6.1 Acoustic Stressors

The only acoustic stressors that would be present on the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise. There are no planned activities on the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The potential impacts of acoustic stressors on birds from sonars and other active acoustic sources, vessel noise, and aircraft noise during training and testing activities are analyzed in Section 3.6.3.1 (Acoustic Stressors). The potential impacts from sonar and other active acoustic sources, vessel noise, and aircraft noise on birds during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.6.2 Energy Stressors

There are no proposed activities on the Undersea Warfare Training Range in the AFTT EIS/OEIS which involve energy stressors.

H.4.6.3 Physical Disturbance and Strike Stressors

The potential impacts of physical disturbance and strike stressors on birds from aircraft, vessels (disturbance and strike), and military expended materials are analyzed in Section 3.6.3.3 (Physical Disturbance and Strike Stressors). The potential impacts on birds due to physical disturbance and strike stressors during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.6.4 Ingestion Stressors

The potential for impacts on birds as a result of various types of ingestion stressors used during proposed training and testing activities is analyzed in Section 3.6.3.4 (Ingestion Stressors). However, all military expended materials resulting from training and testing activities on the Undersea Warfare Training Range are too large to be considered an ingestion risk for birds and no further analysis was conducted.

H.4.6.5 Secondary Stressors

The potential impacts on birds due to secondary stressors are analyzed in Section 3.6.3.5 (Secondary Stressors). The potential impacts on birds due to secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.7 MARINE VEGETATION

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on marine vegetation.

H.4.7.1 Acoustic Stressors

There are no planned activities on the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The only acoustic stressors that would be present on the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise; however, these stressors would have no impact on marine vegetation and no further analysis was conducted.

H.4.7.2 Physical Disturbance or Strike Stressors

The potential impacts of physical disturbance and strike stressors on marine vegetation by vessels, in-water devices, and military expended materials are analyzed in Section 3.7.3.2 (Physical Disturbance and Strike Stressors). Military expended materials would include subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories on the Undersea Warfare Training Range. The potential impacts on marine vegetation due to physical disturbance and strike stressors during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.7.3 Secondary Stressors

The potential impacts on marine vegetation due to secondary stressors are analyzed in Section 3.7.3.3 (Secondary Stressors). The potential impacts on marine vegetation due to secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.8 MARINE INVERTEBRATES

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on marine invertebrates.

H.4.8.1 Acoustic Stressors

Acoustic stressors that would be present at the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise. There are no planned activities on the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The potential impacts of acoustic stressors on marine invertebrates from sonars and other active acoustic sources, vessel noise, and aircraft noise during training and testing activities are analyzed in Section 3.8.3.1 (Acoustic Stressors). The potential impacts from acoustic stressors on marine invertebrates during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.8.2 Energy Stressors

There are no proposed activities on the Undersea Warfare Training Range in the AFTT EIS/OEIS which involve energy stressors.

H.4.8.3 Physical Disturbance and Strike Stressors

The potential impacts of physical disturbance and strike stressors on marine invertebrates by vessels, in-water devices, and military expended materials are analyzed in Section 3.8.3.3 (Physical Disturbance and Strike Stressors). Military expended materials would include subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories on the Undersea Warfare Training Range. The potential impacts on marine invertebrates due to physical disturbance and strike stressors during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.8.4 Entanglement Stressors

The potential for entanglement on invertebrates as a result of proposed training and testing activities is analyzed in Section 3.8.3.4 (Entanglement Stressors). Military expended materials due to training and testing activities on the Undersea Warfare Training Range that were analyzed for entanglement include: (1) fiber optic cables and guidance wires and (2) parachutes.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of approximately 1 cable every 21 nm^2 due to training and 1 cable every 2 nm^2 due to testing (1 cable every 1.7 nm^2 combined) on the Undersea Warfare Training Range. There would also be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on marine invertebrates from entanglement on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.8.5 Ingestion Stressors

The potential for impacts on invertebrates as a result of various types of ingestion stressors used during proposed training and testing activities is analyzed in Section 3.8.3.5 (Ingestion Stressors). Parachutes are the only military expended material used during training and testing activities planned on the Undersea Warfare Training Range that may be considered ingestion stressors.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. Due to the relatively large size of the military expended materials resulting from training and testing activities on the Undersea Warfare Training Range (subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories), it is unlikely that these items would be ingested by invertebrates.

