RCS 14-260

EGLIN AIR FORCE BASE
Florida

MARITIME WEAPONS SYSTEM EVALUATION PROGRAM

FINAL
ENVIRONMENTAL ASSESSMENT

December 2014

MARITIME WEAPONS SYSTEM EVALUATION PROGRAM EGLIN AIR FORCE BASE, FLORIDA

FINAL ENVIRONMENTAL ASSESSMENT

Submitted to:

AFMC 96 CEG/CEIE
Eglin Air Force Base, Florida 32542-6808

Prepared by:

1140 Eglin Parkway
Shalimar, Florida 32579

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LIST OF ACRONYMS AND ABBREVIATIONS

° C	degree Celsius
μPa-m	micropascal-meter
μPa^2-s	squared micropascal-second
46 OG/OGMTP	46th Test Wing Precision Strike Division
86 FWS	86th Fighter Weapons Squadron
96 CEG/CEVH	96th Civil Engineer Group/Cultural Resources Branch
96 RANSS	96th Range Support Squadron
AFB	Air Force Base
AFMC	Air Force Materiel Command
AFSOC	U.S. Air Force Special Operations Command
AGL	above ground level
AGM	air-to-ground missile
AIM	Air Intercept Missile
BA	Biological Assessment
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
BO	Biological Opinion
CAF	Combat Air Force
cal	caliber
CATEXed	categorically excluded
CBU	Cluster Bomb Unit
CCF	Central Control Facility
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CO	carbon monoxide
CO_2	carbon dioxide
CV	Coefficient of Variation
CZMA	Coastal Zone Management Act
dB	decibels
DOI	Department of the Interior
DPS	Distinct Population Segments
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFD	Energy flux density
EFH	essential fish habitat
EGTTR	Eglin Gulf Test and Training Range
EO	Executive Order
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FMC	fishery management councils
FMP	Fishery Management Plan
FWS	Fighter Weapons Squadron
FY	fiscal year
GBU	Guided Bomb Unit
GIS	geographical information system
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GRATY	Gulf Range Armament Test Vessel
GSMFC	Gulf States Marine Fisheries Commission
HAPC	Habitat Areas of Particular Concern
HEI	high explosive incendiary
HSMST	High Speed Marine Surface Target

LIST OF ACRONYMS AND ABBREVIATIONS, CONT'D

Hz	hertz
IHA	Incidental Harassment Authorization
In-lb/in^2	inch-pounds per square inch
INRMP	Integrated Natural Resources Management Plan
J/m^2	Joules per square meter
JASSM	Joint Air-to-Surface Stand-Off Missile
JDAM	joint direct attack munition
kg	kilogram
kHz	kiloHertz
km	kilometers
km^2	square kilometers
lb	pound
LJDAM	laser joint direct attack munition
LOAs	letters of authorization
MBTA	Migratory Bird Treaty Act
mm	millimeters
MMPA	Marine Mammal Protection Act
MTS	Maritime Transportation System
NAAQS	national ambient air quality standards
NDAA	National Defense Authorization Act
NEODS	Naval Explosive Ordnance Disposal School
NEPA	National Environmental Policy Act
NEW	net explosive weight
NHPA	National Historic Preservation Act of 1966
NM	nautical miles
NM2	square nautical miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOTMAR	Notice to Mariners
NRHP	National Register of Historic Places
NSWC PCD	Naval Surface Warfare Center, Panama City Division
NWA	Northwest Atlantic
Pa-s	Pascal-second
PBR	potential biological removal
PGU	Projectile Gun Unit
pH	hydrogen ion concentration
psi	per square inch
psi-msec	per square inch per millisecond
PSW	precision strike weapon
PTS	permanent threshold shift
RCRA	Resource Conservation and Recovery Act
RDX	Research Department Explosive
ROI	region of influence
SDB	Small-diameter bomb
SEFSC	Southeast Fisheries Science Center
SEL	Sound exposure level
SHPO	State Historic Preservation Officer
SOPGM	Stand-off precision guided munition
SPL	sound pressure level
SST	Sea Surface Temperature
TEWG	Turtle Expert Working Group
TNT	trinitrotoluene
TTP	tactics, techniques and procedures
TTS	Temporary threshold shifts
UAVs	Unmanned Aerial Vehicle
U.S.	United States

LIST OF ACRONYMS AND ABBREVIATIONS, CONT'D

U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
W-	Warning Area
W-151	Warning Area 151
WSEP	Weapon Systems Evaluation Program
ZOI	Zone of Influence

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1. PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) analyzes and presents the potential environmental consequences associated with the conduct of live ordnance testing in the Gulf of Mexico (GOM) as part of the 86th Fighter Weapons Squadron (86 FWS) Air-to-Ground Weapons System Evaluation Program (WSEP). The 86 FWS, part of the 53rd Wing, is responsible for operational testing and evaluation of fielded Combat Air Forces (CAFs) equipment and systems in an operationally realistic environment. The EA also addresses simulated ordnance testing on fast-moving, manned small boat formations in Choctawhatchee Bay. This EA is prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 *Code of Federal Regulations* [CFR] 1500–1508), and U.S. Air Force (Air Force) regulations implementing NEPA procedures (32 CFR 989). Figure 1-1 depicts the regional setting of this action.

1.2 BACKGROUND

There has been limited Air Force aircraft and munitions testing on engaging and defeating small boat threats, which have increased in recent years. Small boats can carry a variety of weapons, including anti-ship missiles, unguided rockets, guns, and suicide charges. Because of their low cost, small boats can be employed in large or small numbers by any nation or group. They are difficult to locate and track, and successful engagement in the marine environment in all weather conditions presents unique challenges to the military.

1.3 PROPOSED ACTION

The Air Force proposes to employ live munitions against operationally representative stationary and high-speed remotely controlled boat targets. Figure 1-1 depicts the location of the Proposed Action and alternatives. Swarms of fast-moving manned vessels would also be targeted electronically by aircraft conducting simulated acquisition and defeat of small boat threats. Vessel swarm missions would be carried out in Choctawhatchee Bay and the Gulf of Mexico. More detailed information regarding the Proposed Action and alternatives is provided in Chapter 2, Description of Proposed Action and Alternatives.

1.4 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to continue the development of tactics, techniques, and procedures (TTP) for Air Force strike aircraft to counter small maneuvering maritime targets in order to better protect U.S. and other vessels or assets from small boat threats. Damage effects of these conditions must be known to generate TTPs to engage small moving boats. The test objectives are to (1) develop TTPs to engage small boats in all weather and (2) determine the impact of TTPs on CAF training. The 53rd Wing will use the results of the test to develop publishable TTPs for inclusion in Air Force TTP 3-1 series manuals. Maritime WSEP testing is a high priority for national defense.

Figure 1-1. Eglin Air Force Base and Surrounding Region

1.5 SCOPE OF THE PROPOSED ACTION

The region of influence (ROI) for this analysis is Warning Area 151 (W-151) in the Eglin Gulf Test and Training Range (EGTTR) (Figure 1-2), which includes approximately 10,000 square nautical miles (NM^2) of GOM waters from 3 to 100 miles offshore from Santa Rosa Island. Maritime WSEP operations include use of live munitions, aircraft operations, and restricted access to areas of W-151. Test missions would occur over an approximate two- to three-week period during February and March 2015. Vessel swarm missions would take place between the Mid-Bay and Highway 331 Bridges and in the Gulf of Mexico. This document encompasses only operations associated with Maritime WSEP in the GOM and Choctawhatchee Bay; overland air operations and other activities over the GOM are addressed separately in other NEPA documents. This analysis addresses potential impacts due to Maritime WSEP activities that could affect environmental resources located above, at, and below the GOM water surface. The military mission has been broadly identified as the effector of environmental impacts and the EGTTR environment has been identified as the receptor. Evaluation and quantification of this effector/receptor relationship is the scientific basis for the environmental analysis performed in this report.

1.6 DECISION DESCRIPTION

The Air Force desires to authorize Maritime WSEP operational testing activities in the EGTTR. As described in Chapter 2, an alternative to the detonation depth of live munitions is considered; also included is a No Action Alternative. Therefore, a decision is to be made on the level of activity to be authorized.

1.7 ISSUES

An *issue*, as discussed in this document, is an effect of a mission activity that may directly or indirectly impact physical, biological, and/or cultural environment resources. A *direct* impact is a distinguishable, evident link between an action and the potential impact, whereas an *indirect* impact may occur later in time and/or may result from a direct impact.

Potential environmental impacts of alternative actions on GOM resource areas were identified through preliminary investigation. Resource areas eliminated from further analysis are discussed in Section 1.7.1. Resource areas identified for detailed analysis are described in Section 1.7.2, with narratives providing a summary of the preliminary screening for potential impacts.

1.7.1 Resource Areas Eliminated from Detailed Analysis

Air Quality

Air quality, with respect to those pollutants for which the U.S. Environmental Protection Agency (USEPA) has promulgated National Ambient Air Quality Standards (NAAQS) and/or the Florida

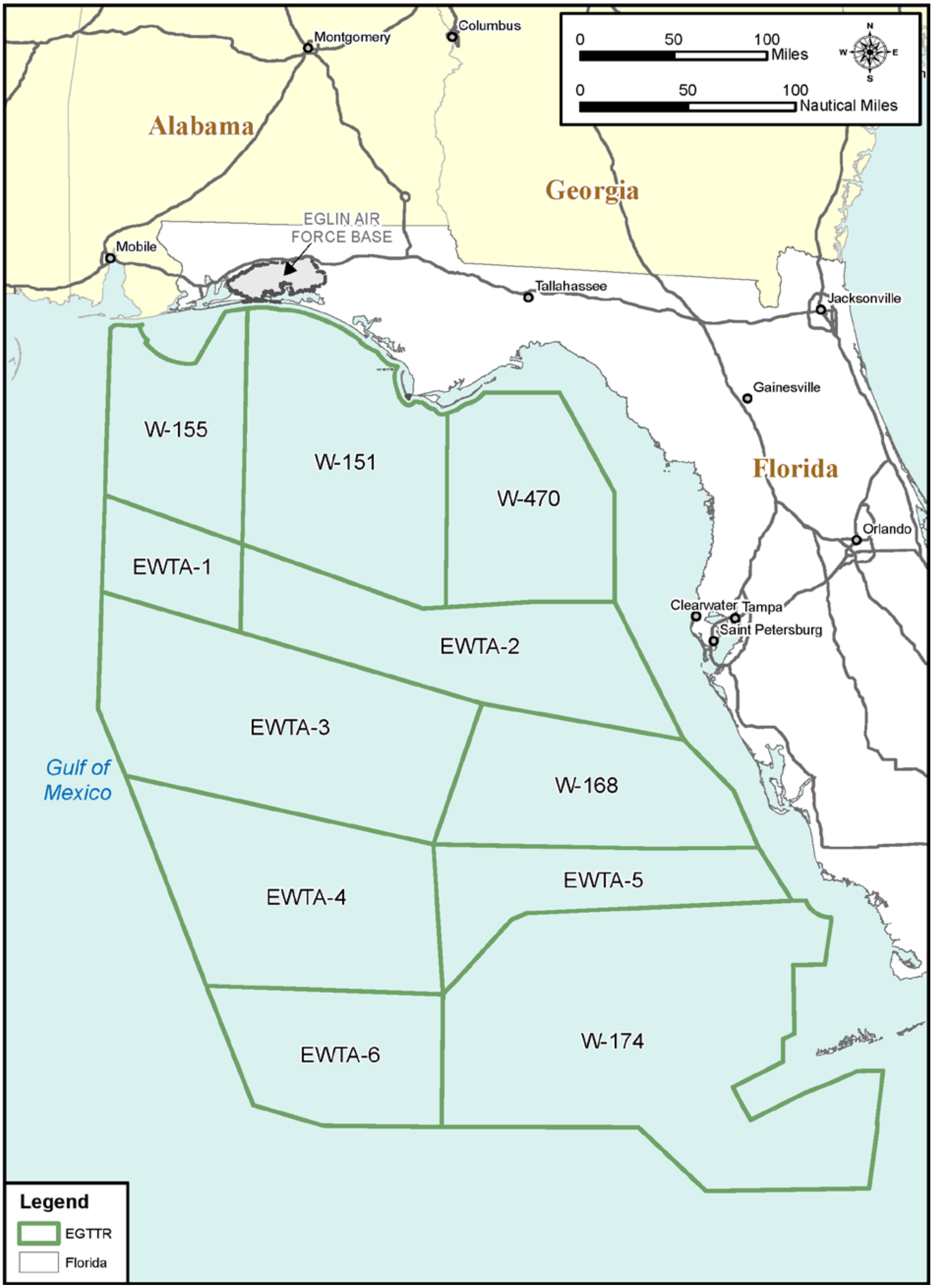

Figure 1-2. Eglin Gulf Test and Training Range (EGTTR)

Department of Environmental Protection (FDEP) has promulgated an ambient standard, was eliminated as a potential issue. Under existing conditions, the ambient air quality in Okaloosa and surrounding counties is classified as in attainment for all NAAQS as promulgated by USEPA. Testing activities would release emissions from munitions use, surface craft, and aircraft.

However, due to the comparatively small number of shots per year and the short duration of each test event, emissions are not anticipated to have any impact on ambient air quality in Okaloosa and surrounding counties.

Cultural Resources

Maritime WSEP activities would occur over offshore waters of the GOM. The National Oceanic and Atmospheric Administration's (NOAA) Automated Wreck and Obstruction Information System was consulted to determine areas of avoidance to ensure testing would not impact cultural resources. No shipwrecks or other obstructions were found within the planned area of activity. Furthermore, in April 2013, in support of a similar program Eglin Air Force Base (AFB) Cultural Resources conducted a remote sensing survey of a 1-mile square region around the target area using side-scan sonar, a magnetometer, and a subbottom profiler to confirm the presence or absence of potential historic shipwrecks. Side-scan sonar provides high-quality images of the seafloor and objects on the floor, while the subbottom profiler detects objects on and below the seafloor. The magnetometer determines the magnetic signature of any detected objects, so that there is high confidence in discriminating underwater objects. Survey results revealed the target area to be sandy with no discernible structures or objects (SEARCH, 2013). Therefore, historic shipwrecks will be avoided and the issue of cultural resources was not carried forward for detailed analysis.

Airspace

Airspace was eliminated as a potential issue because the Proposed Action would occur in airspace designated as warning areas of the EGTTR and established for the purpose of military testing and training. The Proposed Action would be conducted in accordance with established Air Force procedures for air-to-surface testing in the EGTTR, and through coordination with the Federal Aviation Administration (FAA).

Noise Impacts to the Public

Noise impacts to the public were eliminated as a potential issue because the Air Force will establish a safety footprint around the target area that encompasses all potentially harmful in-air noise from detonations. Members of the public will not be allowed to enter the safety footprint. Additionally, mission support personnel will likewise maintain a safe distance from the target area. Because of the distance of the target area from shore the detonation noise perceptible to people on shore can be compared to very faint or distant thunder.

Hazardous Waste

Generally, conventional explosive ordnance testing does not constitute hazardous waste as regulated by the Resource Conservation and Recovery Act (RCRA) (UXOINFO, 2013). Similarly, the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA) does not apply directly to unexploded ordnance (UXO) sites because, under most conditions, UXO is considered a solid waste and not a hazardous waste. However, the number and type of munitions expended on Eglin AFB ranges, including munitions associated with Maritime WSEP testing, must be recorded and reported each year pursuant to the Emergency Planning and Right-To-Know Act. In addition, the proponent is responsible for reporting and funding all costs associated with chemical and fuel spills during test events. All spills, regardless of quantity, are to be reported immediately to 96 CEG/CEVCE at (850) 240-1828.

1.7.2 Resource Areas Identified for Detailed Analysis

Safety

The issue of safety pertains to hazards from the Proposed Action to military personnel and the public. Such hazards include the delivery of live ordnance, live detonations and the possibility of creating UXO from munitions that fail to detonate. In addition, floating debris could present a hazard to boat traffic. The analysis identifies the potential safety hazards and also discusses restricted access areas established by the Air Force to ensure the safety of the public.

Socioeconomics/Environmental Justice

Potential socioeconomic impacts are closely related to the restricted access issue described above and environmental justice. Periodic closure of portions of the GOM could potentially impact the availability of these areas for commercial fishing or other economic activity.

Environmental justice addresses the potential for a proposed federal action to cause disproportionately high and adverse health effects on minority populations or low-income populations, including children. The analysis examines the demographics of potentially affected commercial and recreational users and whether they constitute minority or low-income groups.

Physical Resources

Physical resources, which include water and sediments, would potentially be exposed to explosive byproducts, target materials and residues, and petroleum products. Liquid, solid, and gaseous substances released into the environment from Maritime WSEP missions would consist of organic and inorganic materials that may produce a chemical change or toxicological effect to the environment. Although some mission-related debris would float on the water surface, some percentage, such as destroyed targets, munitions fragments, and unexploded bombs, would be a source of debris that would be deposited into GOM waters and ultimately onto the seafloor.

Biological Resources

Noise from detonations is the primary issue with regard to potential effects to biological resources. Noise may produce stress reactions or behavioral changes (avoidance of the area) in wildlife species and may cause hearing loss or damage. Analysis of potential noise impacts include discussions of two noise components: pressure waves and acoustic sound. Direct impact to a biological resource from a munition fragment or moving target boat, while theoretically possible, is either so unlikely as to be discountable or the associated risk is surpassed by the risk of mortality or injury from blast noise given the larger area of impact.

1.8 REGULATORY COMPLIANCE

This EA has been prepared in accordance with NEPA, which requires a detailed environmental analysis for major federal actions with the potential to significantly affect the quality of the human and natural environments on land ranges and within U.S. territorial waters. As defined in this document, territorial waters extend from shoreline seaward to 22.2 kilometers (km) (12 nautical miles [NM]).

This document was also prepared in accordance with Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*, which requires environmental documentation for effects to resources seaward of U.S. territorial waters. As defined in this document, nonterritorial waters extend beyond 22.2 km (12 NM). The action affects resources that utilize both territorial and nonterritorial waters.

In addition to NEPA and EO 12114, this document complies with a variety of other environmental regulations. The following subsections provide a brief description of the environmental requirements most relevant to this EA.

1.8.1 Marine Mammal Protection Act

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

The National Defense Authorization Act (NDAA) of fiscal year (FY) 2004 (Public Law 108-136) amended the definition of harassment for military readiness activities. Military readiness activities, as defined in Public Law 107-314, Section 315(f), includes all training and operations related to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat. This definition, therefore, includes Maritime WSEP activities occurring in the EGTTR Study Area. The amended definition of harassment for military readiness activities, as applied in this EA, is any act that:

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

Section 101(a)(5) of the MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (exclusive of commercial fishing) within a specified geographic region. These incidental takes may be allowed if the National Marine Fisheries Service (NMFS) determines the taking will have a negligible impact on the species or stock and the taking will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses. Accordingly, Eglin AFB has requested an Incidental Harassment Authorization (IHA) under Section 101(a)(5)(D) of the MMPA from NMFS to authorize takes of marine mammal species by Level A and Level B harassment only.

1.8.2 Endangered Species Act

The Endangered Species Act (ESA) (16 U.S.C. 1531–1543) applies to federal actions in two separate respects. First, the ESA requires that federal agencies, in consultation with the responsible wildlife agency (i.e., NMFS), ensure that proposed actions are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of a critical habitat (16 U.S.C. 1536 [a][2]). Regulations implementing the ESA expand the consultation requirement to include those actions that "may affect" a listed species or adversely modify critical habitat.

Second, if an agency's proposed action would take a listed species, then the agency must obtain an incidental take statement from the responsible regulatory agency (i.e., NMFS). The ESA defines the term *take* to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt any such conduct" (16 U.S.C. 1532[19]). The regulatory definitions of *harm* and *harass* are relevant to the Air Force's determination as to whether the proposed Maritime WSEP activities would result in adverse effects on listed species.

- Harm is defined by regulation as "an act which actually kills or injures" fish or wildlife (50 CFR 222.102).
- Harass is defined by regulation to mean an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering" (50 CFR 17.3).