H.4.8.6 Secondary Stressors

The potential impacts on marine invertebrates due to secondary stressors are analyzed in Section 3.8.3.6 (Secondary Stressors). The potential impacts on marine invertebrates due to secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.9 FISH

The following stressors are analyzed in this AFTT EIS/OEIS for potential impacts on fish.

H.4.9.1 Acoustic Stressors

Acoustic stressors that would be present at the Undersea Warfare Training Range due to training and testing activities are sonar and other active acoustic sources, vessel noise, and aircraft noise. There are no planned activities within the Undersea Warfare Training Range involving explosives, pile driving, swimmer defense air guns, or weapons firing, launch, or impact noise. The potential impacts of acoustic stressors on fish from sonars and other active acoustic sources, vessel noise, and aircraft noise during training and testing activities are analyzed in Section 3.9.3.1 (Acoustic Stressors). The potential impacts from acoustic stressors on fish during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.9.2 Energy Stressors

There are no proposed activities on the Undersea Warfare Training Range in the AFTT EIS/OEIS which involve energy stressors.

H.4.9.3 Physical Disturbance and Strike Stressors

The potential impacts of physical disturbance and strike stressors on fish by vessels, in-water devices, and military expended materials are analyzed in Section 3.9.3.3 (Physical Disturbance and Strike Stressors). Military expended materials would include subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories on the Undersea Warfare Training Range. The potential impacts on fish due to physical disturbance and strike stressors during training and testing activities on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.9.4 Entanglement Stressors

The potential for entanglement to fish as a result of proposed training and testing activities is analyzed in Section 3.9.3.4 (Entanglement Stressors). Military expended materials due to training and testing activities on the Undersea Warfare Training Range that were analyzed for entanglement include: (1) fiber optic cables and guidance wires and (2) parachutes.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of approximately 1 cable every 21 nm^2 due to training and 1 cable every 2 nm^2 due to testing (1 cable every 1.7 nm^2 combined) on the Undersea Warfare Training Range. There would also be a maximum annual concentration of 7 parachutes per nm^2 due to training and 4 parachutes per nm^2 due to testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. The potential impacts on fish from entanglement on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.4.9.5 Ingestion Stressors

The potential for impacts on fish as a result of various types of ingestion stressors used during proposed training and testing activities is analyzed in Section 3.9.3.5 (Ingestion Stressors). Parachutes are the only military expended material used during training and testing activities planned on the Undersea Warfare Training Range that may be considered ingestion stressors.

Under Alternative 2 (Preferred Alternative) there would be a maximum annual concentration of 7 parachutes per nm^2 for training and 4 parachutes per nm^2 for testing (11 parachutes per nm^2 combined) on the Undersea Warfare Training Range. Due to the relatively large size of the military expended materials resulting from training and testing activities on the Undersea Warfare Training

Range (subsurface targets, acoustic countermeasures, sonobuoys, and torpedo launch accessories), it is unlikely that these items would be ingested by fish.

H.4.9.6 Secondary Stressors

The potential impacts on fish due to secondary stressors are analyzed in Section 3.9.3.6 (Secondary Stressors). The potential impacts on fish due to secondary stressors on the Undersea Warfare Training Range would not differ from those described for the AFTT Study Area.

H.5 CONCLUSION

Potential impacts from training and testing on the Undersea Warfare Training Range were analyzed in this AFTT EIS/OEIS and are similar in scope and intensity to activities in the JAX Range Complex and throughout the AFTT Study Area.

Cumulative impacts due to training and testing activities at the Undersea Warfare Training Range would be similar in scope and intensity as those cumulative impacts analyzed in Chapter 4 (Cumulative Impacts) of this AFTT EIS/OEIS.

Mitigation measures would be identical for activities on the Undersea Warfare Training Range to those presented in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of this AFTT EIS/OEIS. Mitigation measures would further reduce potential effects below what is predicted in this EIS/OEIS.