As part of the environmental documentation for this EA, the Air Force entered into formal consultation with NMFS because certain actions under the Proposed Action would result in a "may affect" finding for listed species or designated critical habitat. Formal consultation began with the Air Force submitting a Biological Assessment (BA) to NMFS. Consultation ends once NMFS prepares a final Biological Opinion (BO) and issues an Incidental Take Statement, if required.

1.8.3 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) was enacted to conserve and restore the nation's fisheries requires that NMFS and regional fishery councils describe and identify essential fish habitat (EFH) for all species that are federally managed. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Under the act, federal agencies must consult with NMFS regarding any activity or proposed activity that is authorized, funded, or undertaken by the agency that may adversely affect EFH. An EFH assessment has been provided to NMFS' Southeast Fisheries Science Center in the Maritime WSEP BA. As described in Chapter 4, no significant adverse effects to EFH are anticipated from Maritime WSEP mission activities.

1.8.4 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs for their respective coastal zone. State territorial waters extend outward from the baseline (generally the shoreline) to a distance of 5.6 km (3 NM) on the east coast of Florida and from the shoreline out to 16.7 km (9 NM) on the west coast of Florida.

The CZMA requires all federal agency activities that affect any land or water use, or natural resource of the coastal zone, be conducted in a manner consistent, to the maximum extent practicable, with the enforceable policies of the NOAA-approved state management program. This includes protecting natural resources and managing coastal development. In accordance with the CZMA, both direct and indirect effects are considered, and it is not required that the effects be adverse.

In accordance with 15 CFR 930.41, the state agencies have 60 days from receipt of this document to concur with or object to this Consistency Determination or to request an extension, in writing, under 15 CFR 930.41(b). The federal agency may presume state agency concurrence if the state agency's response is not received within 60 days from receipt of the federal agency's consistency determination and supporting information.

The Air Force prepared a Consistency Determination for the State of Florida (Appendix A). The Air Force received a letter from the Florida State Clearinghouse that provided concurrence with the Consistency Determination (**TBD**).

1.8.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) was enacted to ensure the protection of shared migratory bird resources. The MBTA prohibits the intentional take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase, or barter, any migratory bird or its egg, part, or nest, except as authorized under a valid permit. Current regulations authorize permits for the intentional taking of migratory birds for activities such as scientific research, education, and depredation control. However, these regulations do not expressly authorize the incidental taking of migratory birds resulting from actions where the take was not the intent of the action. The MBTA protects a total of 836 bird species, 58 of which are currently legally hunted as game birds.

Section 315 of the 2003 NDAA, "Incidental Taking of Migratory Birds during Military Readiness Activities," (Public Law 107-314, Section 315) required the Secretary of the Interior to promulgate regulations to exempt the Armed Forces for the incidental taking of migratory birds during military readiness activities. This task was delegated to the U.S. Fish and Wildlife Service (USFWS), who published a final rule in the *Federal Register* (effective March 30, 2007), which directly amended 50 CFR 21, *Migratory Bird Permits*, to authorize takes resulting from otherwise lawful military readiness activities (USFWS, 2007). This rule does not authorize takes under the ESA, and USFWS retains the authority to withdraw or suspend the authorization for incidental takes occurring during military readiness activities under certain circumstances.

Under this rule, the Air Force is still required under NEPA to consider the environmental effects of its actions and assess the adverse effects of military readiness activities on migratory birds. If it is determined that the Proposed Action may result in a significant adverse effect on a population of a migratory bird species, the Air Force will consult with USFWS to develop and implement appropriate conservation measures to minimize or mitigate these effects. Conservation measures, as defined in 50 CFR 21.3, include project designs or mitigation activities that are reasonable from a scientific, technological, and economic standpoint and are necessary to avoid, minimize, or mitigate the take of migratory birds or other adverse impacts. Furthermore, a significant adverse effect on a population is defined as an effect that could, within a reasonable period of time, diminish the capacity of a population of a migratory bird species to sustain itself at a biologically viable level. Based on the analysis provided in Chapter 4, which shows that no adverse effects to migratory birds are anticipated, the Air Force is not planning consultations with USFWS under this act.

1.8.6 Clean Water Act

The Clean Water Act, as amended in 1972, regulates point and non-point source pollutant discharges into navigable waters of the United States. The USEPA controls pollutant discharges through the National Pollutant Discharge Elimination System permit program. As described in Section 3.3, there would be no significant impacts to water quality resulting from the Proposed Action. It is not anticipated that a permit would be required under the Clean Water Act.

1.8.7 National Historic Preservation Act of 1966 (as amended)

The National Historic Preservation Act of 1966 (NHPA) was enacted to set federal policy for managing and protecting significant historic properties for both submerged and terrestrial resources. Federal agencies must identify historic properties and consult with the Advisory Council on Historic Preservation and State Historic Preservation Officer (SHPO). Section 106 of the NHPA requires that federal agencies analyze the impacts of federal activities on historic properties, or cultural resources included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Section 110 of the NHPA requires that federal agencies inventory any cultural resources that are located on their property or within their control and to nominate those found to be significant for inclusion into the National Register.

1.8.8 The Abandoned Shipwreck Act of 1987

The Abandoned Shipwreck Act of 1987 gives the title and jurisdiction over historic shipwrecks to the federal government extending to the Exclusive Economic Zone (EEZ). The EEZ extends 200 nautical miles (NM) from the shoreline and is under the jurisdiction of the Department of the Interior (DoI). This applies even if the ship is within state waters. Before engaging in an activity that may negatively affect a shipwreck, this Act requires consideration of the effect the activity may have on submerged resources.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action is for the 86 FWS to test multiple types of live munitions in the EGTTR against small boat targets, for the Maritime WSEP.

The initial phases of the Maritime WSEP focused on detecting and tracking boats using various sensors, simulated weapons engagements, and testing with inert (containing no explosives) munitions. These actions were reviewed under the Eglin AFB Environmental Impact Analysis Process and categorically excluded (CATEXed) off the *Eglin Gulf Test and Training Range Programmatic Environmental Assessment*, RCS 97-048, and Air-to-Ground and Maritime WSEP CATEX, RCS 14-019. The Proposed Action represents the final phase of testing the effectiveness of live (containing explosive charges) munitions on small boat threats and provides additional discussion on vessel swarm missions in Choctawhatchee Bay. Live munitions testing in the EGTTR would include two fuzing options: detonation above the water surface and at the water surface. The Proposed Action does not include subsurface detonations. The tests would occur on weekdays over a period of two to three weeks in February and March 2015, with a maximum of two tests per day. Test events would be conducted in various sea states and weather conditions, up to a wave height of approximately 4 feet.

2.1.1 Test Methods and Procedures

All Maritime WSEP missions would occur in the EGTTR in the northern GOM, at a location approximately 16.7 miles (14.5 nautical miles) offshore from Santa Rosa Island. The EGTTR is more accurately defined as the airspace over the GOM controlled by Eglin AFB, beginning at a point 3 NM from shore. The EGTTR is subdivided into blocks consisting of Warning Areas W-155, W-151, W-470, W-168, and W-174, as well as Eglin Water Test Areas 1 through 6. Figure 2-1 shows the target location within W-151 as denoted by the Gulf Range Armament Test Vessel (GRATV), which is the instrumentation barge anchored on-site to provide a platform for cameras and weapon-tracking equipment. Test data collection and operation of remotely controlled boats would be conducted from the GRATV. The surrounding notional weapons safety hazard area shown in Figure 2-1 was developed to encompass the flight and impact characteristics of all Maritime WSEP munitions. The actual safety hazard area could be smaller or larger and shaped differently than the composite safety hazard area, depending on the specific munitions and launch conditions.

Swarm missions involving electronic targeting and defeat of multiple fast-moving small boats would occur daily in Choctawhatchee Bay between the Mid-Bay and Highway 331 Bridges, and in the Gulf of Mexico after the live missions have been completed.

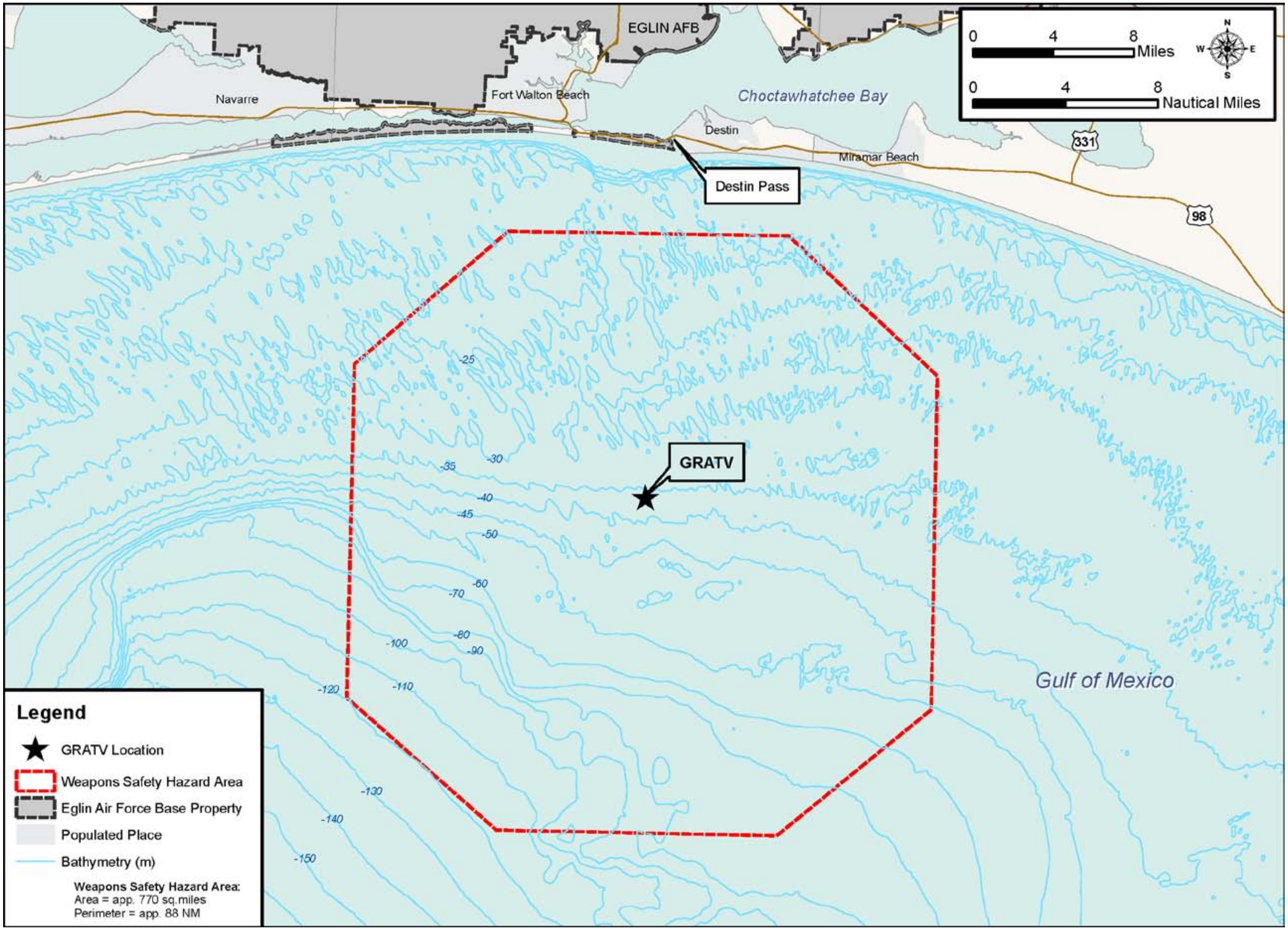

Figure 2-1. Proposed Location for Live Maritime WSEP Tests

Pre-Test Target Area Clearance Procedures for Public Safety

Nonmission personnel, such as recreational and commercial fishermen, would be advised to avoid the safety footprint while it is active, which is expected to be approximately four hours per test (a maximum of two tests per day could occur). Safety support vessels would be contracted by the 96th Range Support Squadron (96 RANSS) to facilitate range clearance. If a nonparticipating vessel entered the hazard area, support vessel crews would attempt to contact the vessel and direct it to maneuver away from the hazard area. The Eglin Safety Office would monitor real-time activity of surface craft and use this information to make clear-to-arm and clear-to-fire calls as appropriate. To inform the public, the Eglin Safety Office would request that the Coast Guard release a Notice to Mariners (NOTMAR) prior to the closure of the safety footprint around the target location. In addition, 96 RANSS personnel will also distribute flyers at the public docks and to vessels in Destin Pass explaining why the area would be closed.

Before ordnance delivery, aircraft would make surveillance passes to ensure recreational and commercial vessels are clear of the danger area. The surveillance may consist of mission aircraft (weapon delivery or chase aircraft) making a dry run over the target area (at least two aircraft would participate in each test), although this action would not necessarily be performed for all tests. Alternatively, an E-9A surveillance aircraft would survey the target area for nonparticipating vessels and other objects on the water surface.

Live Maritime WSEP Missions in the EGTTR

The Air Force proposes to employ multiple munitions and aircraft to meet the objectives of the Maritime WSEP. Various Air Force active duty units, U.S. Navy, National Guard, and Air Force reserve units would deliver ordnance from the several types of aircraft listed in Table 2-1. Units would participate in the missions as interceptors and weapon release aircraft, with multiple dissimilar aircraft operating within the same airspace.

Table 2-1. Proposed Live Munitions and Aircraft

Munitions	Aircraft
GBU-10 or GBU-24	F-15 fighter aircraft
GBU-12 or GBU-54 (LJDAM)	F-16 fighter aircraft
AGM-65 (Maverick)	F-18 fighter aircraft
CBU-105	F-22 fighter aircraft
GBU-39 (LSDB)	AC-130 gunship
AGM-114 (Hellfire)	A-10 fighter aircraft
AGM-176 (Griffin)	B-1 bomber aircraft
Rockets (including APKWS)	B-2 bomber aircraft
PGU-13 HEI 30 mm	B-52 bomber aircraft
7.62 mm/.50 caliber	MH-60
	MQ-1 drone
	MQ-9 drone

AGM = air-to-ground missile; APKWS = Advanced Precision Kill Weapon System; CBU = cluster bomb unit; GBU = guided bomb unit; mm = millimeters; PGU = projectile gun unit; LJDAM = Laser Joint Direct Attack Munition; LSDB = laser small-diameter bomb; WCMD = wind-corrected munitions dispenser

The munitions would be deployed against static, towed, and remotely controlled boat targets. Static and controlled targets would consist of stripped boat hulls with plywood simulated crews and systems. Damaged boats may be recovered for data collection, but target boats may also be sunk. Targets would be positioned from several hundred meters up to 2.5 miles from the GRATV.

Weapon releases will occur in W-151 airspace against unmanned static boat targets and/or boat targets towed by remote controlled high-speed marine surface target (HSMST) boats. The GRATV will be anchored next to the boat target operations area and will provide relay of HSMST control frequencies and camera video. Two HSMSTs will tow the target boats around the GRATV in a circle with a 2- to 3-NM radius.

WSEP will have aircraft to provide aerial video of weapon impacts on boat targets. Release missions will be controlled from the Eglin Central Control Facility (CCF) on Eglin Main Base.

Figure 2-2. Intact Small Boat Targets in the EGTTR

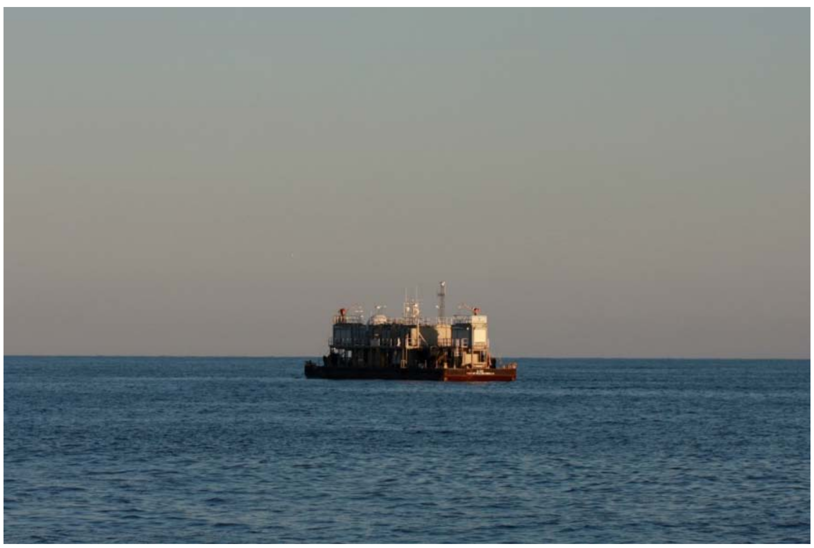

Figure 2-3. Gulf Range Armament Test Vessel (GRATV)

Swarm Missions

Aircraft flight maneuver operations over formations of manned vessels in Choctawhatchee Bay and the Gulf of Mexico, also referred to as swarm missions, will be conducted in restricted airspace R-2919/R-2914 from altitudes of 500 to 7,500 feet above ground level. The target vessels will consist of up to 30 manned boats in Choctawhatchee Bay and three manned boats in the Gulf, ranging in size from 20 to 45 feet in length and traveling at speeds of 20 to 40 knots, depending on sea state. In Choctawhatchee Bay, vessels will travel in formation between the Mid-Bay Bridge and the Highway 331 Bridge (Figure 2-4). Gulf vessels will operate in the nearshore area. Aircraft will be directed in the CCF by the 86 FWS mission director coordinating attack runs. The aircraft will perform dives in conjunction with simulated weapons releases. Aircraft will not be carrying bombs, and aircraft guns will be mechanically safed and unable to fire. Aircraft would conduct simulated weapon release runs by targeting the manned boats. These missions will be controlled from the Eglin CCF. The CCF would be in communication with all aircraft and manned vessels.

Figure 2-4. Choctawhatchee Bay Swarm Missions

Ordnance

Ordnance delivery under the Proposed Action involves the maximum deployment of all live munitions with fuzes set to detonate instantaneously upon contact with the vessel target or in the air. There are no subsurface detonations with the Proposed Action. This level of testing would be expected to provide the intended level of tactics and weapons evaluation, including a number of replicate tests sufficient for an acceptable statistical confidence level regarding munitions capabilities. The number of each type of munition, height or depth of detonation, explosive material, and net explosive weight (NEW) of each munition is provided in Table 2-2.

Table 2-2. Proposed Action

Type of Munition	Total # of Live Munitions	# of Detonations by Height/Depth	Warhead – Explosive Material	Net Explosive Weight per Munition (lb)
GBU-10 or GBU-24	2	Surface	MK-84 – tritonal	945
GBU-12 or GBU-54 (LJDAM)	6	Surface	MK-82 – tritonal	192
AGM-65 (Maverick)	6	Surface	WDU-24/B penetrating blast-fragmentation warhead	86
CBU-105	4	Airburst	10 BLU-108 submunitions with 4 projectiles, parachute, rocket motor, and altimeter; 10.69 lb NEW/submunition (includes 2.15 lb/projectile)	107.63
GBU-39 (LSDB)	4	Surface	AFX-757 (insensitive munition)	36
AGM-114 (Hellfire)	15	Surface	High Explosive Anti-Tank (HEAT) tandem anti-armor metal augmented charge, for subsurface (10-millisecond delay maximum)	20
AGM-176 (Griffin)	10	Surface	Blast fragmentation	13
Rockets (including APKWS)	100	Surface	Comp B-4 HEI	12
PGU-13 HEI 30 mm	1,000	Surface	30- x 173-mm caliber with aluminized RDX explosive. Designed for GAU-8/A gun system	0.1
7.62 mm/50 caliber	5,000 rounds	Surface	N/A	N/A

AGL = above ground level; AGM = air-to-ground missile; APKWS = Advanced Precision Kill Weapon System; CBU = cluster bomb unit; GBU = guided bomb unit; HEI = high-explosive incendiary; lb = pounds; LSDB = laser small-diameter bomb; mm = millimeters; NEW = net explosive weight; PGU = projectile gun unit; SDB = small-diameter bomb

Pre-Test Protected Species Monitoring Procedures

A separate zone around the target would also be established for the protection of marine species, based on the results of acoustic impacts analysis for live ordnance detonations. The Air Force will prepare a mitigation and monitoring plan that calculates the number of vessels required to adequately survey the area of potential acoustic impact to protected species. The dimensions of the survey area will depend on the munitions being released that day. Figure 2-5 depicts a survey scenario executed for previous mission similar to those of the Proposed Action. At least two of the support vessels would conduct marine species surveys of the target area, and more vessels as necessary. Missions would not proceed until the target area is determined to be clear of unauthorized personnel and protected species.

In addition to vessel-based monitoring, one to three video cameras would be positioned on the GRATV. The camera configuration and actual number of cameras used would depend on the specific test being conducted. The camera(s) are typically used for situational awareness of the target area and surrounding area and could also be used for monitoring the test site for the presence of marine species. Standard video frame resolution is 1024 × 800 pixels. A marine species observer would be located in the Eglin CCF, along with mission personnel, to view the video feed before and during test activities. The distance to which objects can be detected at the water surface by use of the cameras is generally comparable to that of the human eye.

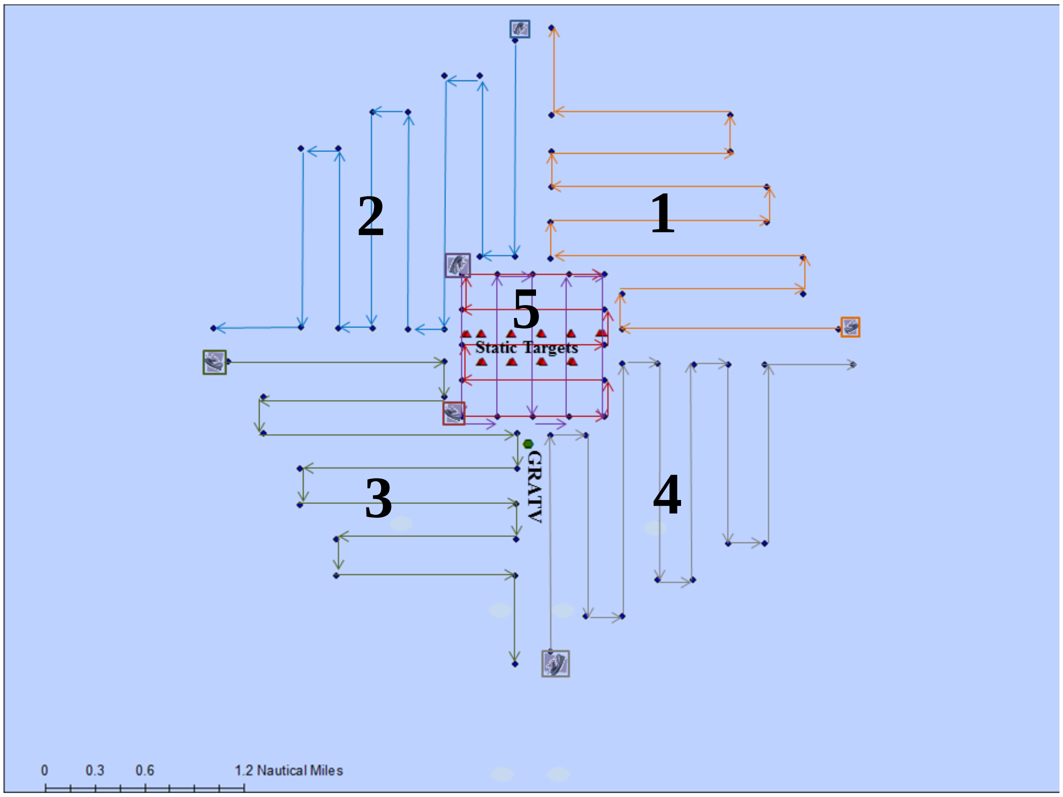

Figure 2-5. Example Monitoring Scenario for a 3,500-m Radius Acoustic Zone of Influence Around Static Targets

This scenario required five vessels to complete the survey within the allotted amount of time.

2.1.2 Post-Test

Post-test activities would consist of Air Force Explosive Ordnance Disposal (EOD) personnel detonating in place any remaining munitions components or items that would be considered UXO, including fuzes or intact munitions, debris retrieval, and post-mission protected species surveys.

EOD Procedures

The EOD team would be available as needed to dispose of any UXO on target vessels. While a UXO scenario is unlikely, UXO detonated in place could involve the sinking of target vessels, though some vessels may remain intact (Figure 2-6). Depending on the specific weapon system used and the location or position of the UXO, the test area could be closed for an extended period of time. EOD teams extensively survey target boats and the surrounding area prior to approaching and after disposing of unexploded ordnance items. Disposal is accomplished with C-4 explosive and detonations would occur above the surface of the water.

Figure 2-6. Target Boat After UXO Disposal with C-4

Post-Mission Surveys

The Air Force will conduct post-mission monitoring once the range is confirmed to be safe to enter. At least two vessels will conduct post-mission surveys for approximately 30 minutes, initiating survey efforts downcurrent from the detonation site. Vessels engaged in debris retrieval will opportunistically monitor for protected species and relay any information to the survey vessels. Observers will photograph and document on a Marine Observer Report Form the species, group size, location and condition/behavior of any animals sighted. Eglin Natural Resources and the National Marine Fisheries Stranding Network will be notified immediately if a dead or injured animal is sighted. Additional details of post-mission monitoring are provided in Chapter 5, Section 5.2.4.

Debris Retrieval

Following declaration of the target area by EOD as safe to enter, several Air Force vessels will engage in retrieving target debris. Large, mostly intact damaged target vessels may be towed, while smaller pieces of debris will be netted or lifted aboard Air Force vessels and taken to shore for disposal. Figure 2-7 shows debris and damaged target vessels from a previous similar exercise, Maritime Strike, conducted in 2013.

Figure 2-7. Target Vessels and Debris from Previous Maritime Strike Missions

2.2 ALTERNATIVES CONSIDERED

This section introduces the alternatives that will be evaluated for potential environmental impacts in this EA for Maritime WSEP activities. The Proposed Action and alternatives, which are analyzed in this document, are:

- **Proposed Action, No Subsurface Detonations:** Authorize the total desired number of live munitions with no subsurface detonation scenarios.
- **Alternative 1, Subsurface Hellfire Missiles (Preferred Alternative):** Authorize the total desired number of live munitions with subsurface Hellfire missile detonations (Table 2-3).
- **No Action Alternative:** Under this alternative, Maritime WSEP testing with live ordnance would not occur at Eglin AFB.

The general target location in the EGTTR is not flexible due to instrumentation and operational constraints, particularly the need to anchor the GRATV and the distance that radio communications are effective. Therefore, the basis of alternative development focused on decreasing potential environmental concerns. A description of each alternative is provided in the following sections. The differences between the alternatives pertain to the number of live munitions used and different altitude detonation scenarios. All other aspects of the alternatives (with the exception of the No Action Alternative) would be the same.

2.2.1 Alternative 1: Subsurface Hellfire Missiles

Alternative 1 involves authorizing the total desired number of live munitions with subsurface Hellfire detonations (Table 2-3).

Table 2-3. Alternative 1, All Munitions Plus Subsurface Hellfire Missiles

Type of Munition	Total # of Live Munitions	# of Detonations by Height/Depth	Warhead – Explosive Material	Net Explosive Weight per Munition (lb)
GBU-10 or GBU-24	2	Surface	MK-84 – tritonal	945
GBU-12 or GBU-54 (LJDAM)	6	Surface	MK-82 – tritonal	192
AGM-65 (Maverick)	6	Surface	WDU-24/B penetrating blast-fragmentation warhead	300
CBU-105	4	Airburst	10 BLU-108 submunitions with 4 projectiles, parachute, rocket motor, and altimeter; 10.69 lb NEW/submunition (includes 2.15 lb/projectile)	107.63
GBU-39 (LSDB)	4	Surface	AFX-757 (insensitive munition)	36
AGM-114 (Hellfire)	15	Subsurface (10 feet)	High Explosive Anti-Tank (HEAT) tandem anti-armor metal augmented charge; for subsurface (10-millisecond delay maximum)	20
AGM-176 (Griffin)	10	Surface	Blast fragmentation	13
Rockets (including APKWS)	100	Surface	Comp B-4 HEI	12
PGU-13 HEI 30 mm	1,000	Surface	30 x 173 mm caliber with aluminized RDX explosive; designed for GAU-8/A gun system	0.1
7.62 mm/50 caliber	5,000 rounds	Surface	N/A	N/A

AGL = above ground level; AGM = air-to-ground missile; APKWS = Advanced Precision Kill Weapon System; CBU = cluster bomb unit; GBU = guided bomb unit; HEI = high-explosive incendiary; lb = pounds; LSDB = laser small-diameter bomb; mm = millimeters; PGU = projectile gun unit

2.2.2 No Action Alternative

Under the No Action Alternative, Maritime WSEP testing would not occur at Eglin AFB. The program would not achieve objectives of developing effective methods to counter small boat threats from the air.

2.3 COMPARISON OF ALTERNATIVES

The number of live detonations for each alternative is shown below in Table 2-4. Potential impacts under each alternative are summarized in Table 2-5.

Table 2-4. Number of Live Detonations for Each Alternative

Type of Munition	Proposed Action		Alternative 1 (Preferred Alternative)	
	Number of Live Munitions	Detonation Scenario	Number of Live Munitions	Detonation Scenario
AGM-114 (Hellfire)	15	Surface	15	**Subsurface**
AGM-176 (Griffins)	10	Surface	10	Surface
AGM-65 (Mavericks)	6	Surface	6	Surface
CBU-105 (WCMD)	4	Airburst	4	Air burst
GBU-12/GBU-54 (LJDAM)	6	Surface	6	Surface
GBU-10/GBU-24	2	Surface	2	Surface
PGU-13 HEI 30 mm	1,000 rounds	Surface	1,000 rounds	Surface
2.75 rockets	100	Surface	100	Surface
7.62 mm/50 caliber	5,000 rounds	Surface	5,000 rounds	Surface
GBU-39 (LSDB)	4	Surface	4	Surface

AGM = air-to-ground missile; CBU = cluster bomb unit; GBU = guided bomb unit; HEI = high-explosive incendiary; LJDAM = laser joint direct attack munition; mm = millimeters; LSDB = laser small-diameter bomb; PGU = projectile gun unit; WCMD = wind-corrected munitions dispenser

Table 2-5. Summary of Potential Impacts for All Alternatives

Resource	Proposed Action	Alternative 1 (Preferred Alternative)	No Action Alternative
Safety/ Restricted Access	Nonparticipating vessels and persons would be kept from the mission area by use of safety boats and Notice to Mariners. The Eglin Air Force Base EOD team would resolve any UXO issues on surface targets. Clearance of the surface by the Eglin EOD team would be required for military and civilian personnel to reenter target areas. Closure of the mission area would be temporary and intermittent and would not significantly impact recreational or commercial fishing.	The potential safety/restricted access impacts would be the same for Alternative 1 as for the Proposed Action.	There would be no significant impacts due to safety or restricted access issues. Maritime WSEP activities would not occur.
Socioeconomics	There would be potential for impacts to socioeconomic activities, including fishing and boating, from restricted access; however implementation of BMPs and continued use of communication services would minimize adverse impacts. Therefore, no significant impacts to socioeconomic resources would be anticipated under the Proposed Action. Additionally, no disproportionate impacts to low-income communities, minorities, or children have been identified under the Proposed Action.	The potential socioeconomic impacts would be the same for Alternative 1 as for the Proposed Action.	There would be no potential impacts to socioeconomic and environmental justice resources from additional access restrictions under this alternative
Physical Resources	There would be no significant impacts to physical resources. Impacts to water column and substrate quality would be minor. Detonations would not be of sufficient strength to cause seafloor cratering. Scouring of the seafloor by debris pieces would be minor.	The potential physical resources impacts would be the same for Alternative 1 as for the Proposed Action.	There would be no significant impacts to physical resources, as Maritime WSEP testing would not occur.
Biological Resources	Marine fish may be injured or killed by detonations, but the number is expected to be negligible relative to overall populations. Maritime WSEP activities would occur outside the principle distribution range of ESA-protected fish species, and Gulf sturgeon critical habitat would not be affected. Detonations would not significantly affect benthic communities. Known hardbottom habitats and artificial reefs would be avoided. Essential fish habitat would not be significantly impacted. Significant impacts to marine birds, including ESA-listed and migratory species, are not expected. Marine mammals and sea turtles could be exposed to noise or pressure levels resulting in mortality, injury, or harassment.	Subsurface detonations would potentially result in higher numbers of injury, mortality, and harassment of protected species including marine mammals and sea turtles. The risk of fish kills would be greater. Gulf sturgeon critical habitat would not be affected. A larger acoustic zone of influence would potentially require more survey vessels and more time to clear the target area of protected species. Mitigation measures would decrease the potential for impacts. Eglin would request a Biological Opinion under the ESA and an IHA under the MMPA. NMFS would conduct environmental analyses and if appropriate determinations are made NMFS would issue an IHA permit and Biological Opinion, and Eglin would commence activities.	There would be no significant impacts to biological resources, as Maritime WSEP testing would not occur.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 SAFETY/RESTRICTED ACCESS

3.1.1 Definition

Safety refers to the evaluation of risks to public health (both military and civilian) due to direct strikes by weapons, blast effects, UXO, and debris. Injury or death is possible without proper safety precautions. *Restricted access* refers to closure of the test area to recreational and commercial vessels for defined time periods.

3.1.2 Affected Environment

For actions occurring in the EGTTR with inherent safety risks, such as the Maritime WSEP test mission, the Air Force implements measures to control the risk to the public. Such measures include the designation of areas as “restricted” or “closed” to the public. The closures are driven by the dimensions of the “safety footprint” of a particular action that may have potentially harmful noise, blast, or other effects. Safety footprints vary based on several factors, including weapon type, flight profile, altitude of delivery, speed, or flight system of the specified test activity. Areas of the Gulf and Choctawhatchee Bay where swarm missions would be conducted are not restricted and would not be closed to the public.

When applying the individual weapon safety footprints to a test area in the EGTTR, it is generally the policy of the Eglin Range Safety Office to apply a safety buffer called the “impact limit line.” This line is the outermost impact boundary of items generated by the test. The safety buffer not only protects public users from areas potentially impacted by the test activity, but it also buffers the activity from adjacent Gulf uses (e.g., shipping, recreational boating, commercial activities), thereby ensuring public safety and compatible use of the Gulf. The buffer can also attenuate the noise from test area activities, mitigating the impact to adjacent/surrounding user groups.

Restricted access may affect the availability of discreet areas of ocean surface for uses including commercial fishing, recreational fishing, and other recreational activities, such as boating and scuba diving. The EGTTR is composed of several warning areas plus the Eglin Water Test Areas 1 through 6. There are generally no restrictions on public or commercial uses of the surface water under the warning areas unless DoD activities are planned, including activities that require airspace use. These activities must be scheduled through the controlling agency for that airspace. If there is an activity that could be hazardous to public or commercial use of the surface, a local NOTMAR may be issued through the U.S. Coast Guard Service stating the activity and potential hazards, although a NOTMAR is not necessarily requested for all hazardous tests. Even with these notices, it is the responsibility of the military to ensure that there is no surface traffic in the area. Aircrews must wait until the area is clear of surface traffic or find another location in the EGTTR that is clear of traffic. Due to the level of cooperation provided by local commercial and public users of the surface and the offshore nature of EGTTR waters, rescheduling of tests rarely occurs.

3.1.3 Environmental Consequences

3.1.3.1 Proposed Action

Safety

Maritime WSEP missions include the detonation of live weapons, some of which have a large net explosive weight (up to 945 pounds). Therefore, to protect military and civilian personnel, several safety features would be implemented. Safety measures would generally be categorized as test area clearance and UXO disposition, as described below. In addition to on-site safety measures, the Eglin Safety Office Risk Management Board would review the specific test plan approximately one month in advance in order to discuss issues and identify risks. Test plans considered "high risk" would be elevated to the base commander for review. Swarm missions in the Gulf and Choctawhatchee Bay would not pose a public safety risk. All vessels would operate at safe cruising speeds and would avoid nonparticipating vessels.

A NOTMAR would be issued in advance of each test and would include a description of the hazard, test area location, and time frame of closure. The NOTMAR would be broadcast on channel 16 through the U.S. Coast Guard. In addition, 96 RANSS personnel would distribute flyers at public docks explaining the closure, and diagramming the area to be closed.

The test area would be cleared of all commercial and recreational boats on the morning of the test. The cleared area would include a safety footprint around the target, the size of which would depend on the particular weapon being tested. The area would be cleared with the assistance of Air Force and contracted safety boats. Safety boats would include a number of local charter fishing boats with crews familiar with the test area, and possibly other commercial vessels operating in the vicinity. The use of local operators is expected to increase cooperation among other nonparticipating vessels. Safety boats would be positioned in a pattern such that unauthorized vessels would be seen if entering the cleared area. Some of the safety boats would be equipped with radar to detect nonparticipating vessels. Safety boat crews would attempt to contact any nonparticipating vessel and direct it to maneuver away from the hazard area. The Eglin Safety Office would monitor real-time activity of surface craft and use this information to make clear-to-arm and clear-to-fire calls as appropriate. Test area clearance would begin at daylight and continue throughout the mission. The safety footprint is expected to be closed for approximately four hours for each test (no more than two tests per day).

In addition to clearance by safety boats, the test area would be surveyed from aircraft prior to the test. Before ordnance delivery, aircraft would make surveillance passes to ensure recreational and commercial vessels are clear of the danger area. The surveillance may consist of mission aircraft (weapon delivery or chase aircraft) making a dry run over the target area (at least two aircraft would participate in each test), although this action would not necessarily be performed for all tests. Alternatively, an E-9A surveillance aircraft based at Tyndall AFB would survey the target area for nonparticipating vessels and other objects on the water surface. Observation effectiveness may vary among aircraft types, with jets and bombers possibly moving at high speed. However, propeller aircraft would be able to fly at slower speeds. The turboprop-driven E-9A aircraft is well suited to observe the GOM surface and is used regularly as a surveillance platform during Air Force missions (U.S. Air Force, 2009). It can be modified with the AN/APS-143(V)-1 Airborne Sea Surveillance Radar (also known as OceanEye™) to detect objects on the ocean surface. This radar allows E-9A operators to detect a person in a life raft up to 25 miles away. Location telemetry data can be transmitted to the range safety officer. Personnel in the E-9A would be able to adequately observe the ocean surface for nonparticipating vessels.

Finally, a limited degree of clearance effort may be conducted from the GRATV. Mission-related personnel would be aboard the barge anchored on-site, up to a certain point prior to the test. A video link would be established between the barge and the target boat. Video controllers would, therefore, have a limited ability to observe the water surface near the target for unauthorized vessels.

There is potential for munitions to fail to detonate, resulting in UXO within the test area. Although the dud rate of the various munitions is not quantified, it is expected to be low (less than five percent), possibly resulting in a small number of unexploded gunnery rounds or larger ordnance remaining on intact target boats or on the seafloor. After the mission, targets still afloat would be inspected by the Eglin EOD team to identify any munitions components that would be considered UXO, including fuzes or intact munitions. UXO would be blown in place, which could result in sinking of target vessels. Floating non-UXO debris that is not recovered could pose a strike hazard to vessels operating in the area. However, the amount of such material is expected to be small because the Air Force will remove debris to the extent feasible. The Eglin Marine Operations Team would collect as much floating debris from the mission site as possible. Large pieces of the targets, such as boat hulls or large fragments of plywood or other materials, would be towed back to Eglin AFB for analysis. Smaller debris would be collected with dip nets and transported to shore for analysis or disposal. Clearance of surface UXO by the Eglin EOD team would be required prior to military and civilian personnel reentering the target area.

UXO, if present, may also sink to the seafloor. Submerged UXO would potentially pose a safety hazard because of the potential for recovery by members of the public. Once in the marine environment, UXO may be subject to a number of processes including transport, burial, exhumation, encasement, and corrosion/degradation. UXO may be buried upon impact with the seafloor (depending on velocity and sediment characteristics) or may become buried over time due to current-induced sediment movement. Shifting sediments may also cause exposure of previously buried ordnance, and a cycle of repeated burial/exhumation events can occur in some cases. Water currents may transport unburied UXO, potentially resulting in shoreward movement into shallower water. Such movement is more likely for smaller munitions such as gunnery rounds.