RECORD OF DECISION

ISSUANCE OF MARINE MAMMAL PROTECTION ACT (MMPA) REGULATIONS TO TAKE MARINE MAMMALS INCIDENTAL TO U.S. NAVY TRAINING AND TESTING ACTIVITIES IN THE ATLANTIC FLEET TRAINING AND TESTING STUDY AREA

Supported by: U.S. Navy Final Environmental Impact Statement/
Overseas Environmental Impact Statement for Atlantic Fleet Training and Testing

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Protected Resources
Silver Spring, Maryland

In accordance with the National Environmental Policy Act (NEPA) and its implementing regulations and the National Oceanic and Atmospheric Administration's (NOAA's) Administrative Order 216-6 Environmental Review Procedures for Implementing the National Environmental Policy Act, this document comprises NOAA's National Marine Fisheries Service's (NMFS's) Record of Decision (ROD) for issuance of regulations pursuant to section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1361 *et seq.*) to the U.S. Navy (Navy) for the taking of marine mammals incidental to the conduct of specified activities in the Atlantic Fleet Training and Testing Study Area.

I. INTRODUCTION

In April 2012, NMFS received an application from the Navy requesting five-year regulations and authorizations for the take of 42 species of marine mammals incidental to Navy training activities to be conducted within the Navy's Atlantic Fleet Training and Testing (AFTT) Study Area, for the period of November 2013 through November 2018. These training and testing activities may incidentally take marine mammals present within the AFTT Study Area by exposing them to sound from active sonar or to underwater detonations at levels that NMFS associates with the take of marine mammals as defined by the MMPA, as well as vessel strikes. NMFS' issuance of MMPA regulations to the Navy governing the incidental take of marine mammals is a Federal action for which NMFS is responsible for analyzing the effects on the human environment pursuant to NMFS' NEPA procedures.

NMFS participated as a cooperating agency in the development of the Navy's Final Environmental Impact Statement/Overseas Environmental Impact Statement (hereinafter,

FEIS/OEIS), which contained an analysis of the effects of the Navy's activities on the human environment. NMFS worked closely with the Navy to provide information in NMFS' area of expertise to support the FEIS/OEIS' effects analyses for endangered species, marine mammals, and other marine resources. In accordance with the NEPA regulations at 40 CFR 1506.3, NMFS analyzed the Draft EIS/OEIS and concluded that NMFS' comments and suggestions have been addressed. NMFS adopted the Navy's FEIS/OEIS in November 2013.

A. Navy Proposed Action

As described in the FEIS/OEIS, the Navy proposes to conduct training and testing activities – that include the use of active sonar and explosives – within the AFTT Study Area in the western Atlantic Ocean off the east coast of the United States, in the Gulf of Mexico, and in portions of the Caribbean Sea. These activities will also occur at Navy pierside locations, Navy-contracted shipbuilder locations, port transit channels, and the lower Chesapeake Bay.

The purpose of conducting training and testing activities in the AFTT Study Area is to ensure that the Navy meets its mission, which is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.

The Navy evaluated conducting current and future training and testing activities in the FEIS/OEIS.

B. NMFS' MMPA Decision Authorities

Sections 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) during periods of not more than five consecutive years if certain findings are made and regulations are issued or, if the taking is limited to harassment and of no more than 1 year, the Secretary shall issue a notice of proposed authorization for public review.

As described in the Navy's application, the specified Navy activities to be conducted in the AFTT Study Area are expected to take marine mammals as defined by the MMPA, and the Navy requested incidental take authorization in accordance with Section 101(a)(5)(A) of the MMPA. In order to issue the regulations and subsequent Letters of Authorization (LOAs) under this section, NMFS must make the determination that the specified activities will result in a negligible impact on the affected species or stocks and not result in an unmitigable adverse impact on the availability of marine mammal species or stocks for subsistence uses. In addition, NMFS, as part of its regulatory process, is required to prescribe the permissible methods of taking, the means of effecting the least practicable adverse impact on the species or stock and its habitat (i.e., mitigation) and to set forth requirements pertaining to monitoring and reporting of such taking.

NMFS has defined "negligible impact" as "an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." (50 CFR § 216.103).

The National Defense Authorization Act (NDAA) (Public Law 108-136) amended the MMPA, by removing the "small numbers" and "specified geographical region" limitations and amending the definition of "harassment" as it applies to a "military readiness activity" to read as follows (Section 3(18)(B) of the MMPA):

(i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or

(ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

The MMPA also contains a provision related to "military readiness activities" that requires NMFS, when making a determination of "least practicable adverse impact on such species or stock" to consider personnel safety, practicality of implementation and impact on the effectiveness of the military readiness activity. Before making the required determination, NMFS must consult with the Department of Defense regarding the mitigation measures and their effect on the aforementioned factors.