If UXO were to migrate out of the test area, it could be encountered by scuba divers or impacted by dredging operations. Dredging periodically occurs south of the Destin Pass and Eglin's Santa Rosa Island property. UXO could also be encountered during fishing operations (for example, bottom trawling during shrimp fishing). In extreme cases, ordnance could eventually reach the shoreline where it would potentially be accessible to a larger number of people, although this would not be likely for the larger munitions. Any of these scenarios would be considered a human safety hazard. The potential for UXO burial or migration is unknown for the specific Maritime WSEP test location at this time.

Several factors could decrease the likelihood of impacts due to UXO. Submerged UXO would corrode and degrade over time in the saltwater environment. In some cases, unexploded munitions can become entombed long term within the seabed. In addition, UXO may be subject to concretion, whereby the munition becomes encased by minerals, metals, or biogenic accretion.

Concretion may stabilize the munition to some degree, possibly resulting in decreased likelihood of detonation from physical disturbance, although it may also result in preservation of the detonation mechanisms for some time. Recreational scuba divers would likely encounter UXO only if it migrated to an area containing natural or artificial reefs or other structures where marine life is concentrated.

In summary, a small number of UXO items could possibly be produced during Maritime WSEP test activities. These items could be or become accessible to members of the public, thereby posing a human safety hazard. However, Eglin EOD personnel would be present for each test and would neutralize UXO to the extent possible. UXO deposited on the seafloor could be subject to long-term burial in the sediment and would corrode and degrade over time. The likelihood of migration into areas of increased potential for human access is unquantified at this time; however, a modeling task will be performed and the results will be included in the final EA. Given these factors, there would not be a significant risk to safety resulting from Maritime WSEP activities.

Potential safety issues with swarm missions include the presence of other vessels in Choctawhatchee Bay. Mission vessels communicate with each other via radio to inform the swarm fleet of any nonparticipants on the water. Nonparticipant vessels are given wide berth; therefore minimizing potential safety concerns.

Restricted Access

An area of ocean surface would be closed to the public each time a live mission is conducted. The size of the closed area would vary, depending on the net explosive weight of the weapon being tested. The composite safety footprint shown in Figure 3-1 has an area of approximately 301 square miles, which represents about 2 percent of W-151 and 8 percent of W-151A. Closure would generally extend for about four hours per test, over the course of two to three weeks. However, if UXO are present after a test and depending on the specific weapon system used and the location/configuration of the UXO, the test area could be closed for a longer time period. Compared with the overall area of nearshore Gulf waters available in the region, the closed area would be small and established on an intermittent, short-term basis. Choctawhatchee Bay and the Gulf swarm mission area would not be closed.

A number of known artificial reefs would likely be inaccessible to recreational and commercial fishermen during test area closure, as well as an additional number of undisclosed reefs. However, commercial and recreational users of the Gulf would generally not be excluded from access to similar nearby resources. Boats would be required to move a moderate distance east or west when coming out of the Destin Pass (average safety zone radius would be less than five miles), which could cause public annoyance. It is unlikely that closure would require a vessel to return to port from limited fishing capability or require a charter fishing company to provide a refund to passengers. There would be no significant impacts to access of the Gulf of Mexico due to Maritime WSEP activities.

There would be no restricted access impacts from swarm missions in Choctawhatchee Bay. The bay is not closed during this activity as nonparticipating vessels are easily avoided.

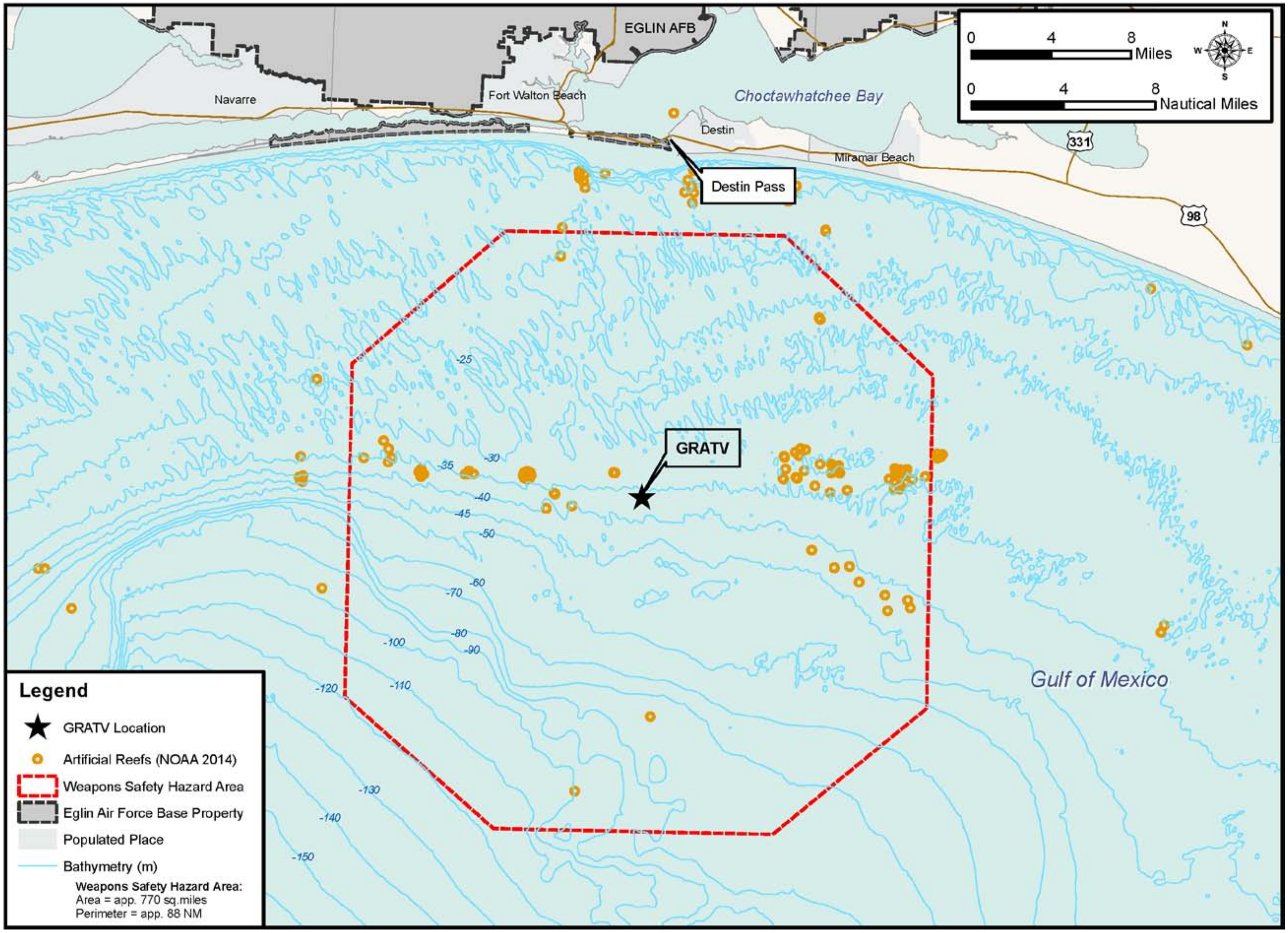

Figure 3-1. Artificial Reefs Within the Maritime WSEP Safety Footprint

3.1.3.2 Alternative 1: Subsurface Hellfire Missiles (Preferred Alternative)

Impacts to safety and Gulf access under Alternative 1 would be similar to those described for the Proposed Action. The number of munitions is the same though a subsurface detonation scenario may potentially increase the likelihood that a munition may not properly detonate, resulting in an increased potential for UXO. There would be no significant impacts due to safety or restricted access.

3.1.3.3 No Action Alternative

Under the No Action Alternative, Maritime WSEP activities would not occur. There would be no associated safety concerns or closure of safety footprints. There would be no significant impacts due to safety or restricted access.

3.2 SOCIOECONOMICS

3.2.1 Definition of the Resource

Socioeconomic activities associated with the alternatives are concentrated in the GOM, which is the ROI for this analysis. The major socioeconomic concerns are the potential impacts associated with restricted access to the marine environment. Many recreational and commercial activities take place in the GOM and are an important economic contributor to the coastal communities surrounding the GOM.

Environmental Justice and Special Risks to Children

In 1994, EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations (Environmental Justice),* was issued to focus the attention of federal agencies on how their actions affect the human health and environmental conditions to which minority and low-income populations are exposed. This EO was also established to ensure that, if there were disproportionately high and adverse human health or environmental effects of federal actions on these populations, these effects would be identified and addressed. The environmental justice analysis addresses the characteristics of race, ethnicity, and poverty status for populations residing in areas potentially affected by implementation of the proposed action.

In 1997, EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks (Protection of Children),* was issued to identify and address anticipated health or safety issues that affect children. The protection-of-children analysis addresses the distribution of population by age in areas potentially affected by implementation of the proposed action.

For the purpose of the environmental justice analysis, these populations are defined as follows:

> **Minority Populations**: All persons identified by the U.S. Census Bureau to be of Hispanic or Latino origin, regardless of race, plus non-Hispanic persons who are Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or members of some other (i.e., nonwhite) race or two or more races.

Low-Income Populations: All persons who fall within the statistical poverty thresholds established by the U.S. Census Bureau. For the purposes of this analysis, low-income populations are defined as persons living below the poverty level. Starting with the 2010 decennial census, poverty data will be provided through the annual American Community Survey rather than as part of the decennial census.

Children: All persons identified by the census to be under the age of 18 years.

As detailed in Section 1.5, the Region of Influence (ROI) is Warning Area 151 (W-151) in the Eglin Gulf Test and Training Range (EGTTR), which includes approximately 10,000 square nautical miles (NM2) of GOM waters from 3 to 100 miles offshore of Santa Rosa Island. As such, a characterization of population groups living in the GOM is not applicable. However, impacts on human populations (i.e., effects on commercial or recreational fishing) were considered in the analysis of environmental consequences to determine effects on users.

3.2.2 Affected Environment

Recreational Fishing

Recreational fishing effort in the GOM is a popular activity for residents in surrounding GOM communities and visitors. Recreational fishing participation in the Gulf has fluctuated over the past decade but is anticipated to increase over the next several years. In 2013, more than 25 million angler trips were made to the GOM (NMFS, 2014a) (Table 3-1).

Table 3-1. Annual Estimate of the Number of Angler Trips to the Gulf of Mexico

Year	Angler Trips	Percent Change over Previous Year
2004	26,429,207	15.13%
2005	23,289,807	-11.88%
2006	23,292,921	0.01%
2007	24,289,264	4.28%
2008	24,789,852	2.06%
2009	22,597,249	-8.84%
2010	21,047,433	-6.86%
2011	22,575,779	7.26%
2012	23,172,483	2.64%
2013	25,233,371	8.89%

Source: NMFS, 2014a

Each state agency regulates the type and number of fish that can be caught and kept, which fish can be caught and released, and the maximum size of each type of fish caught. The species of fish caught also depend on the fishing location and the time of the year. In 2013, the majority of total catch in the GOM were fished primarily from inland waters, (inshore saltwater and brackish water bodies), (61 percent), followed by state territorial seas, (approximately 10 statute miles from shore) (29 percent), and the federal EEZ, (State Territorial Seas to 200 nautical miles) (10 percent) (NMFS, 2012b). Certain types of species of fish are available year round.

There are typically two types of recreational fishing participants in the GOM that would have access to the area of influence: private/rental and charter participants. Private recreational participants include those who own a boat or have access to a private or rental boat. Table 3-2 shows the number of angler trips made to specific fishing areas in the GOM during 2013.

Table 3-2. Angler Trips by Area, 2013

Fishing Mode	Fishing Area	Angler Trips
Shore	Ocean (≤3 miles)	1,498,313
Shore	Ocean (≤10 miles)	3,745,909
Shore	Inland	5,572,622
Charter Boat	Ocean (≤3 miles)	27,862
Charter Boat	Ocean (> 3 miles)	71,672
Charter Boat	Ocean (≤10 miles)	199,908
Charter Boat	Ocean (> 10 miles)	322,185
Charter Boat	Inland	285,301
Private/Rental	Ocean (≤3 miles)	207,437
Private/Rental	Ocean (> 3 miles)	398,438
Private/Rental	Ocean (≤10 miles)	2,572,325
Private/Rental	Ocean (> 10 miles)	1,136,161
Private/Rental	Inland	9,195,239

Source: NMFS, 2014c

The second type of recreational fishing participant in the GOM include those individuals who do not have access to a private boat or choose to hire a charter boat for access to the fisheries. In 2013, the majority of angler trips by charter boat to the GOM were in the federal EEZ (greater than 10 miles from shore) followed by inland trips (NMFS, 2014b). Charter boats typically operate during the months of May through the month of October, each day beginning at 6:00 AM in the morning. Late morning and early afternoon trips are typically available for 8-, 10-, 12-hour and overnight trips. Rates vary depending on several factors including the length of the trip and the number of persons participating. Charter boat captain salaries are highly dependent on experience, employer, and geographic location. Based on the 2013 Occupational Employment Statistics Survey by the U.S. Bureau of Labor Statistics, “water vessel captains, mates, and pilots” had an annual mean wage of $69,450 in the state of Florida, which was lower than the national average of $75,580 (BLS, 2014).

A report by the Recreational Boating and Fishing Foundation (2013) provides information on the demographics of saltwater fishing participants. Based on the report, the majority of saltwater fisherman participants were 44 years of age or older (44.4 percent), were male (68.1 percent), had 1 to 3 years of college education (27.8 percent) or higher, had an annual income of over $100,000 (28.8 percent), and classified themselves as Caucasian/White (71.8 percent) (RBFF, 2013).

Commercial Fishing

Commercial fishing refers to harvesting and selling fish to markets, seafood wholesalers, processors and retailers for a profit. Commercial fisheries are operated under strict guidelines established by the NMFS. In 2012, a total of approximately 1.3 billion pounds of fish were caught commercially within the five Gulf States (i.e., Alabama, Florida West Coast, Louisiana, Mississippi, and Texas), with the majority from Louisiana, for a total worth of $309.96 million (NMFS, 2014d). In 2010, the most commonly caught species in Louisiana between 3 and 200 miles from U.S. shore were menhaden followed by shrimp (NMFS, 2012a); off the Florida west coast, the most commonly caught species between 3 to 200 miles was shrimp, followed by grouper (NMFS, 2012b).

Tournaments and Events

A number of fishing tournaments, festivals, concerts, and other events are held annually in the Gulf of Mexico. The most popular events are center around boating and fishing and take place between March and October. Popular species sought during tournaments in the GOM includes cobia, kingfish, red snapper, blue marlin, sailfish, and king mackerel.

Maritime Transportation

The Maritime Transportation System (MTS) refers to the system of waterways, ports, and intermodal connections in which vessels traverse and transport people and goods on the water (DOT, 2012a). There are over 300 ports in the United States (DOT, 2012a). The closest ports to the Proposed Action are the Port of Pensacola and the Panama City Marina Wharf. Both ports are within approximately 40 miles of the Proposed Action. The majority of maritime cargo in the area takes place in the Gulf Intracoastal Waterway (GIWW), the 1,300 miles inland waterway that links deep-water ports, tributaries, rivers, and bayous from Brownsville, Texas, along the entire coast of the Gulf of Mexico to Apalachicola, Florida (USACE, 2012). The GIWW runs through Choctawhatchee Bay.

The Office of Security issues maritime administration advisories to vessel masters, ship operators, and other U.S. maritime interests. Advisories are communicated through several mediums, including telex or message formats, Maritime Administration’s web site, and the National Imaging and Mapping Agency’s weekly NOTMARs (DOT, 2012b).

Artificial Reefs

Artificial reefs, shown in Figure 3-1 provide many opportunities for recreational anglers, divers, and other user groups which result in economic benefits to the coastal communities surrounding the Gulf of Mexico. The closest artificial reefs are approximately two to three miles from the GRATV. There are approximately 2,700 artificial reef deployments located off 34 coastal counties in Florida, making it the state with the most permitted artificial reefs in the nation. The economic benefits, or expenditures, associated with artificial reefs in Northwest Florida, which is comprised of 5 counties, have been estimated at $414 million and support 8,136 jobs and contribute $84 million in wages and salaries. Of the total expenditures, $359 million were attributed to visitors and $56 million to residents. The annual recreational use value of artificial reefs was estimated to be $19.7 million. The majority of expenditures were distributed in Bay (36 percent), followed by Okaloosa (30 percent), Escambia (22 percent), Santa Rosa (7 percent), and Walton (5 percent) (Adams et al., 2011).

3.2.3 Environmental Consequences

3.2.3.1 Proposed Action

Under the Proposed Action, there would be a restriction in access within W-151 in the EGTTR, as shown in Figure 3-1, associated with the frequency of testing activities. The frequency of closures within W-151 to the public due to testing activities under the proposed alternative would occur approximately 8 to 10 times within a 2-week period in the month of March. During this time, nonmission personnel, such as recreational and commercial fisherman, would be excluded from entering into the safety footprint while it is active. Recreational and commercial fishermen operating in Choctawhatchee Bay or the Gulf swarm mission area would not be affected, as the Air Force would not restrict access to these waters.

Recreational and commercial fishing participants, as well as other recreational seekers in the restricted area could potentially be affected by the action in several ways. First, fisherman and other recreational users traversing through or planning to visit the area within the safety footprint while it is active could experience additional costs associated with time delays and rerouting. The continued use of NOTMARs and other modes of communication in advance of military activities could minimize the potential impacts to recreational and commercial users by providing time for users to plan their activities accordingly.

Second, mission activities would occur during the same months as fishing tournaments and could interfere with tournament participants planning to utilize the area within the safety footprint. Popular tournaments in the vicinity during the March time frame are focused on cobia. During cobia tournaments, fishermen stay near shore and typically devote efforts to the particular catch. To minimize impacts to recreational fisherman, testing activities under the proposed action would not occur on weekends and would be limited to four hours each day. Additionally, implementation of best management practices (BMPs) that would restrict military missions during holidays or special events in the month of March could minimize the potential impacts to recreational and commercial users.

Third, several charter boats and local boat owners would be temporary employed by Eglin Range Safety and compensated by the Air Force in exchange for providing assistance as part of the safety perimeter team, which refers to the team of boats that are on location to inform and protect the public from entering the safety footprint during testing activities, and as participants in swarm missions. Compensation received from the Air Force could offset the potential loss in income associated with the loss in business activities or other recreational excursions during the closures.

As described above, there would be potential for adverse impacts to socioeconomic activities including fishing and boating from restricted access but also beneficial impacts to several local boat owners and charter boats that would be compensated by the Air Force in exchange for their service as part of the safety perimeter team. Implementation of BMPs and continued use of communication services would minimize adverse impacts; therefore, no significant impacts to socioeconomic resources would be anticipated under the Proposed Action.

The affected area is located within W-151 in the EGTTR and Choctawhatchee Bay. Human activity in this area consists primarily of military testing and training exercises and commercial endeavors such as fishing and shipping. A characterization of population groups living in the

GOM is not applicable; however, based on demographic information of recreational fishing and boating participants reported by the Recreational Boating and Fishing Foundation (2013), there would not be disproportionate impacts to minority, low-income individuals, or children under the Proposed Action.

3.2.3.2 Alternative 1: Subsurface Hellfire Missiles (Preferred Alternative)

Under Alternative 1, the number and length of access restrictions would be the same as those described under the Proposed Action because the number of test events and safety hazard area is the same. The difference in subsurface Hellfire missiles under Alternative 1 would have no bearing with regard to socioeconomic resources.

3.2.3.3 No Action Alternative

Under this alternative, Maritime WSEP testing with live ordnance would not occur at Eglin AFB and, thus, there are no potential impacts to socioeconomic and environmental justice resources from additional access restrictions.

3.3 PHYSICAL RESOURCES

3.3.1 Definition

Physical resources evaluated in this document include the Gulf of Mexico water column and underlying sediments.

3.3.2 Affected Environment

The physical marine environment potentially affected by the Proposed Action is within W-151 of the EGTTR, the area of Choctawhatchee Bay between the Mid-Bay and Highway 331 Bridges, and the nearshore Gulf. Specifically, Gulf test site is located in subarea W-151A, southeast of the Destin Pass (Figure 3-1). This location is approximately 16.7 miles (14.5 nautical miles) offshore and is therefore outside of the 12-nautical mile state water boundary. The affected environment of the Gulf area includes the water column and sediments, as described below. The physical environment in Choctawhatchee Bay would not be affected.

Ocean water in the vicinity of the Maritime WSEP test area typically has a salinity equal to or greater than 35 parts per thousand. Dissolved inorganic ions in Gulf waters over the continental shelf include sodium, chlorine, magnesium, potassium, calcium, and phosphate (SAIC, 1997). Tidal action in the Gulf of Mexico is less developed than that of the Atlantic Coast and may be diurnal (one high and one low), semidiurnal (two high and two low tides daily), or mixed (ESE, 1987 as cited in U.S. Air Force, 2002). Water depth in W-151A ranges from 30 to 350 meters, and the depth at the test site is about 35 meters. Turbidity, a measure of water clarity, in the GOM generally decreases from nearshore to offshore, and bottom turbidity measurements tend to be higher than turbidity levels at the surface. High turbidity measurements are caused by suspended solids or impurities in the water column.

The substrate (sediments) underlying W-151 is comparable to that found throughout the eastern half of the Gulf and consists primarily of quartz sand high in sulfur and phosphate content.

There are locations of hardbottom substrate and artificial reefs in W-151, though not beneath the target area (Figure 1-2). However, a number of artificial reefs could occur inside the safety footprint and would be inaccessible for the duration of the test. The number of such structures affected would depend on the type of munition used, delivery parameters, etc. The geology of this area of the Gulf is characterized as a shallow, broad continental shelf, with steep slopes leading to two large deep water plains several miles from the target area and scattered regions where the bottom is somewhat higher.

Water quality within W151-A could be impacted by a number of effectors, including chemical materials, waste disposal, tides, and impacts from commercial activities, artificial reefs, and military activities (U. S. Air Force, 2005).Chemical pollutants from oil spills, leaks, discharges, and organotins (boat de-fouling reagents) may enter the nearshore coastal environment and flow outward to the open ocean by tidal action and eventually impact water quality. Chemical pollutants can have an effect through ingestion and long-term accumulation in the bodies of marine species. Pollutants have a tendency to bioaccumulate based on where the animal is situated within the food chain.

Vessels passing through the affected area may discharge food waste, oil and grease, cleaning products, detergents, oil, lubricants, fuel, and sewage. Untreated sewage in unregulated open ocean waters can cause eutrophication leading to excessive algal growth and depleted oxygen in the water column, resulting in harm to other organisms in the marine habitat. Certain algal species can produce biotoxins that can kill fish and marine mammal species.

Heavy metals and hydrocarbons have not been assessed specifically in the sediments of the W151-A test range. Elements such as nitrogen, iron, zinc, aluminum, manganese, and organic compounds are found naturally in Gulf waters, but some are also common byproducts of underwater explosives and ammunition firing.

Maritime WSEP testing would result in deposition of target and munitions fragments, and potentially UXO, on the seafloor. Other types of past missions occurring in the EGTTR have resulted in deposition of similar items in the northeastern Gulf. The Military Munitions Rule, which addresses military munitions deposited on military ranges, is the result of a requirement for the USEPA, Department of Defense, and the states to issue a rule identifying when such munitions become hazardous waste under RCRA. A "military munition" is defined as all ammunition produced or used for national defense, and includes a number of items such as bombs, missiles, and small arms ammunition (40 CFR, Parts 260 – 270). A military munition is not considered solid waste under RCRA when it is used for its intended purpose on a military range, which includes testing and evaluation, among other uses. However, a munition is considered solid waste if it lands off-range and is not promptly rendered safe and/or retrieved. Generally, conventional explosive ordnance testing does not constitute hazardous waste under RCRA (UXOINFO, 2013). The rule's discussion of hazardous waste management includes reference to an "explosives or munitions emergency" involving UXO.

3.3.3 Environmental Consequences

3.3.3.1 Proposed Action

Physical resources (substrate and the water column) could be affected by metals and chemical materials introduced through spent munitions and explosive byproducts and by direct impacts.

Metals typically used to construct bombs, missiles, and gunnery rounds include copper, aluminum, steel, and lead. Aluminum is also present in some explosive materials such as tritonal and PBXN-109. Lead is present in batteries typically used in vessels such as the remotely controlled target boats. Metals would settle to the seafloor after munitions are detonated. Metal ions would slowly leach into the substrate and the water column, causing elevated concentrations in a small area around munitions fragments. Some of the metals, such as aluminum, occur naturally in the ocean at varying concentrations and would not necessarily impact the substrate or water column. Other metals, such as lead, could cause toxicity in microbial communities in the substrate. However, such effects would be localized and would not significantly affect the overall habitat quality of sediments in the northeastern Gulf. In addition, metal fragments would corrode, degrade, and become encrusted over time.

Chemical materials include explosive byproducts and fuel, oil, and other fluids (including battery acid) associated with remotely controlled target boats. Explosive byproducts would be introduced into the water column through detonation of live munitions. Explosive materials associated with Maritime WSEP ordnance include tritonal and research department explosive (RDX), among others. Tritonal is primarily composed of 2,4,6-trinitrotoluene (TNT). RDX is sometimes referred to as cyclotrimethylenetrinitramine. Various byproducts are produced during and immediately after detonation of TNT and RDX. During the very brief time that a detonation is in progress, intermediate products may include carbon ions, nitrogen ions, oxygen ions, water, hydrogen cyanide, carbon monoxide, nitrogen gas, nitrous oxide, cyanic acid, and carbon dioxide (Becker, 1995). However, reactions quickly occur between the intermediates, and the final products consist mainly of water, carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen gas, although small amounts of other compounds may be produced as well.

Chemicals introduced to the water column would be quickly dispersed by waves, currents, and tidal action and eventually become uniformly distributed throughout the northern GOM. A portion of the carbon compounds, such as CO and CO_2, would likely become integrated into the carbonate system (alkalinity and pH buffering capacity of seawater). Some of the nitrogen and carbon compounds, including petroleum products, would be metabolized or assimilated during protein synthesis by phytoplankton and bacteria. Most of the gas products that do not react with the water or become assimilated by organisms would be released to the atmosphere. Due to dilution, mixing, and transformation, none of these chemicals are expected to have significant impacts on the marine environment.

Explosive material that is not consumed in a detonation could sink to the substrate and bind to sediments. However, the quantity of such materials is expected to be inconsequential. Research has shown that if munitions function properly, nearly full combustion of the explosive materials will occur, and only extremely small amounts of raw material will remain. In addition, TNT decomposes when exposed to sunlight/ultraviolet radiation and is also degraded by microbial activity (Becker, 1995). Several types of microorganisms have been shown to metabolize TNT. Similarly, RDX is decomposed by hydrolysis, ultraviolet radiation exposure, and biodegradation.

Direct physical impacts to the seafloor could occur due to debris and detonation shock waves. Debris deposited on the seafloor would include spent munitions fragments and possibly pieces of the target boats (fiberglass, plywood, etc.). Debris would not appreciably affect the sandy seafloor. Debris moved by water currents could scour the bottom, but sediments would quickly refill any affected areas, and overall effects to benthic communities would be minor. Large pieces of debris would not be as prone to movement on the seafloor and could result in beneficial effects by providing habitat for encrusting organisms, fish, and other marine fauna. Target boats have foam-filled hulls, and most of the pieces are designed to float in order to facilitate collection for a damage assessment. Overall, the quantity of material deposited on the seafloor would be small compared with other sources of debris in the GOM. Hardbottom habitats and artificial reefs are not located in the vicinity of the test site and would not be affected by debris. There is a potential for some debris to be carried by currents and interact with the substrate, but damage to natural or artificial reefs is not expected and the impacts would not be significant.

In summary, there would be no significant impacts to physical resources from the Proposed Action.

3.3.3.2 Alternative 1: Subsurface Hellfire Missiles (Preferred Alternative)

Detonations in the water column of sufficient strength to produce pressure waves reaching the seafloor would displace sediments and possibly cause cratering. Equations for determining the radius of a crater due to underwater explosions on the seafloor are provided by O'Keefe and Young (1984). However, the equations for seafloor detonations cannot be directly applied to detonations in the water column. In this case (and when the detonation occurs in relatively deep water), the radius of the explosive gas bubble may be considered a reasonable approximation of the radius of a crater if the detonation were to occur on the seafloor. Based on this association, the bubble radius of detonations in the water column is used to determine impacts to bottom sediments. If the radius extends to the seafloor, then impacts to the sediment would likely occur. If, however, the radius does not reach the bottom, then no impacts to sediment would be considered.

Swisdak (1978) provides the equation for the maximum radius of a gas bubble as:

$$Amax = (J)\ (W^{.33}/[H+Ho]^{.33})$$

Where:

Amax = maximum bubble radius (m)

J = bubble coefficient, which for TNT is 3.5 $m^{4/3}/kg^{1/3}$

W = charge weight (kilograms [kg])

H = depth of explosion (m)

Ho = atmospheric head, which equals 10 m

For Alternative 1, the only subsurface detonation scenario would involve Hellfire missiles, which has a NEW of 20 pounds. The depth of underwater detonation for the Hellfire missiles would be 10 feet beneath the surface. The equation above calculates a maximum bubble radius from a 10-foot deep Hellfire detonation to be 2.02 meters, or 6.63 feet. Given the water depth at the target location to be approximately 35 meters, the explosive bubble radius would not extend to the seafloor and, thus, would not cause sediment displacement or cratering.

Under Alternative 1, impacts to physical resources would be similar to those described for the Proposed Action. Resources could be affected by metals and chemical materials introduced through spent munitions, explosive byproducts, and petroleum products and by direct impacts. Thus, there would be no significant impacts to physical resources under Alternative 1.

3.3.3.3 No Action Alternative

Under the No Action Alternative, Maritime WSEP test activities would not take place. No detonations would occur, and no materials would be introduced into the water. There would be no impacts to physical resources.

3.4 BIOLOGICAL RESOURCES

3.4.1 Definition

This section summarizes the biological resources that could be affected by Maritime WSEP activities in the Gulf of Mexico. Effects may potentially occur in the form of mortality, injury, harassment, or behavioral modifications. Resources include marine fish, marine birds, sea turtles, marine mammals, and select habitats. Species protected by federal laws including the Endangered Species Act of 1973 (ESA) and Marine Mammal Protection Act of 1972 (MMPA) are also identified. Similar types of resources occur in Choctawhatchee Bay but as swarm missions consist of simple boat operations, these resources would not be affected.

The ESA provides for the protection of endangered and threatened species, and the habitats upon which they depend. An "endangered species" is defined as any species that is in danger of extinction throughout all or a significant portion of its range, whereas a "threatened species" is defined as any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA prohibits, with certain permitted exceptions, the "taking" of listed species. The Act defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. The ESA also requires critical habitat to be identified for listed species. Critical habitat is defined as the physical and biological features essential for a species' conservation. Such features may include food, water, and shelter, among many others. The ESA requires all federal agencies to ensure that their actions do not jeopardize the continued existence of a listed species or their designated critical habitat. Whenever a federal agency proposes to authorize, fund, or carry out an action in an area where listed species or critical habitat may be present, the agency is required to prepare a biological assessment that evaluates potential effects to the species and habitat. If it is determined that the action may adversely affect the species or habitat, a formal consultation with the appropriate Service (U.S. Fish and Wildlife Service [USFWS] or the National Marine Fisheries Service [NMFS]) is required. At the close of the consultation, the Service issues a biological opinion that describes the impacts to species and habitat.

In addition to endangered and threatened designations, the USFWS and the NMFS have additional status categories including candidate species and species of concern. Candidate species are those species identified by either of the Services as facing immediate, identifiable risks, but that have not yet been listed as threatened or endangered. The USFWS and NMFS have somewhat different criteria for identifying candidates. The USFWS identifies candidate species as those for which sufficient information is available to propose them as endangered or threatened, but for which development of a proposed regulation is precluded by other, higher priority listing activities. NMFS defines candidate species as petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which an ESA status review has been initiated and announced in the *Federal Register*. A species of concern refers to a species about which NMFS has concerns regarding status and threats, but for which insufficient information is available to indicate a need to list under the ESA.

Similar to the ESA, the MMPA prohibits, with certain permitted exceptions, the “taking” and importation of all marine mammals and marine mammal products. The term “take” is defined as harassing, hunting, capturing, or killing any marine mammal, or the attempt to do so. The term “harassment” is further categorized by level of severity as Level A or Level B. For military readiness activities specifically, harassment is defined as any act of pursuit, torment, or annoyance that:

Level A harassment - has the significant potential to injure a marine mammal or marine mammal stock in the wild.

Level B harassment - has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered.

The NMFS may authorize the incidental (not intentional) take of marine mammals in certain situations. Such permits may be of five years maximum duration and require public notice and comment before approval, as well as regulations and monitoring procedures. These authorizations are known as letters of authorization (LOAs) and, because of the regulatory requirements, may take up to about eighteen months to obtain. If the take will be in the form of harassment only (not serious injury or mortality), an incidental harassment authorization (IHA) may be issued. An IHA may be granted through an expedited regulatory process and is valid for one year.

3.4.2 Affected Environment

Marine Fish

Over 550 taxonomically and ecologically diverse species of fish are found in the GOM. Marine fish are an ecologically important component of the marine food web. Fish feed on other marine species such as plants, plankton, and other smaller fish species. They also serve as prey to other organisms including other marine fish, seabirds, and marine mammals, and many species are economically important to humans (recreational and commercial fishing). The eastern GOM includes a variety of habitats that, in turn, support a wide diversity of fish. The abundance and distribution of fish occurring in the eastern GOM are affected not only by their physical environment but also by the habitat available to them. Key habitat features include coral reefs off southern Florida, a broad continental shelf off western Florida, DeSoto and Mississippi Canyons, the Mississippi River delta extending into the Gulf as part of Louisiana, and deepwater areas beyond the continental shelf.

In addition to habitat preference, the distribution of marine fish can also be affected by the species’ life cycles, as well as position in the water column. Some species spend part of their lives in saltwater and part of their lives in freshwater or brackish water. Different life cycles for marine fish include the following:

- Estuarine-dependent fish depend on bays and/or estuaries for part of their life cycle.
- Catadromous fish spawn in saltwater, then migrate into freshwater to grow to maturity.
- Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and return to fresh water to spawn.
- Some fish species are totally marine and spend their entire lives at sea.

Fish of the eastern GOM can also be characterized by where they typically reside in the water column. Benthic and reef fish are found at or near the seafloor and around artificial or natural reef systems. Typical species include snapper, grouper, grunt, and triggerfish, among others. Pelagic fish, which occur mostly in the open waters of the Gulf, make seasonal, latitudinal migrations along the Florida coast. These migrations are caused by seasonal changes in temperature, movement of their food resources, and spawning instincts (MMS, 1990). Coastal pelagic families include jack, herring, mullet, bluefish, cobia, tuna, and mackerel. Oceanic pelagic species include dolphinfish, marlin, tuna, and swordfish.

Distribution, abundance, and diversity of fish in the GOM are further affected by physical and chemical characteristics such as salinity, temperature, depth, bottom type, primary productivity, oxygen content, turbidity, and currents. Table 3-3 depicts scientific families of the more common fish species occurring in the eastern GOM by temperature preference.

Table 3-3. Common Fish of the Eastern Gulf of Mexico Delineated by Temperature Preference

Temperature Preference	Scientific Family Name	Common Name
Temperate[1]	Acipenseridae	Sturgeons
	Atherinidae	Silversides
	Clupeidae	Herring, menhaden
	Cyprinodontidae	Mummichogs, killifish
	Engraulidae	Anchovies
	Exocoetidae	Flying fish
	Percichthyidae	Striped bass
	Pomatomidae	Bluefish
Subtropical[2]	Albulidae	Bonefish
	Carangidae	Jacks
	Ephippidae	Spadefish
	Holocentridae	Squirrelfish
	Istiophoridae	Marlins
	Labridae	Wrasses
	Lutjanidae	Snappers
	Mullidae	Goatfish
	Scaridae	Parrotfish
	Sciaenidae	Drums
	Scombridae	Mackerel, bonito, tunas
	Serranidae	Groupers
	Sparidae	Porgies
	Xiphiidae	Swordfish
Tropical[3]	Centropomidae	Snooks
	Chaetodontidae	Butterflyfish, angelfish
	Coryphaenidae	Dolphinfish
	Elopidae	Tarpon
	Gerreidae	Mojarras
	Lutjanidae	Snappers
	Pomacentridae	Damselfish
	Pomadasyidae	Grunts
	Rachycentridae	Cobia
	Sciaenidae	Drums
	Sphymidae	Hammerhead sharks
	Sphyraenidae	Barracudas

1. Species that prefer water temperatures of 10 degrees Celsius (ºC) or below, with a maximum temperature tolerance of 15ºC.
2. Species that tolerate a minimum water temperature between 10º to 20ºC.
3. Species that prefer waters greater than 20ºC or above.

Threatened and Endangered Fish Species

Two species listed under the Endangered Species Act (ESA), the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and the smalltooth sawfish (*Prestis pectinata*) occur in the eastern GOM including Choctawhatchee Bay. The Gulf sturgeon is listed as threatened, while the sawfish is listed as endangered. In addition, five species of concern have a reasonable potential for occurrence in the action area. Table 3-4 includes all species with a listing status that could potentially occur in the project area. Individual species descriptions follow.

Table 3-4. Fish Species with Federal Listing Status Potentially in the Project Area

Species Common Name	Species Scientific Name	Federal Status
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened
Smalltooth sawfish	*Pristis pectinata*	Endangered
Alabama shad	*Alosa alabamae*	Species of concern
Dusky shark	*Carcharhinus obscurus*	Species of concern
Sand tiger shark	*Carcharius taurus*	Species of concern
Speckled hind	*Epinephelus drummondhayi*	Species of concern
Warsaw grouper	*Epinephelus nigritus*	Species of concern

The **Gulf sturgeon** is an anadromous fish occurring in riverine, estuarine, and nearshore marine environments of coastal states along the Gulf of Mexico. Adults range in length from 4 to 8 feet (1 to 2.5 meters). The species' freshwater range encompasses seven river systems from Lake Pontchartrain in Louisiana to the Suwannee River in Florida. Adult Gulf sturgeons occur in fresh water during the warm months, when spawning occurs, and migrate into estuarine and marine environments in the fall to forage and overwinter. Gulf sturgeon feeding habits appear to differ according to age and environment (USFWS and NMFS, 2003 [critical habitat]). Young-of-the-year remain in freshwater and feed on invertebrates and detritus for about a year. Juveniles are thought to forage extensively through river systems, feeding on aquatic insects, worms, and bivalve mollusks. Adult and subadult sturgeons apparently do not feed in freshwater. Feeding occurs in estuarine and marine environments. Prey items are primarily benthic invertebrates including amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, mollusks, and crustaceans

The USFWS and NMFS designated critical habitat for the Gulf sturgeon in 2003 (USFWS and NMFS, 2003). Critical habitat includes numerous units in riverine, estuarine, and marine areas. Marine critical habitat encompasses coastal waters from the mean high water line out to 1.9 km (1 NM) offshore. Critical habitat also includes several rivers and bays, including Choctawhatchee Bay near Eglin AFB.

Eglin AFB has studied sturgeon occurrence and distribution in areas potentially affected by military activities through funding provided by the Department of Defense Legacy Resource Management Program. Results show that the fish generally begin outmigration in October and have departed the river systems by November. After moving into the Gulf of Mexico, sturgeon may move east or west. A number of those moving east appear to remain in the vicinity of Eglin property, while most of those moving west continue to further locations outside the footprint of Eglin-scheduled activities. Movement back toward the river systems generally begins in March. The amount of sturgeon activity detected near Eglin's Santa Rosa Island property appears to be predominantly from sturgeon tagged in the Choctawhatchee River. Initial results indicated that sturgeons remain very close to shore off Santa Rosa Island (within 1,000 meters). However, a more offshore distribution was noted during the last year of study, when over 80 percent of sturgeon detections were recorded at a receiver 1,250 meters from shore. Given the commonly cited receiver detection range of 500 meters, some number of sturgeons could have been at least 1,750 meters (approximately 1 mile) from shore. The extent of the offshore distribution could not be discerned because receivers were not placed farther out in the Gulf. However, the 1,750-meter distance does not approach the offshore test area location, and sturgeon occurrence is not considered likely.