II. NMFS' DECISION AND FACTORS CONSIDERED IN THE DECISION

A. THE DECISION

NMFS' decision is to issue regulations and two 5-year LOAs (one for training and one for testing) for the unintentional take of marine mammals incidental to specified activities included within the FEIS/OEIS Alternative 2, which was the preferred alternative identified in the Draft EIS/OEIS and the action presented to NMFS in the Navy's LOA application (as updated). The regulations will govern the unintentional taking of marine mammals incidental to training and testing activities conducted in the AFTT Study Area for the period of November 2013 through November 2018. Alternative 2 of the FEIS includes an analysis of all of the activities for which the Navy has requested incidental take authorization pursuant to the MMPA. The regulations will prescribe the permissible methods of taking, the means of effecting the least practicable adverse impact on the species or stock and its habitat (i.e., mitigation) and will set forth requirements pertaining to monitoring and reporting of such taking for the specified activities, as described in Alternative 2.

The Navy will be authorized to take individuals of 42 species of marine mammals by Level B Harassment and individuals of 32 marine mammal species by Level A harassment. In addition, the Navy will be authorized to take by serious injury or mortality individuals of 16 marine mammal species due to the use of explosives, and 11 total marine mammals (any species except North Atlantic right whale) over the course of the 5-year rule due to vessel strike. NMFS will issue a final rule that establishes a framework in which incidental take can be authorized through issuance of two 5-year LOAs for training and testing, respectively.

B. FACTORS CONSIDERED IN REACHING THE DECISION

In the FEIS/OEIS, the affected environment and environmental consequences are both discussed in Chapter 3, within subsections arranged by Resource type, including: Sediments and Water Quality; Air Quality; Marine Habitats; Marine Mammals; Sea Turtles and Other Marine Reptiles; Birds; Marine Vegetation; Marine Invertebrates; Fish; Cultural Resources; Socioeconomic Resources; and Public Health and Safety. A section addressing Marine Protected Areas is included within the Additional Regulatory Considerations chapter. The Marine Mammals chapter (chapter 3) and Appendix G contain the majority of the analysis that relates to NMFS' action of issuing incidental take regulations. Other sections of the FEIS/OEIS contain analyses related to potential impacts on marine mammal habitat and further support NMFS' proposed issuance of regulations and the LOAs. In addition, Chapter 4 provides an assessment of potential cumulative impacts, including analyzing the potential for cumulatively significant impacts to the marine environment and marine mammals.

Within the Marine Mammals section (and Appendix G), the Navy's FEIS/OEIS addresses potential acoustic impacts resulting from active sonar, explosive detonations, or air guns, as well as non-acoustic impacts (such as ship strikes). These sections describe in detail the acoustic thresholds used to indicate at what received sound levels marine mammals will be considered taken pursuant to the MMPA. The FEIS/OEIS also describes in detail the analytical framework and model that the Navy uses to estimate take. Last, the Navy presents estimates (for each alternative) of the number of each species of marine mammal that will be exposed to levels of sound that NMFS has determined will result in Level A or Level B Harassment, as well as the number of marine mammals that may be struck by vessels. The Navy uses these take estimates, combined with the other information included in this Chapter to conclude that none of the alternatives will result in any adverse population level effects on any of the affected species or stocks. The take estimates for the Navy's preferred alternative are the subject of the Navy's request to NMFS for MMPA Section 101(a)(5)(A) authorization.

As described above, the environmental consequences to the marine environment are of particular importance for NMFS' evaluation in reaching the decision to issue MMPA incidental take regulations. In particular, because NMFS' action is specific to authorizing unintentional take of marine mammals, the key factors considered in the decision are related to NMFS' statutory missions under the MMPA and the Endangered Species Act (ESA). The primary documents supporting this decision are the Navy's AFTT FEIS/OEIS and the AFTT Biological Opinion.