The **smalltooth sawfish** is one of two sawfish species occurring in U.S. waters. Once common throughout the GOM from Texas to Florida, the current distribution is limited primarily to peninsular and southern Florida. The species is only commonly found in the Everglades and in shallow areas with mangrove forests in Florida Bay and the Florida Keys, as well as off southern Florida. Sawfish are considered to typically reside within 1.9 km (1 NM) of the shore in estuaries, shallow banks, sheltered bays, and river mouths with sandy and muddy bottoms. Occasionally, they are found offshore on reefs or wrecks and over hard or mud bottoms. The smalltooth sawfish feeds on fish and crustaceans, using the long flat snout to stun and kill prey.

The **Alabama shad** is an anadromous species that spawns in large flowing rivers from the Mississippi River to the Suwannee River of Florida. Fish enter fresh water during January to April, where spawning occurs over sand, gravel, and rock substrates. Young individuals remain in fresh water for the first six to eight months. Adults leave the spawning area soon after spawning is complete. The current primary threats to Alabama shad include locks and dams blocking spawning migration, commercial and navigational dredging, and alteration of hydrology and river substrates (NMFS, 2008). Commercial fishing was previously a threat to this species.

The **dusky shark** has a wide-ranging but patchy distribution in warm-temperate and tropical waters, including the Atlantic Ocean. It is coastal and pelagic in its distribution, occurring from the surf zone to well offshore and from the surface to depths of 400 meters (NMFS, 2011). In the western Atlantic, this shark occurs from southern New England to southern Brazil, including the Caribbean Sea and Gulf of Mexico. The dusky shark undertakes long, temperature-related migrations, moving northward in summer as the waters warm and southward in fall as water temperatures drop.

The **sand tiger shark** is distributed in all warm and temperate seas except the eastern Pacific (NMFS, 2010). It is a species of concern in the western Atlantic and northern GOM. Sand tiger sharks range from the surf zone to depths up to 190 meters (626 feet). They are often found near the sea bottom but may occur at any point in the water column. This species is migratory, moving north during the summer and south during fall and winter.

The **speckled hind** inhabits warm, moderately deep waters from North Carolina to Cuba, including the GOM. The preferred habitat is hardbottom reefs in depths from 24 to 396 meters (80 to 1,300 feet), although they generally prefer depths of 61 to 122 meters (200 to 400 feet) (NMFS, 2009).

The **Warsaw grouper** occurs on reefs in water depths of 55 to 525 meters (180 to 1,700 feet) (NMFS, 2009a). The species ranges from North Carolina to the Florida Keys, including the

GOM. On September 28, 2010, the NMFS issued a finding that a petition to list the Warsaw grouper under the ESA did not present substantial information indicating listing was warranted. However, as of September 2014, this species remains listed as a species of concern list on the NMFS website.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.) established jurisdiction over marine fishery resources within the U.S. EEZ. The Magnuson-Stevens Act mandated the formation of eight fishery management councils (FMCs), which function to conserve and manage certain fisheries within their geographic jurisdictions. The FMCs are required to prepare and maintain a Fishery Management Plan (FMP) for each fishery that requires management. The Gulf of Mexico Fishery Management Council (GMFMC) manages fisheries in the Maritime WSEP study area. Amendments contained in the Sustainable Fisheries Act of 1996 (Public Law 104-267) require the councils to identify essential fish habitat (EFH) for each fishery covered under a FMP. EFH is defined as the waters and substrate necessary for spawning, breeding, or growth to maturity. The term "fish" is defined as "finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds."

In addition to the GMFMC, the Gulf States Marine Fisheries Commission (GSMFC) and NMFS also have management responsibilities for certain fisheries. The GSMFC is an organization of five states from the Gulf coast of Florida to Texas that manages fishery resources in state waters. The GSMFC provides coordination and administration for a number of cooperative state/federal marine fishery resources. NMFS has jurisdiction over highly migratory species in federal waters of the GOM.

The GMFMC manages seven fishery resources in federal waters between Texas and Key West, Florida. The coral and coral reef FMP includes over 300 coral species. The reef fish FMP includes 31 species of snappers, groupers, tilefishes, jacks, triggerfishes, and wrasses. Fish in this FMP are generally demersal subtropical species that utilize similar habitats and are harvested by similar methods, both recreationally and commercially. Shrimp species include brown, white, pink, and royal red. The spiny lobster fishery is managed jointly by the GMFMC and the South Atlantic Fishery Management Council, with the GMFMC acting as the lead council. The Coastal Migratory Pelagics management unit consists of king mackerel, Spanish mackerel, cobia, dolphin, little tunny, cero mackerel, and bluefish. Highly migratory species, managed by NMFS, include tunas (5 species), billfish (4 species), swordfish, large coastal sharks (22 species), small coastal sharks (7 species), and pelagic sharks (10 species). Managed species and associated EFH are shown in Table 3-5.

In addition to establishing EFH, the Magnuson-Stevens Act also directs NMFS and the FMCs to characterize habitat areas of particular concern (HAPCs). HAPCs are subsets of EFH that are rare, especially ecologically important, particularly susceptible to human-induced degradation, or located in environmentally stressed areas. HAPCs typically include high-value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish. HAPCs located off the Florida coast include the Madison-Swanson Marine Reserve, Florida Middle Grounds, Pulley Ridge, and Tortugas North and South Ecological Reserves. Other HAPCs located in the GOM include East and West Flower Garden Banks and the following reefs and banks: Stetson, Sonnier, MacNeil, 29 Fathom, Rankin Bright, Geyer, McGrail, Bouma, Rezak Sidner, Alderice, and Jakkula (GMFMC, 2010). None of these areas are near the Maritime WSEP test area and would not be affected by test activities.

Table 3-5. Fish Species and Management Units for Which Essential Fish Habitat Has Been Identified

Species or Management Unit	Essential Fish Habitat
Coastal Migratory Pelagics (7 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the U.S./Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council, from estuarine waters out to depths of 100 fathoms.
Coral and Coral Reefs (over 300 species)	The total distribution of coral species and life stages throughout the Gulf of Mexico including the East and West Flower Garden Banks, Florida Middle Grounds, southwest tip of the Florida reef tract, and predominant patchy hardbottom offshore of Florida from approximately Crystal River south to the Keys, and scattered along the pinnacles and banks from Texas to Mississippi, at the shelf edge.
Red Drum	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to depths of 25 fathoms; waters and substrates extending from Crystal River, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms.
Reef Fish (31 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the U.S./Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.
Shrimp (4 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the U.S./Mexico border to Fort Walton Beach, Florida, from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana, to Pensacola Bay, Florida, between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida, to Naples, Florida, between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.
Spiny Lobster	Gulf of Mexico waters and substrates extending from Tarpon Springs, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 15 fathoms.
Stone Crab	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the U.S./Mexico border to Sanibel, Florida, from estuarine waters out to depths of 10 fathoms; waters and substrates extending from Sanibel, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 15 fathoms.
Highly Migratory Species (49 species)	Coastal to offshore water column throughout the Gulf of Mexico, out to the U.S. Exclusive Economic Zone boundary.

Source: GMFMC, 2004; NMFS, 2009b

Marine Birds

Marine birds are considered in this section to be those bird species 1) whose habitat and food source includes the sea, whether coastal, offshore, or pelagic waters, and/or 2) whose migratory routes at least partially traverse the sea. These species may be generally separated into six groups: diving birds, gulls/terns, shorebirds, passerines, wading birds, and waterfowl. Examples of birds that are characteristic of each group are provided in Table 3-6. While some marine bird species inhabit only pelagic habitats in the GOM, most inhabit waters of the continental shelf and adjacent coastal and inshore habitats.

Table 3-6. Bird Species Associated with the Gulf of Mexico

Diving Birds	Gulls/Terns	Shorebirds	Passerines	Wading Birds	Waterfowl
Common loon Horned grebe Pied-billed grebe Anhinga Double-crested cormorant Gannets Boobies Petrels Shearwaters	Gulls Terns Noddies Jaegers Black skimmer	Jacana Oystercatcher Stilt Avocet Snipe Sandpipers Dunlin Plovers	Blue jay Red-winged blackbird Common grackle Northern cardinal Eastern towhee	Bitterns Herons Egrets White ibis	Scaups Blue-winged teal

Source: MMS, 2007; USGS, 2007

Most marine birds that use the sea as a food source are visual predators and forage during daylight hours (Shealer, 2002). Some species use tactile or olfactory perception (Furness and Monaghan, 1987). Most species feed at or near the surface (Furness and Monaghan, 1987). Others (e.g., many terns, pelicans) feed just below the surface using a method referred to as plunge diving, where the bird dives from the air into the water (Schreiber and Burger, 2002). When plunge diving, birds generally penetrate the water little further than their own body length (Furness and Monaghan, 1987) and remain underwater for only a few seconds. Another feeding method is pursuit diving, used by species such as cormorants and petrels, where a bird uses its wings and/or feet to swim underwater in pursuit of prey. A few species can dive to considerable depth and stay submerged for several minutes. Cormorants may forage to a depth of up to 30 meters (98 feet), gannets and boobies up to 25 meters (82 feet), and petrels and shearwaters up to 70 meters (230 feet), although typical foraging depths may be much shallower (Wilson et al., 2002).

The eastern GOM is a migratory route populated by both resident and migratory marine birds. A migratory bird is any species of family of birds that lives, reproduces, or migrates within or across international borders at some point during its annual life cycle. These species are protected under the Migratory Bird Treaty Act (MBTA). The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, and migratory bird, their eggs, parts, and nests, except as authorized under a valid permit. Current regulations authorize permits for certain actions, including military readiness activities.

Approximately two-thirds of the breeding bird species of the eastern United States migrate to Central and South America, Mexico, and the Caribbean. The states that border the eastern GOM lie within the Atlantic Flyway, a major migration route. Passerines (i.e., perching birds such as finches and sparrows) use an offshore route in the GOM. Most migratory land birds are nocturnal flyers (Moore et al., 1995). Migration generally peaks in late April to early May.

Some important resting areas for migratory birds include St. Andrew State Recreation Area, Gulf Islands National Seashore, St. Joseph Peninsula State Park, and St. George Island State Park (Duncan, 1994). Summer residents include Audubon’s shearwaters, Wilson’s storm-petrels, magnificent frigatebirds, sandwich terns (in the Florida Panhandle), least terns, and sooty terns. Winter residents include common loons, horned grebes, northern gannets, great cormorants, pomarine jaegers, parasitic jaegers, Bonaparte’s gulls, and ring-billed gulls. Permanent residents include pied-billed grebes, anhingas, double-crested cormorants, brown pelicans, laughing gulls, royal terns, and Caspian terns.

Threatened, Endangered, and Protected Bird Species in the Gulf of Mexico

Two bird species with potential occurrence in the project area are listed as threatened or endangered under the ESA: the piping plover (*Charadrius melodus*) and wood stork (*Mycteria americana*). The bald eagle (*Haliaeetus leucocephalus*) has been removed from the federal ESA list, but remains protected under the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA prohibits, among other things, the taking of bald eagles and their parts, nests, or eggs. Protected bird species are listed in Table 3-7.

Table 3-7. Endangered and Threatened Bird Species in the Gulf of Mexico

Species	Status	Areas of Occurrence
Piping plover (*Charadrius melodus*)	ESA: Threatened	Winters along the Gulf coast from Florida to Texas.
Wood stork (*Mycteria americana*)	ESA: Endangered	In the U.S., occurs in wet areas from North Carolina to Mississippi; nests in some areas of Florida.
Bald eagle (*Haliaeetus leucocephalus*)	BGEPA	Nests regularly along the Gulf coast, including the Florida Panhandle.

BGEPA = Bald and Gold Eagle Protection Act; ESA = Endangered Species Act

Winter foraging critical habitat for the piping plover was designated in 2001 (USFWS, 2001) and includes numerous areas along the Florida coast from Pensacola to the Florida Keys. Critical habitat is included in Eglin-owned property near Navarre Beach. Piping plovers may be found anywhere that affords adequate foraging and sheltering resources. The species is known to forage in exposed wet sand areas such as wash zones, intertidal ocean beachfronts, wrack lines, washover passes, mud and sand flats, ephemeral ponds, and salt marshes. Plovers are also known to use adjacent areas for sheltering in dunes, debris, and sparse vegetation. Critical habitat has not been designated for the wood stork.

Marine Mammals

Marine mammals that potentially occur within the study area include two species of cetaceans and one sirenian, the Florida manatee (*Trichechus manatus latirostrus*). Manatees primarily inhabit coastal and inshore waters, and are rarely sighted offshore. Maritime WSEP missions would be conducted approximately 17 miles off the coast. Therefore, manatee occurrence is considered unlikely, and further discussion of marine mammal species is limited to cetaceans.

Species that occur within the test area include the bottlenose dolphin (*Tursiops truncatus*) and Atlantic spotted dolphin (*Stenella frontalis*). These two species are frequently sighted in the northern Gulf over the continental shelf, in a water depth range that encompasses the Maritime WSEP test location (Garrison, 2008; DON, 2007; Davis et al., 2000). Dwarf sperm whales (*Kogia sima*) and pygmy sperm whales (*Kogia breviceps*) are occasionally sighted over the continental shelf but are not considered regular inhabitants (Davis et al., 2000).

Information on each dolphin species, including general descriptions, status, and occurrence, is provided below. Descriptions include mention of “potential biological removal” (PBR). PBR is defined as the maximum number of animals that may be removed, not including natural mortalities, from a stock while allowing the stock to reach or maintain its optimal sustainable population. In addition, the NMFS had identified certain cetacean stocks as strategic. A “strategic stock” is a marine mammal stock considered likely to be listed under the ESA, currently listed under the ESA, currently listed as depleted under the MMPA, or for which the level of nonnatural mortality or serious injury (e.g., from commercial fishing) exceeds the PBR level.

Bottlenose dolphin (*Tursiops truncatus*)

Description – Bottlenose dolphins are large and robust, varying in color from light gray to charcoal. The genus *Tursiops* is named for its short, stocky snout that is distinct from the melon (Jefferson et al., 1993). The dorsal fin is tall and falcate. There are regional variations in body size, with adult lengths from 1.9 to 3.8 meters (6.2 to 12.5 feet) (Jefferson et al., 1993).

Scientists currently recognize a nearshore (coastal) and an offshore form of bottlenose dolphins, which are distinguished by external and cranial morphology, hematology, diet, and parasite load (Duffield et al., 1983; Hersh and Duffield, 1990; Mead and Potter, 1995; Curry and Smith, 1997). There is also a genetic distinction between nearshore and offshore bottlenose dolphins worldwide (Curry and Smith, 1997; Hoelzel et al., 1998). It has been suggested that the two forms should be considered different species (Curry and Smith, 1997; Kingston and Rosel, 2004), but no official taxonomic revisions have been made.

Status – In the northern GOM, there are coastal stocks; a continental shelf stock; an oceanic stock; and 32 bay, sound, and estuarine stocks (Waring et al., 2006). Table 3-8 summarizes information on bottlenose dolphin stocks that occur in the north-central Gulf of Mexico, although not all these stocks have an equal probability of occurrence in the Maritime WSEP test area. More detailed descriptions follow the table. Descriptions were obtained from stock assessment reports available on the NMFS website.

Table 3-8. Bottlenose Dolphin Stocks in the North-Central Gulf of Mexico

Stock		Distribution	Strategic Stock	Estimated Abundance	PBR
Bay, Sound, & Estuarine Stocks:	Choctawhatchee Bay	Areas of contiguous, enclosed, or semi-enclosed water bodies	Yes	179 resident, 53 transient	1.7
	Pensacola/East Bay		Yes	33	U
	St. Andrew Bay		Yes	124	U
Gulf of Mexico Northern Coastal		Waters from shore to the 20-meter (66-foot) isobath, from the Mississippi River delta to the Florida Big Bend region	Yes	2,473	20
Northern Gulf of Mexico Continental Shelf		Waters between the 20- and 200-meter (66- and 656-foot) isobaths, from Texas to Key West	No	17,777	U
Northern Gulf of Mexico Oceanic		Waters from the 200-meter (656-foot) isobath to the seaward extent of the U.S. Exclusive Economic Zone	No	5,806	42

PBR = Potential Biological Removal; U = undetermined

Genetic, photo-identification, and tagging data support the concept of relatively discrete bay, sound, and estuarine stocks. The NMFS has provisionally identified 32 such stocks which inhabit areas of contiguous, enclosed, or semi-enclosed water bodies adjacent to the northern GOM. The stocks are based on a description of dolphin communities in some areas of the Gulf coast. A community is generally defined as resident dolphins that regularly share a large portion of their range, exhibit similar distinct genetic profiles, and interact with each other to a much greater extent than with dolphins in adjacent waters. Although the shoreward boundary of W-151 is beyond these environments, individuals from these stocks could potentially enter the study area. Movement between various communities has been documented (Waring et al., 2009; Fazioli et al., 2006) reported that dolphins found within bays, sounds, and estuaries on the west central Florida coast move into the nearby Gulf waters used by coastal stocks. Maritime WSEP activities would occur seaward of the area considered to be occupied by the Choctawhatchee Bay stock. The best abundance estimate for this stock, as provided in the Stock Assessment Report, is 179 resident dolphins, with an additional 53 transient dolphins. Stocks immediately to the west and east of Choctawhatchee Bay include Pensacola/East Bay and St. Andrew Bay stocks. PBR for the Choctawhatchee Bay stock is 1.7 individuals. NMFS considers all 32 stocks to be strategic.

Three coastal stocks have been identified in the northern GOM, occupying waters from the shore to the 20-meter (66-foot) isobath: eastern coastal, northern coastal, and western coastal stocks. The western coastal stock inhabits nearshore waters from the Texas/Mexico border to the Mississippi River delta. The northern coastal stock's range is considered to be from the Mississippi River delta to the Big Bend region of Florida (approximately 84°W). The eastern coastal stock is defined from 84°W to Key West, Florida. Of the coastal stocks, the northern coastal is geographically most closely associated with the Maritime WSEP mission area. PBR is 20 individuals. Prior to 2012, this stock was not considered strategic. However, the current Stock Assessment Report identifies an ongoing Unusual Mortality Event of unprecedented size and duration (since February 2010) that has resulted in NMFS reclassification of this stock as strategic.

The northern GOM continental shelf stock is defined as bottlenose dolphins inhabiting the waters from the Texas/Mexico border to Key West, Florida, between the 20- and 200-meter (66- and 656-foot) isobaths. The continental shelf stock probably consists of a mixture of coastal and offshore ecotypes. PBR is undetermined, and the stock is not considered strategic.

The oceanic stock is provisionally defined as bottlenose dolphins inhabiting waters from the 200-meter (656-foot) isobath to the seaward extent of the U.S. EEZ. This stock is believed to consist of the offshore form of bottlenose dolphins. The continental shelf stock may overlap with the oceanic stock in some areas and may be genetically indistinguishable. PBR is 42 individuals, and the stock is not considered strategic.

Diving Behavior **–** Dive durations as long as 15 minutes are recorded for trained individuals (Ridgway et al., 1969). Typical dives, however, are more shallow and of a much shorter duration. Mean dive durations of Atlantic bottlenose dolphins typically range from 20 to 40 seconds at shallow depths (Mate et al., 1995) and can last longer than 5 minutes during deep offshore dives (Klatsky et al., 2005). Offshore bottlenose dolphins regularly dive to 450 meters (1,476 feet) and possibly as deep as 700 meters (2,297 feet) (Klatsky et al., 2005).

Acoustics and Hearing **–** Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Clicks and whistles have a dominant frequency range of 110 to 130 kilohertz (kHz) and a source level of 218 to 228 decibels referenced to 1 micropascal-meter (dB re 1 μPa-m peak-to-peak) (Au, 1993) and 3.4 to 14.5 kHz and 125 to 173 dB re 1 μPa-m peak-to-peak, respectively (Ketten, 1998). Whistles are primarily associated with communication and can serve to identify specific individuals (i.e., signature whistles) (Caldwell and Caldwell, 1965; Janik et al., 2006). Up to 52 percent of whistles produced by bottlenose dolphin groups with mother-calf pairs can be classified as signature whistles (Cook et al., 2004). Sound production is also influenced by group type (single or multiple individuals), habitat, and behavior (Nowacek, 2005). Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fish in some regions (Janik, 2000). Additionally, whistle production has been observed to increase while feeding (Acevedo-Gutiérrez and Stienessen, 2004; Cook et al., 2004). Furthermore, both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (e.g., feeding, milling, traveling, and socializing) (Jones and Sayigh, 2002; Zaretsky et al., 2005; Baron, 2006).

Bottlenose dolphins can hear within a broad frequency range of 0.04 to 160 kHz (Au, 1993; Turl, 1993). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles (Ridgway, 2000). Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz (Nachtigall et al., 2000). Recent research on the same individuals indicates that auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at lower (10 kHz) and higher (80 and 100 kHz) frequencies (Finneran and Houser, 2006).

Temporary threshold shifts (TTS) in hearing have been experimentally induced in captive bottlenose dolphins using a variety of noises (i.e., broad-band, pulses) (Ridgway et al., 1997; Schlundt et al., 2000; Nachtigall et al., 2003; Finneran et al., 2005; Mooney et al., 2005; Mooney, 2006). For example, TTS has been induced with exposure to a 3-kHz, 1-second pulse with sound exposure level (SEL) of 195 decibels referenced to 1 squared micropascal per second (dB re 1 μPa^2-s) (Finneran et al., 2005), 1-second pulses from 3 to 20 kHz at 192 to 201 decibels referenced to 1 micropascal-meter (dB re 1 μPa-m) (Schlundt et al., 2000), and octave band noise (4 to 11 kHz) for 50 minutes at 179 dB re 1 μPa-m (Nachtigall et al., 2003). Preliminary research indicates that TTS and recovery after noise exposure are frequency dependent and that an inverse relationship exists between exposure time and sound pressure level associated with exposure (Mooney et al., 2005; Mooney, 2006). Observed changes in behavior were induced with an exposure to a 75-kHz 1-second pulse at 178 dB re 1 μPa-m (Ridgway et al., 1997; Schlundt et al., 2000). Finneran et al. (2005) concluded that an SEL of 195 dB re 1 μPa^{2-}s is a reasonable threshold for the onset of TTS in bottlenose dolphins exposed to mid-frequency tones.

Distribution **–** Bottlenose dolphins are distributed worldwide in tropical and temperate waters. The species occurs in all three major oceans and many seas. In the western North Atlantic, bottlenose dolphins occur as far north as Nova Scotia but are most common in coastal waters from New England to Florida, the Gulf of Mexico, the Caribbean, and southward to Venezuela and Brazil (Würsig et al., 2000). Bottlenose dolphins occur seasonally in estuaries and coastal embayments as far north as Delaware Bay (Kenney, 1990) and in waters over the outer continental shelf and inner slope, as far north as Georges Bank (CETAP, 1982; Kenney, 1990).

The bottlenose dolphin is by far the most widespread and common cetacean in coastal waters of the GOM (Würsig et al., 2000). Bottlenose dolphins are frequently sighted near the Mississippi River Delta (Baumgartner et al., 2001) and have even been known to travel several kilometers up the Mississippi River.

Gulf of Mexico

Bottlenose dolphins are abundant in continental shelf waters throughout the northern GOM (Fulling et al., 2003; Waring et al., 2006), including the outer continental shelf, upper slope, nearshore waters, the DeSoto Canyon region, the West Florida Shelf, and the Florida Escarpment. Mullin and Fulling (2004) noted that in oceanic waters, bottlenose dolphins are encountered primarily in upper continental slope waters (less than 1,000 meters in bottom depth) and that highest densities are in the northeastern Gulf. Significant occurrence is expected near all bays in the northern Gulf.

The results of a more recent survey effort of nearshore and continental shelf waters of the eastern GOM (Garrison, 2008) identified four areas where bottlenose dolphins were clustered in winter: nearshore waters off Louisiana, the Florida Panhandle, north of Tampa Bay, and southwestern Florida. Dolphins were also common over the entire shelf. In summer, the number of group sightings was comparatively lower than in winter (162 versus 281), and bottlenose dolphins were more evenly distributed throughout coastal and shelf waters.

Atlantic spotted dolphin (*Stenella frontalis*)

Description – The Atlantic spotted dolphin has features that resemble the bottlenose dolphin. In body shape, it is typically somewhat larger than the inshore bottlenose dolphin ecotype, with a moderately long, thick beak. The dorsal fin is tall and falcate and there is generally a prominent spinal blaze. Adults are up to 2.3 meters (7.5 feet) long and can weigh as much as 143 kilograms (315 pounds) (Jefferson et al., 1993). Atlantic spotted dolphins are born spotless and develop spots as they age (Perrin et al., 1994; Herzing, 1997). Some individuals become so heavily spotted that the dark cape and spinal blaze are difficult to see (Herzing, 1997).

There is marked regional variation in adult body size of the Atlantic spotted dolphin (Perrin et al., 1987). In addition, there are two forms: a robust, heavily spotted form that inhabits the continental shelf, usually found within 250 to 350 km (135 to 189 NM) of the coast, and a smaller, less-spotted form that inhabits offshore waters (Perrin et al., 1994). The largest body size occurs in waters over the continental shelf of North America (east coast and GOM) and Central America (Perrin, 2002). The smaller, offshore form is not known to occur in the GOM.

Status – The most recent abundance estimate, as provided in the most recent Stock Assessment Report, is 37,611 individuals in the northern GOM (outer continental shelf and oceanic waters). The northern GOM population is considered genetically differentiated from the western North Atlantic populations. PBR for this species is undetermined. This is not considered a strategic stock.

Diving Behavior – Information on diving depth for this species is available from a satellite-tagged individual in the Gulf of Mexico (Davis et al., 1996). This individual made short, shallow dives to less than 10 meters (33 feet) and as deep as 60 meters (197 feet), while in waters over the continental shelf on 76 percent of dives.

Acoustics and Hearing – A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin. Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz) (Lammers et al., 2003). Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 0.1 to 8 kHz. Recorded echolocation clicks had two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (i.e., lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels (Au and Herzing, 2003). Echolocation click source levels as high as 210 dB re 1 μPa-m peak-to-peak have been recorded (Au and Herzing, 2003). Spotted dolphins in the Bahamas were frequently recorded during agonistic/aggressive interactions with bottlenose dolphins (and their own species) to produce squawks (0.2 to 12 kHz broadband burst pulses; males and females), screams (5.8 to 9.4 kHz whistles; males only), barks (0.2 to 20 kHz burst pulses; males only), and synchronized squawks (0.1- to 15-kHz burst pulses; males only in a coordinated group) (Herzing, 1996).

Hearing ability for the Atlantic spotted dolphin is unknown. However, odontocetes are generally able to hear high frequencies (Ketten, 1997).

Distribution **–** Atlantic spotted dolphins are distributed in warm-temperate and tropical Atlantic waters from northern New England to Venezuela, including the GOM and the Caribbean Sea (Perrin et al., 1987). Atlantic spotted dolphins may occur in both continental shelf and offshore waters (Perrin et al., 1994). In oceanic waters, this species usually occurs near the shelf break and upper continental slope (Davis et al., 1998; Mullin and Hansen, 1999).

Gulf of Mexico

Atlantic spotted dolphins in the northern GOM are abundant in continental shelf waters (Fulling et al., 2003; Waring et al., 2006). In the GOM, Atlantic spotted dolphins are most abundant east of Mobile Bay (Fulling et al., 2003). On the West Florida shelf, spotted dolphins are more common in deeper waters than bottlenose dolphins (Griffin and Griffin, 2003); Griffin and Griffin (2004) reported higher densities of spotted dolphins in this area during November through May.

In winter, there may be occurrence in waters over the continental shelf and along the shelf break throughout the entire northern GOM. Stranding data suggest that this species may be more common than survey data demonstrate.

Occurrence during spring is primarily in the vicinity of the shelf break from central Texas to southwestern Florida. Sighting data reflect high usage of the Florida Shelf by this species.

In summer, occurrence is primarily in waters over the continental shelf, along the shelf break throughout the entire northern GOM, and over the Florida Escarpment. Sighting data show increased usage of the Florida Shelf, as well as the Florida Panhandle and inshore of

DeSoto Canyon. An additional area of increased occurrence is predicted in shelf waters off western Louisiana.

In fall, the sighting data demonstrate occurrence in waters over the continental shelf and along the shelf break throughout the entire northern GOM. There are numerous sightings in the Mississippi River delta region and Florida Panhandle. This is the season with the least amount of systematic survey effort, and inclement weather conditions can make sighting cetaceans difficult during this time of year.

Marine Mammal Density

Bottlenose and spotted dolphin density estimates were obtained from two sources. Bottlenose dolphin estimates were obtained from a habitat modeling project conducted for portions of the EGTTR, including the Maritime WSEP project area, as described in Garrison (2008). As part of the modeling effort, personnel from NOAA Fisheries' Southeast Fisheries Science Center (SEFSC) conducted line transect aerial surveys of the continental shelf and coastal waters of the eastern GOM during winter (February 2007, water temperatures of 12° to 15° Celsius) and summer (July/August 2007, water temperatures greater than 26° Celsius). The surveys covered nearshore and continental shelf waters (to a maximum depth of 200 meters), with the majority of effort concentrated in waters from the shoreline to 20 meters depth. Marine species encounter rates during the surveys were corrected for sighting probability and the probability that animals were available on the surface to be seen. The survey data were combined with remotely sensed environmental data/habitat parameters (water depth, sea surface temperature [SST], and chlorophyll-*a* concentration) to develop habitat models. The technical approach, described as Generalized Regression and Spatial Prediction, spatially projects the species-habitat relationship based on distribution of environmental factors, resulting in predicted densities for unsampled locations and times. The spatial density model can therefore be used to predict relative density in unobserved areas and at different times of year based upon the monthly composite SST and chlorophyll datasets derived from satellite data. Similarly, the spatial density model can be used to predict relative density for any subregion within the surveyed area.

Garrison (2008) produced bottlenose dolphin density estimates at various spatial scales within the EGTTR. At the largest scale, density data were aggregated into four principal strata categories: north-inshore, north-offshore, south-inshore, and south-offshore. Densities for these strata were provided in the published survey report. Unpublished densities were also provided for smaller blocks (subareas) corresponding to airspace units, and a number of these subareas were combined to form larger zones. Densities in these smaller areas were provided to Eglin AFB in Excel© spreadsheets by the report author.

For both large areas and subareas, regions occurring entirely within waters deeper than 200 meters were excluded from predictions, and those straddling the 200-meter isobath were clipped to remove deep water areas. In addition, because of limited survey effort, density estimates beyond 150 meters water depth are considered invalid. The environmental conditions encountered during the survey periods (February and July/August) do not necessarily reflect the range of conditions potentially encountered throughout the year. In particular, the transition seasons of spring (April-May) and fall (October-November) have a very different range of water temperatures. Accordingly, for predictions outside of the survey period or spatial range, it is necessary to evaluate the statistical variance in predicted values when attempting to apply the model. The coefficient of variation (CV) of the predicted quantity is used to measure the validity of model predictions. According to Garrison (2008), the best predictions have CV values of approximately 0.2. When CVs approach 0.7, and particularly when they exceed 1.0, the resulting model predictions are extremely uncertain and are considered invalid.

Based on the preceding discussion, the bottlenose dolphin density estimate used in this document is the median density corresponding to subarea 137 (Figure 3-2). The planned Maritime WSEP test location lies within this subarea. Within this block, Garrison (2008) provided densities based on one-year (2007) and five-year monthly averages for SST and chlorophyll. The five-year average is considered preferable. Only densities with a CV rounded to 0.7 or lower (i.e., 0.64 and below) were considered. Maritime WSEP test activities could occur any time during February or March. Accordingly, the density estimate associated with the highest monthly five-year average with an acceptable corresponding CV value was used for this analysis. Bottlenose dolphin density estimates are 1.019 for February and 1.194 for March; the higher of the two estimates (March) was used for impact estimates. The CV for March in this particular block is 0.28.

Atlantic spotted dolphin density was derived from Fulling et al. (2003), which describes the results of mammal surveys conducted in association with fall ichthyoplankton surveys from 1998 to 2001. The surveys were conducted by SEFSC personnel from the U.S.-Mexico border to southern Florida, in water depths of 20 to 200 meters. Using the software program DISTANCE©, density estimates were generated for east and west regions, with Mobile Bay as the dividing point. The east region is used in this document. Densities were provided for Atlantic spotted dolphins and unidentified *T. truncatus*/*S. frontalis* (among other species). The unidentified *T. truncatus*/*S. frontalis* category is treated as a separate species group with a unique density. Density estimates from Fulling et al. (2003) were not adjusted for sighting probability (perception bias) or surface availability (availability bias) [$g(_0) = 1$] in the original survey report, likely resulting in underestimation of true density. Perception bias refers to the failure of observers to detect animals, although they are present in the survey area and available to be seen. Availability bias refers to animals that are in the survey area, but are not able to be seen because they are submerged when observers are present. Perception bias and availability bias result in the underestimation of abundance and density numbers (negative bias).

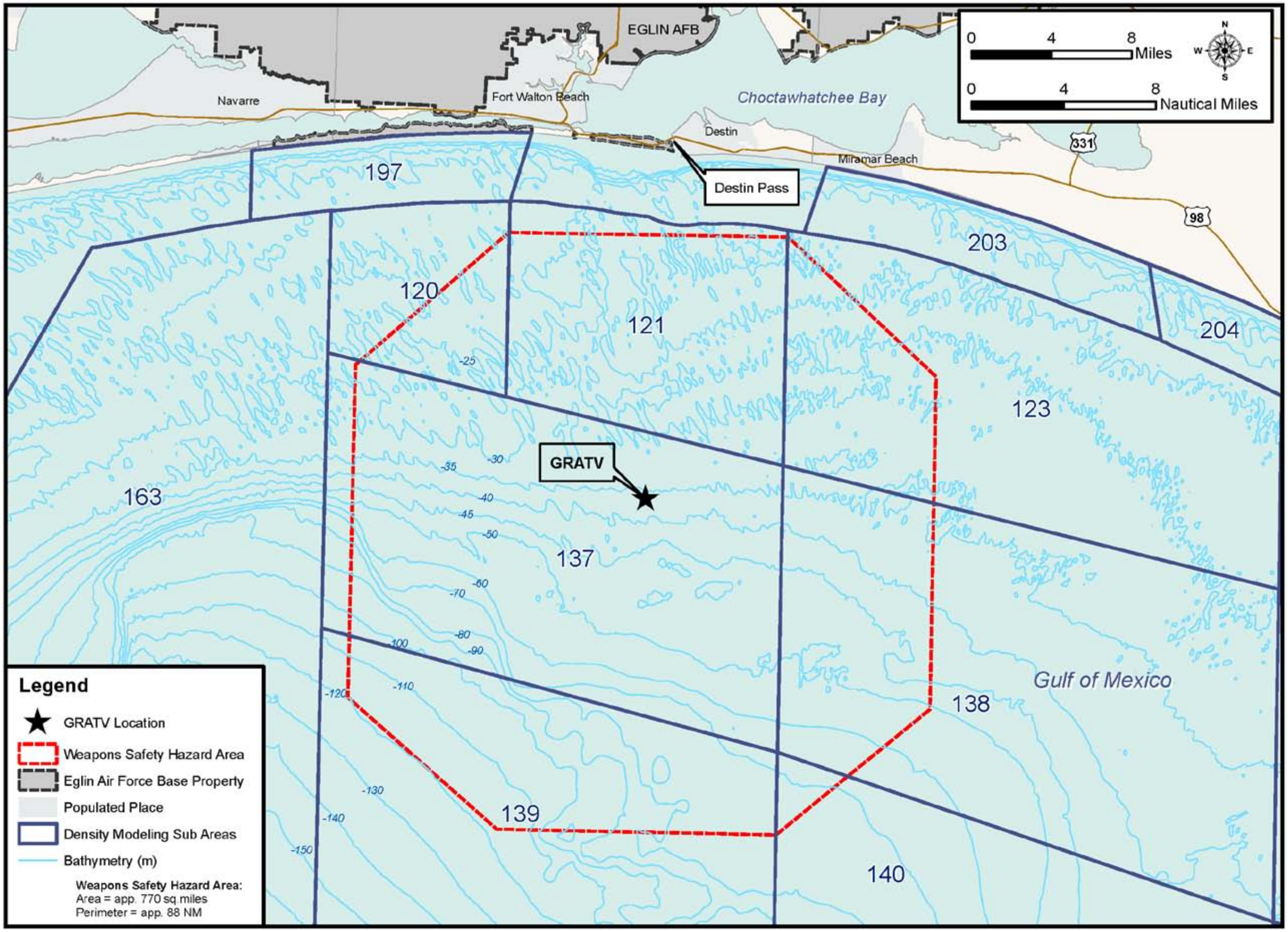

Figure 3-2. Subareas Included in Garrison (2008)

Fulling et al. (2003) did not collect data to correct density for perception and availability bias. In order to address negative bias, Eglin AFB has adjusted density estimates based on information provided in available literature. There are no published $g(_0)$ correction factors for Atlantic spotted dolphins. However, Barlow (2006) estimated $g(_0)$ for numerous marine mammal species near the Hawaiian Islands, including offshore pantropical spotted dolphins (*Stenella attenuata*). Separate estimates for this species were provided for group sizes of 1 to 20 animals ($g(_0) = 0.76$), and greater than 20 animals ($g(_0) = 1.00$). Although Fulling et al. (2003) sighted some spotted dolphin groups of more than 20 individuals, the 0.76 value is used as a more conservative approach. Barlow (2006) provides the following equation for calculating density:

$$\text{Density (\# animals/km}^2) = \frac{(n)\ (S)\ f(_0)}{(2L)\ g(_0)}$$

Where:

n = number of animal group sightings on effort

S = mean group size

$f(_0)$ = sighting probability density at zero perpendicular distance (influenced by species detectability and sighting cues such as body size, blows, and number of animals in a group)

L = transect length completed (km)

$g(_0)$ = probability of seeing a group directly on trackline (influenced by perception bias and availability bias)

Because (n), (S), and (f_0) cannot be directly incorporated as independent values due to lack of original information, we substitute the variable $X_{species}$ which incorporates all three values, such that $X_{species} = (n)(S)(f_0)$ for a given species. This changes the density equation to:

$$D = \frac{X_{species}}{(2L)\ (g_0)}$$

Using the minimum density estimates provided in Fulling et al. (2003) for Atlantic spotted dolphins and solving for $X_{SpottedDolphin}$:

$$0.201 = \frac{X_{Spotted\ Dolphin}}{(2)\ (816)\ (1.0)}$$

$X_{SpottedDolphin} = 328.032$.

Placing this value of n and the revised $g(_0)$ estimate in the original equation results in the following adjusted density estimate:

$$D_{Adjusted} = \frac{328.032}{(2)(816)(0.76)}$$

$D_{Adjusted} = 0.265$

Using the same method, adjusted density for the unidentified *T. truncatus*/*S. frontalis* species group is 0.009 animals/km^2. There are no variances attached to either of these recalculated density values, so overall confidence in these values is unknown. Table 3-9 shows the densities for each species and species group used in this document to calculate potential takes.

Table 3-9. Marine Mammal Density Estimates

Species	Density (animals/km^2)
Bottlenose dolphin[1]	1.194
Atlantic spotted dolphin[2]	0.265
Unidentified bottlenose dolphin/Atlantic spotted dolphin[2]	0.009

km^2 = square kilometers
1. Source: Garrison, 2008; adjusted for observer and availability bias by author
2. Source: Fulling et al., 2003; adjusted for negative bias based on information provided by Barlow (2003, 2006)

Sea Turtles

Four sea turtle species have reasonable likelihood of occurrence within the Maritime WSEP test area, including the Atlantic loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), Atlantic green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) (Table 3-10). All species but the loggerhead are classified under the ESA as endangered. The loggerhead is classified as threatened. Sea turtles spend their lives at sea and rarely come ashore except to nest. It is theorized that young turtles, between the time they enter the sea as hatchlings and their appearance as subadults, spend their time drifting in ocean currents among seaweed and marine debris (Carr, 1986a, 1986b, 1987). The number of sea turtles decreased significantly during the 20th century. Factors contributing to this decline include habitat destruction from beach lighting, erosion-control practices, off-road vehicle use, predator activities, and illegal egg harvesting.