As a cooperating agency, NMFS assisted the Navy by providing technical information and analyses to evaluate the effects of naval training exercises on marine mammal species or stocks and their habitat. Via the MMPA process, NMFS reviewed the Navy's request to determine whether the total taking resulting from the activities would have a negligible impact on the affected species or stocks of marine mammals, would not have an unmitigable adverse impact on the availability of those species or stocks of marine mammals intended for subsistence uses, and that the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. As supported by the FEIS/OEIS, NMFS has made the requisite findings under the MMPA and will include these findings in a final rule.

Key relevant factors considered by NMFS in this decision include:

- Requiring mitigation. As noted above, for military readiness activities, NMFS is required to consider personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity when it makes its determination of "least practicable adverse impact." NMFS consulted with the Navy via the MMPA process and as a NEPA cooperating agency before making the required determination. NMFS assisted in the preparation of a section of the AFTT FEIS/OEIS (mitigation assessment) that augments the analysis of mitigation measures. This section included additional analysis of mitigation measures NMFS considered during the MMPA rulemaking, with particular emphasis on whether these measures would be beneficial, effective and practicable. Through this process, the Navy proposed to extend the boundary of the eastern Gulf of Mexico planning awareness area to encompass a biologically important area for a resident population of Bryde's whale.

- Addressing uncertainty. The FEIS/OEIS acknowledges a degree of uncertainty regarding the effects of underwater sound on marine mammals. NMFS provided extensive input in the FEIS/OEIS process to address these uncertainties, and has included requirements for mitigation, monitoring and reporting by the Navy in the final rule to manage uncertainty. The key issues and the manner in which they are addressed in the final rule include:

    1. The FEIS/OEIS addressed uncertainty about behavioral effects of active sonar on marine mammal via development of revised acoustic thresholds that, in some instances, reflect a change from what NMFS has used to evaluate the Navy's activities in previous authorization. The revised thresholds, which the Navy developed in coordination with NMFS, are based on the evaluation and inclusion of new information from recent scientific studies; a detailed explanation of how they were derived is provided in the AFTT FEIS/OEIS Criteria and Thresholds Technical Report. The revised thresholds are adopted for this rulemaking after providing the public with an opportunity for review and comment via the Proposed Rule (78 FR 7050, January 31, 2013).
    2. Continuing management to reduce uncertainty will be implemented via the MMPA final rule by requiring extensive monitoring and reporting by the Navy, including the establishment and implementation of a monitoring plan specific to the AFTT Study Area and an Integrated Comprehensive Monitoring Plan. These plans are available on NMFS' website, and are specifically designed to be iterative and provide feedback to support NMFS' use of adaptive management throughout rule implementation, as presented in the FEIS/OEIS and further explained in the final rule. Drafts of these plans were made available for comment on the NMFS website concurrent with availability of the MMPA proposed rule. The public will also have the opportunity to review the Navy's monitoring reports from the Navy's marine species monitoring website: http://www.navymarinespeciesmonitoring.us/.

3. Finally, while not a required component of the final rule, the Navy's FEIS/OEIS describes the Navy's continuing commitment to marine mammal research, in particular research related to the effects of underwater sound on marine mammals. NMFS will continue to encourage and support the Navy's research efforts. The timeframe for completing the research and conducting an assessment of how that research factors into MMPA authorizations however, does not allow NMFS to wait for the results of the research prior to authorizing the Navy's request for incidental take.

NMFS finds that the FEIS/OEIS appropriately acknowledges uncertainty and provides detailed analyses as to how existing information is incorporated to assess effects where uncertainties exist, and to address and manage uncertainty via mitigation, monitoring, reporting and research.

- Considering effects to ESA-listed marine mammals. On November 14, 2013, NMFS issued a programmatic biological opinion on the U.S. Navy's proposal to conduct training and testing exercises in the AFTT Study Area from November 2013 through November 2018 and the Permits Division's proposal to promulgate regulations governing the issuance of LOAs to authorize the U.S. Navy to "take" marine mammals incidental to the conduct of training and testing exercises in the AFTT Study Area during the same period of time. The Biological Opinion concludes that the proposed regulations and any take associated with activities authorized by those regulations are not likely to jeopardize the continued existence of threatened or endangered species in the action area during any single year or as a result of the cumulative impacts of annual authorizations. The Biological Opinion includes an explanation of how the results of NMFS' baseline and effects analyses in Biological Opinions relate to those contained in the cumulative impact section of NEPA documents. In particular, these analyses consider the effects resulting from interactions of potential stressors, thereby augmenting the FEIS/OEIS' cumulative impacts analysis.

Coastal Zone Management Act Concerns. In December 2012, the Navy submitted consistency determinations under 15 CFR 930 for the proposed action to 18 states and two territories adjacent to the AFTT Study Area. As of March 14, 2013, letters indicating concurrence were received from 16 states/territories. After 60 days, concurrence was assumed for the remaining four states/territories (Rhode Island, South Carolina, Texas, and the U.S. Virgin Islands).

Essential Fish Habitat. The Navy determined that the proposed activity may have potential impacts to EFH. NMFS' Office of Habitat Conservation reviewed the Navy's assessment and adopted the Navy's mitigation measures as conservation recommendations.

National Marine Sanctuaries Act Concerns. Federal agency actions that are likely to injure sanctuary resources are subject to consultation with the Office of National Marine Sanctuaries (ONMS) under section 304(d) of the National Marine Sanctuaries Act. The Navy analyzed potential impacts to sanctuary resources and provided the analysis in the Navy's FEIS to ONMS. In response, ONMS determined that the use of active mid-frequency sonar is likely to injure sanctuary resources, and recommended that: 1) the Navy should continue the spatial mitigation measure to restrict all active sonar use inside and within a 2.7 mile buffer around Stellwagen

Bank, Monitor, Gray's Reef, Florida Keys and Flower Garden Banks national marine sanctuaries and that the Navy not employ sonar or other active acoustic sources within Gray's Reef national marine sanctuary; and 2) the Navy should conduct observation and monitoring on the effects of electromagnetic devices on sanctuary resources and share that data with ONMS as appropriate. In response, the Navy indicated it is proposing limited activities in the sanctuaries and will implement considerable mitigations, and is not proposing to use active sonar in Stellwagen Bank national marine sanctuary. Further, based on the analysis in the FEIS and historic lack of impacts, the Navy believes its proposed activities are unlikely to injure sanctuary resources. Therefore, the Navy declined to implement the first recommendation. The Navy agreed to implement the second recommendation to the maximum extent allowed by the classification of the responsive material. Because the Navy did not agree to implement the ONMS recommendation, it would be responsible for mitigation and restoration or replacement of any sanctuary resource that was injured as a result.

III. OTHER ALTERNATIVES CONSIDERED

The alternatives analyzed in the Navy's FEIS/OEIS and their relationship to NMFS' alternatives are described here. NMFS' proposed action (issuance of regulations and LOAs) would authorize take of marine mammals incidental to a subset of the activities analyzed in the Navy's AFTT FEIS/OEIS that are anticipated to result in the take of marine mammals, i.e., those activities that involve the use of active sonar, underwater detonations, air guns, and vessel strikes. Thus, these components of the Navy's proposed action are the subject of NMFS' proposed MMPA regulatory action. The Navy's FEIS/OEIS contains a thorough analysis of the environmental consequences of their proposed action (with specific sections for active sonar, underwater detonations, air guns, and vessel strikes) on the human environment, including a specific section on marine mammals.

A. Summary of the Alternatives Considered by the Navy

The Navy analyzed three alternatives in the FEIS/OEIS, including two action alternatives (Alternatives 1 and 2) and the No Action Alternative.

No Action Alternative: The No Action Alternative is required by CEQ regulations as a baseline against which the impacts of the Proposed Action are compared. In the FEIS, the No Action Alternative is represented by baseline training and testing activities and force structure requirements as defined by existing Navy environmental planning documents.

Alternative 1: Alternative 1 consists of the No Action Alternative plus the expansion of the Study Area boundaries and adjustments to the locations and tempos of training and testing activities. This alternative reflects the adjustment to the baseline necessary to support current and proposed Navy at-sea training and testing activities through 2018. Alternative 1 would not expand the area where the Navy trains and tests, but would simply expand the area that is analyzed. This alternative also includes changes to training and testing requirements necessary to accommodate (a) the relocation of ships, aircraft, and personnel, (b) planned aircraft, vessel, and weapons systems, (c) ongoing activities not addressed in previous documents. Force structure changes involve the relocation of ships, aircraft, and personnel. As forces are moved within the existing Navy structure, training needs will necessarily change as the location of forces change. This alternative examines the training and testing requirements of planned

vessels, aircraft, and weapons systems that the Navy would use in the Study Area. Finally, current training and testing activities that were not addressed in previous documentation are analyzed under this Alternative.

Alternative 2 (Preferred Alternative): Alternative 2 would include all of the activities described in Alternative 1 plus the establishment of new range capabilities and modifications of existing capabilities, adjustments to types and tempos of training and testing, and the establishment of additional locations to conduct activities within the Study Area.

B. SUMMARY OF ALTERNATIVES CONSIDERED BY NMFS

For all of the Navy alternatives identified above, the Navy includes an associated list of standard protective measures specifically developed to minimize adverse impacts on marine mammals. NMFS worked closely with the Navy throughout the development of the FEIS/OEIS to identify additional mitigation measures (for marine mammals) that the Navy should consider in their analysis. As a result of this cooperating agency role, the Navy discussed and considered additional mitigation measures in its FEIS/OEIS, and determined that all of these were not able to be implemented either because the measures were not consistent with mission requirements or were prohibitively difficult to implement, or because the Navy's analysis concluded that the measures did not provide sufficient protective benefits to marine mammals. However, the Navy determined that they would adhere to some of the additional mitigation measures if implemented in the final rule for AFTT.

The inclusion of the analysis of these additional mitigation measures strengthens the FEIS/OEIS' support and coverage of NMFS' FEIS/OEIS alternatives, which are listed below. The Navy does not enumerate these alternatives in the FEIS/OEIS. However, the FEIS/OEIS supports the analyses of these alternatives:

No Action Alternative: NMFS is unable to reach the required determinations under the MMPA, and denies the Navy's request for an incidental take authorization (for NMFS, this constitutes the NEPA-required No-action Alternative).

Alternative 3: NMFS promulgates regulations and issues LOAs authorizing take of marine mammals incidental to the Navy's training and testing activities in the AFTT Study Area as described in the Navy's FEIS/OEIS preferred alternative (Alternative 2), with the mitigation, monitoring and reporting measures presented in Chapter 5 of the FEIS/OEIS (except those considered but eliminated).

Alternative 4: NMFS promulgates regulations and issues LOAs authorizing take of marine mammals incidental to the Navy's training and testing activities in the AFTT Study Area as described in the Navy's FEIS/OEIS preferred alternative (Alternative 2), but with additional mitigation requirements for marine mammals, potentially including measures considered but eliminated in Chapter 5 of the FEIS/OEIS or other additional measures developed by NMFS or suggested to NMFS via public comment on the proposed rule.

C. THE ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The No Action Alternative described in the Navy's FEIS/OEIS is the baseline level of training and testing being conducted in the AFTT Study Area prior to the Navy's November 2013 ROD. The No Action Alternative includes training and testing activities in several Primary Mission Areas, including Anti-Air Warfare, Amphibious Warfare, Strike Warfare, Anti-Surface Warfare, Anti-Submarine Warfare, Electronic Warfare, and Mine Warfare exercises that would continue at baseline levels. Both Alternatives 1 and 2 (preferred alternative) include increased numbers of activities above those numbers analyzed in the No Action Alternative. The No Action is considered the environmentally preferred alternative.

IV. PUBLIC INVOLVEMENT

Public opportunities for review and comment have occurred in support of the FEIS/OEIS preparation and the consideration of MMPA rulemaking. The Navy published a Notice of Intent (NOI) to prepare an EIS/OEIS in the *Federal Register* on July 15, 2010 (75 FR 41163). In the NOI, the Navy and NMFS solicited scoping comments on community concerns and local issues to be addressed in the EIS/OEIS. The Navy received comments from 69 individuals and groups at the end of the 60-day public scoping period.

The Navy prepared a Draft EIS/OEIS to analyze the Navy's training and testing activities in the AFTT Study Area. The notice of availability published on May 11, 2012 (EIS No. 2012142) and the public could provide comments through the Navy's AFTT EIS website at http://www.aftteis.com or by mailing a written comment. The Navy distributed copies of the DEIS/OEIS as described in the DEIS/OEIS. Copies were available at 28 public libraries across many East Coast states, and could be obtained by request or electronically at the Navy's AFTT EIS website.

The Navy received comments from eight federal agencies, 16 state/local/regional agencies, 14 organizations, and approximately 500 individuals. The comments focused on the following general categories: marine mammals; different alternatives; mitigation measures; and noise concerns. The FEIS/SEIS addressed all oral and written comments received during the DEIS/OEIS comment period. As a cooperating agency, NMFS assisted in the analysis and consideration of public comments in NMFS' areas of jurisdiction and expertise to support the development of the FEIS/OEIS. The Navy ensured the FEIS/OEIS was mailed to all individuals, agencies, and organizations that requested a copy of the final document and that FEIS/OEIS is available at http://www.aftteis.com. The Navy made the FEIS/OEIS available on August 30, 2013 (EIS No. 20130253), and presents the distribution list in Chapter 8 of the FSEIS/SOEIS. The Navy received no public comments during the FEIS/OEIS wait period.

Substantial public involvement also occurred in association with NMFS' rulemaking. On October 4, 2012 (77 FR 60679) NMFS published a notice of receipt regarding the application for letters of authorization for the U.S. Navy's training and testing in the AFTT Study Area, which included a request for comments and information open through November 5, 2012. On January 31, 2013 (78 FR 7050), NMFS published a proposed rule in response to the Navy's request to take marine mammals incidental to training and testing exercises in the AFTT Study Area and requested comments, information and suggestions concerning the request. During the 30-day

public comment period, NMFS received comments from the Marine Mammal Commission, Georgia Department of Natural Resources, Maine Department of Natural Resources, Stranded No More, the Natural Resources Defense Council (on behalf of the Animal Legal Defense Fund, Animal Welfare Institute, California Coastal Protection Network, Center for Biological Diversity, Cetacean Society International, The Humane Society of the United States, International Fund for Animal Welfare, Ocean Care, Ocean Mammal Institute, and Whale and Dolphin Conservation), and Earthjustice, as well as interested members of the public. The comments were considered in developing the final rule, and detailed responses to those comments are included in the preamble to the final rule. The categories of public comments addressed include additional mitigation recommendations, mitigation effectiveness, impact analyses, monitoring and reporting, general opposition to the rulemaking, and other comments not specific to a category.

Public input was carefully considered by NMFS in developing a final rule and in reaching this decision to issue the regulations for the activities specified in FEIS/OEIS Alternative 2.

V. MITIGATION, MONITORING AND REPORTING MEASURES

The final rule includes detailed mitigation measures that must be implemented by the Navy when conducting specified activities in the AFTT Study Area. Inclusion of these requirements ensures that NMFS' action of issuing incidental take regulations specifies and requires all practicable means to avoid or minimize environmental harm from the selection of FEIS/OEIS Alternative 2. Moreover, NMFS' final rule will specify the requirements for Navy to implement a monitoring and reporting program.

In addition to the requirements that will be established in the rule and required of Navy, NMFS will conduct the following activities as part of the continuing MMPA implementation process:

- NMFS will meet annually with the Navy to discuss the required Navy monitoring reports, Navy R&D developments, and current science and whether mitigation or monitoring modifications are appropriate. This use of adaptive management via the MMPA process will allow NMFS to consider new data from different sources to determine (in coordination with the Navy) on an annual basis if mitigation or monitoring measures should be modified or added (or deleted) if new data suggests that such modifications are appropriate (or are not appropriate) for the LOAs.

VI. CONCLUSIONS

Through the FEIS/OEIS and as documented in this ROD, NMFS has considered the goals and objectives of the NMFS' proposed action and has analyzed a reasonable range of alternatives that adequately address the objective of the proposed action. Furthermore, NMFS has analyzed the associated environmental consequences of the identified alternatives and the mitigation measures and monitoring requirements needing to be analyzed and required under the final rule and LOAs. NMFS has also considered the public comments addressed to the Navy in the FEIS/OEIS and the comments addressed to NMFS during the proposed rule comment period. Consequently, NMFS has selected the alternative of issuing regulations authorizing the unintentional harassment of

marine mammals incidental to Navy training and testing activities in the AFTT Study Area in accordance with Alternative 2 of the FEIS/OEIS (Alternative 3 in the Summary of Alternatives Considered by NMFS) for the period November 2013 through November 2018, including in that regulation specified requirements for mitigation, monitoring and reporting.

Signed: _____ Date: 11/14/13

Alan D. Risenhoover
Director, Office of Sustainable Fisheries,
performing the functions and duties of the
Deputy Assistant Administrator for Regulatory Programs