Table 3-10. Sea Turtle Species with Potential Occurrence in the Maritime WSEP Test Area

Species	Federal Status
Atlantic loggerhead sea turtle (*Caretta caretta*)	Threatened
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Atlantic green sea turtle (*Chelonia mydas*)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered

Nesting activity in Florida is documented by the Florida Fish and Wildlife Conservation Commission for the loggerhead, green, and leatherback sea turtle. Of these species, the loggerhead is the most prolific, with Florida accounting for over 90 percent of nesting in the U.S. (FWRI, 2012). The majority of sea turtle nesting occurs along the southeastern Florida peninsula. For example, in 2013 there were 24,630 loggerhead nests in Brevard County, compared to 144 nests for Santa Rosa, Okaloosa, and Walton Counties combined (the three counties in which Eglin AFB lies). Sea turtle nesting data for these three counties are provided in Table 3-11. Although the State website does not list nesting activity for leatherback or Kemp's ridley sea turtles in the northern Gulf, Eglin AFB reports that these two species occasionally nest on military-controlled beaches of Santa Rosa Island.

Table 3-11. Sea Turtle Nesting Data, 2013

County	Survey Length in km (mi)	Loggerhead Sea Turtle Nests	Loggerhead Sea Turtle Nonnesting Emergences	Green Sea Turtle Nests	Green Sea Turtle Nonnesting Emergences	Leatherback Sea Turtle Nests	Leatherback Sea Turtle Nonnesting Emergences
Santa Rosa	11.2 (7.00)	12	7	1	0	0	0
Okaloosa	38.0 (23.6)	31	19	7	4	0	0
Walton	48.7 (30.3)	44	29	1	0	0	0

Source: FWRI, 2014
km = kilometers; mi = miles

Loggerhead Sea Turtle – Northwest Atlantic Ocean Distinct Population Segment

The loggerhead sea turtle was listed as a threatened species throughout its range on July 28, 1978. NMFS and the USFWS have published a final rule designating nine Distinct Population Segments (DPS) for loggerhead sea turtles (76 FR 58868, September 22, 2011; effective October 24, 2011). The Northwest Atlantic DPS (NWA DPS) is the only one that coincides with the Maritime WSEP action area and therefore is the only one considered in this document.

Description, Distribution, and Population Structure

The loggerhead turtle is a large, hard-shelled sea turtle. The mean straight carapace length of adults is approximately 92 centimeters (cm) (36 inches [in]), and the average weight is 116 kilograms (kg) (256 pounds [lb]) (NMFS and USFWS, 1991a). This species inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd, 1988). The majority of nesting occurs along the western boundaries of the Atlantic and Indian Oceans (NRC, 1990). Loggerhead turtles are not as dependent upon nearshore waters as some other species (greens and hawksbills), and the expected distribution therefore extends from the shoreline past the continental shelf break into waters of the continental slope. On average, loggerhead turtles spend over 90 percent of their time underwater (DON, 2007). Routine dive depths of 9 to 22 meters (29.5 to 72 feet) have been recorded, and dives of up to 233 meters (764 feet) have been recorded for a post-nesting female loggerhead. Routine dives typically last from 4 to 172 minutes.

In the western North Atlantic, loggerhead nesting occurs primarily along the U.S. coast from southern Virginia to Alabama. Additional nesting beaches are found along the northern and western GOM, eastern Yucatán Peninsula, and in areas of the Bahamas, Cuba, Central and South America, and the eastern Caribbean Islands. Nonnesting adult females occur throughout the species' U.S. coastal range and the Caribbean Sea. Little is known about the distribution of adult males. Aerial surveys suggest that about 12 percent of loggerheads in U.S. waters occur in the eastern GOM; the majority (54 percent) occurs along the southeast U.S. Atlantic coast (TEWG, 1998, as cited in NMFS, 2013). Shallow water habitats with large expanses of open ocean access provide foraging habitat for adult loggerheads, while juveniles are found in enclosed, shallow water estuarine environments not frequented by adults (Epperly et al., 1995c, as cited in NMFS, 2013). Benthic, immature loggerheads are known to migrate between northern and southern areas off the U.S. coast as water temperatures seasonally rise and fall (Morreale and Standora, 1998; Shoop and Kenney, 1992) (Keinath, 1993; Epperly et al., 1995c; as cited in NMFS, 2013).

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to southern peninsular Florida, and along the Florida Gulf coast. Previously, NMFS recognized at least five Western Atlantic loggerhead subpopulations. The Florida Panhandle nesting subpopulation was considered to consist of individuals occurring at Eglin AFB and beaches near Panama City, Florida. However, the recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula (and presumably other areas of Florida as well) and that subpopulation boundaries could not be designated based on genetic differences. Therefore, the recovery plan uses a combination of nesting densities, geographic separation, geopolitical boundaries, and genetic differences to identify recovery units. The Northern Gulf of Mexico Recovery Unit (Franklin County, Florida through Texas) is the unit associated with the Maritime WSEP test area. The plan concluded that all recovery units are essential to the recovery of the species.

Life History

Loggerhead sea turtles reach sexual maturity between 20 and 38 years of age, although the age appears to vary widely among populations (NMFS-SEFSC, 2001) (Frazer and Ehrhart, 1985, as cited in NMFS, 2013). The mating season occurs from late March to early June, and eggs are laid throughout the summer months. Female loggerheads deposit an average of 4.1 nests per nesting season (Murphy and Hopkins, 1984) and have an average remigration interval of 3.7 years (Tucker, 2010, as cited in NMFS, 2013). Mean clutch size along the southeastern U.S. coast varies from 100 to 126 eggs (Dodd, 1988).

Loggerhead sea turtles are generally thought to circumnavigate the North Atlantic Gyre as pelagic post-hatchlings and early juveniles (often occurring in *Sargassum* drift lines or other convergence zones), and may lead a pelagic existence for as long as 7 to 12 years (Bolten et al., 1998). At some point, individuals apparently shift to a different midwater feeding habitat; in the eastern North Atlantic Ocean, it is believed to be the waters surrounding the Azore and Madeira Islands. Other oceanic waters include the Grand Banks (Newfoundland, Canada) and the Mediterranean Sea. As later juveniles and adults, loggerheads most often occur on the continental shelf and shelf edge of the U.S. Atlantic and Gulf coasts; they are also known to inhabit coastal estuaries and bays along both coasts (CETAP, 1982; Shoop and Kenney, 1992). However, the results of recent studies suggest that not all loggerhead turtles follow the model described above (Laurent et al., 1998; Bolten and Witherington, 2003; as cited in NMFS, 2013). These studies suggest some turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized, or move back and forth between pelagic and coastal habitats (Witzell, 2002). Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd, 1988). Subadult and adult loggerheads, primarily found in coastal waters, prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Abundance and Trends

Although the loggerhead is the most commonly sighted sea turtle in the southeastern United States, there currently is not a reliable estimate of population size in the western North Atlantic Ocean. The NMFS SEFSC has developed a preliminary demographic model to predict population trajectories (NMFS, 2013). One of the most robust results estimated an adult female population size for the western North Atlantic of between 20,000 and 40,000 individuals, with a low likelihood of being up to 70,000. Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can under some circumstances provide a reasonable estimate of trends in the adult female population (assuming strong nest site fidelity). Loggerhead nesting at all combined Florida index beaches declined significantly for the NWA DPS between 1989 and 2008. However, nesting has increased substantially since that time, such that the overall nesting trend from 1989 to 2012 is approximately zero (no gain or loss) (NMFS, 2013). There was a near record level of nests in 2012. Nesting for the Northern Gulf of Mexico Recovery Unit showed a significant declining trend of 4.7 percent from 1997 to 2008. Nesting on Florida Panhandle index beaches specifically, which represents the majority of nesting for this recovery unit, generally declined between 1997 and 2011 (with a notable exception in 2008). However, nesting in 2012 and 2013 increased to levels comparable to the late 1990s, with a record level in 2012.

A recent study conducted between 2010 and 2012 used satellite telemetry to tag and track the movements of 39 adult female loggerheads from nesting beaches at three sites in Florida and Alabama (Hart et al, 2013). The results of this study have indicated that female loggerheads from this subpopulation make longer movements during the inter-nesting period than previously thought and may regularly utilize nesting beaches from different geographic areas within the same reproductive season, which demonstrates a significantly less nest-site fidelity level than previously reported (Hart et al., 2013). This study also spatially defined and identified characteristics of in-water inter-nesting areas and assessed overlap between these areas with shrimp trawling and active oil and gas extraction activities.

Threats

Loggerhead sea turtles are exposed to a variety of threats, as described by NMFS (2013). Cold stunning is a natural event that may result in mortality. The greatest anthropogenic threat to the NWA DPS is fishery bycatch in neritic and oceanic habitats. Domestic (U.S.) fishery operations that result in capture, injury, and mortality to sea turtles of various life stages include pelagic longline, shrimp, trawl, gill net, purse seine, hook-and-line, pound net, and trap fisheries. In addition, loggerheads are exposed to direct and incidental impacts due to foreign fishing operations including longline, trawl, and gill net fisheries. Specifically, the in-water inter-nesting habitat areas of the Northern Gulf of Mexico subpopulation of loggerhead sea turtles identified by Hart et al. (2013) directly overlapped with areas reporting a moderate level of shrimp trawling activities and the locations of active oil and gas platforms.

Loggerhead sea turtles are also affected by nonfishery impacts in marine and terrestrial environments. Construction and maintenance of federal navigation channels in nearshore U.S. waters can result in turtle mortality due to entrainment in dredges. Turtles may also be entrained in the cooling systems of electrical plants. Other nearshore threats include vessel operations, military exercises (including detonations), and scientific research activities.

Coastal development may affect sea turtles through habitat alteration and nesting interference. The placement of buildings, pilings, and beach armoring materials, as well as sand removal or beach renourishment, may remove nesting beach habitat, change thermal profiles, and increase erosion. Artificial lighting associated with coastal development may also interfere with nesting behavior and may result in hatchling disorientation. Additional terrestrial threats include predation by land animals, direct egg and adult harvest (mostly in foreign countries), and introduction of pollutants such as pesticides, hydrocarbons, and organochlorides into marine waters.

There have been actions implemented to reduce anthropogenic impacts to sea turtles, particularly since the early 1990s. These actions include lighting ordinances, predation control, nest relocations, and measures to reduce mortality resulting from various fisheries and other marine activities. Use of Turtle Excluder Devices has significantly decreased impacts due to shrimp trawling in the U.S., although trawling is still one of the largest sources of anthropogenic loggerhead mortality.

Critical Habitat Designation

On July 10, 2014 the USFWS and NMFS issued Final Rules to designate critical habitat for the NWA DPS of the loggerhead sea turtle (79 FR 39755 and 79 FR 39855, effective August 11, 2014). Under the USFWS rule, approximately 1,102 km (685 miles) of loggerhead sea turtle nesting beaches in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi are included in the terrestrial component of critical habitat. The nesting beaches on Eglin AFB (including Cape San Blas) are exempt because Eglin's Integrated Natural Resources Management Plan (INRMP) already incorporates measures that provide a benefit for the species.

Under the NMFS rule, 38 occupied marine areas within the range of the NWA DPS are included in the marine component of critical habitat and contain at least one, or a combination of the following habitat types: nearshore reproductive habitat, winter area, breeding area, constricted migratory corridor, and *Sargassum* habitat. Of those, only nearshore reproductive habitat and *Sargassum* habitat areas were designated in the northern Gulf of Mexico (Figure 3-3).

Nearshore reproductive habitat describes nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water. This includes nearshore waters out to 1.6 km (1 mile) offshore. The identification of nearshore reproductive habitat was based primarily on location of beaches identified as high density nesting beaches by the USFWS and beaches adjacent to the high density nesting beaches that serve as expansion areas. As a result, 36 units of nearshore reproductive critical habitat have been identified. This includes waters off three high density/expansion nesting beaches not designated as terrestrial critical habitat by the USFWS because they occur on military lands with an associated INRMP in place. Since Eglin's INRMP does not address waters off the nesting beaches on SRI and Cape San Blas, nearshore reproductive habitat has been designated from the shoreline of these beaches out to 1.6 km (1 mile) in the Gulf.

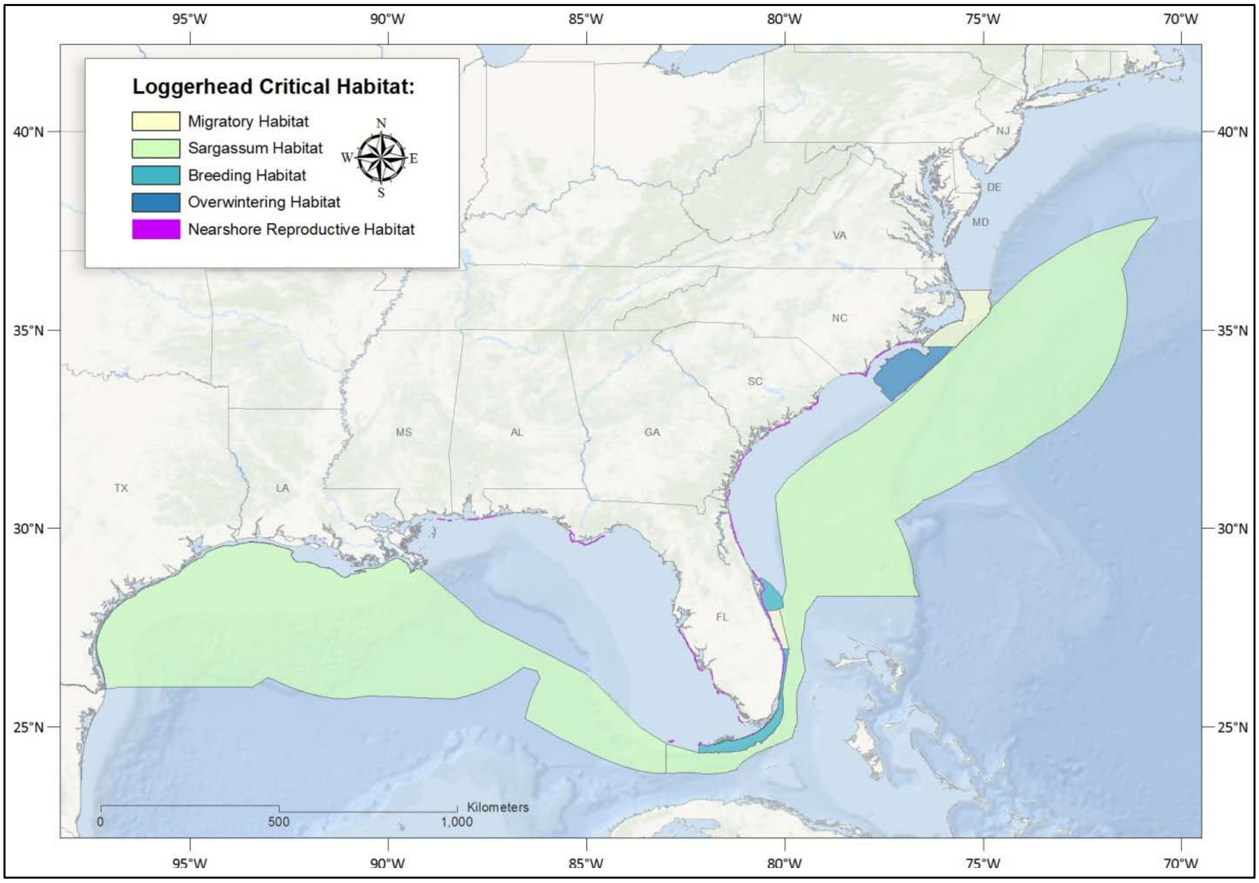

Figure 3-3. Marine Component of Loggerhead Sea Turtle Critical Habitat Designation
(Source: NOAA Fisheries, 2014)

The *Sargassum* habitat portion of the marine designation consists of the western Gulf of Mexico from the 10-meter bathymetry line starting at the mouth of the Mississippi River and proceeding west and south to the outer boundary of the U.S. EEZ. The southern boundary is the U.S. EEZ from the 10-meter bathymetry line off of Texas to the Gulf of Mexico-Atlantic Ocean border. The eastern edge follows the 10-meter bathymetry line from the mouth of the Mississippi River then goes in a straight line to the northernmost boundary of the Loop Current and follows along its eastern edge to the Gulf of Mexico-Atlantic Ocean border.

Since neither the nearshore reproductive habitat nor the *Sargassum* habitat units occur within the Maritime WSEP mission area, loggerhead sea turtle critical habitat would not be adversely affected and is not discussed further in this EA.

Kemp's ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered throughout its entire range on December 2, 1970, under the Endangered Species Conservation Act of 1969 (a precursor to the ESA). The Kemp's ridley is considered the most imperiled of the world's sea turtles (USFWS and NMFS, 1992).

Description, Distribution, and Population Structure

The Kemp's ridley sea turtle is the smallest living sea turtle. The straight carapace length is approximately 65 cm (26 in) and adults weigh less than 45 kg (99 lb) (USFWS and NMFS, 1992). Adults Kemp's ridley shells are almost circular. Few data are available on the maximum dive duration. Satellite-tagged juveniles showed different mean surface intervals and dive depths depending on whether they are located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals) (DON, 2007). Dive times range from a few seconds to a maximum of 167 min; routine dives last between 16.7 and 33.7 minutes. Kemp's ridleys spend between 89 and 96 percent of their time submerged.

Adults have a very restricted distribution relative to other sea turtles, occurring mostly in shallow nearshore waters of the GOM (although adults are sometimes sighted along the eastern U.S. coast). Post-pelagic turtles can be found over crab-rich sandy or muddy bottoms. Nesting is generally limited to beaches of the western GOM, primarily in the Mexican state of Tamaulipas, although a few nests have also been recorded in Florida and the Carolinas (Meylan et al., 1995). Kemp's ridleys nest in daytime aggregations known as "arribadas," primarily at Rancho Nuevo, Mexico; most nesting occurs in this single locality (Pritchard, 1969, as cited in NMFS, 2013). The Kemp's ridley is a rare nester on Eglin beaches and was documented for the first time in 2008 when three nests were deposited on Santa Rosa Island. Since the confirmed nesting in 2008, Kemp's ridleys have returned in 2010, 2011, 2012, and 2013.

Life History

Kemp's ridley sea turtles reach maturity at 7 to 15 years of age. Although some turtles nest annually, the remigration rate is approximately two years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing about 100 eggs (Márquez, 1994). The species remains in the post-hatchling pelagic stage from one to four years, and in the benthic immature stage for approximately seven to nine years (Schmid and Witzell, 1997). Little is known of the movements of the post-hatching, planktonic stage within the GOM, although the turtles are assumed to associate with *Sargassum* seaweed. Post-hatchlings and small juveniles may be retained in the northern Gulf until migrating inshore to demersal habitats, or may be carried south in the Loop Current where they may become entrained in the Florida Current and Gulf Stream (Musick and Limpus, 1997). Once they reach a size of approximately 20 to 30 cm (8 to 12 in), or about 2 years of age, the turtles migrate to neritic developmental habitats along the U.S. Atlantic and Gulf coasts, where they spend the majority of their lives as large juveniles and adults. Atlantic juveniles/subadults travel northward with seasonal warming to feed in coastal waters from Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick, 1985; Henwood and Ogren, 1987; Ogren, 1989).

Adult Kemp's ridleys primarily occupy neritic habitats that typically contain muddy or sandy bottoms where prey can be found. The diet of post-pelagic turtles consists primarily of crabs, with a preference for portunid crabs (Bjorndal, 1997, as cited in NMFS, 2013). Stomach contents of Kemp's ridleys along the lower Texas coast consisted mostly of nearshore crabs and mollusks, in addition to fish, shrimp, and other foods likely scavenged from shrimping operations (Shaver, 1991, as cited in NMFS, 2013). Highly suitable habitats identified in the GOM include the western coast of Florida (particularly the Cedar Keys area), the eastern coast of Alabama (including Mobile Bay), the mouth of the Mississippi River, and coastal waters off western Louisiana and eastern Texas.

Abundance and Trends

Of the seven existing sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. The adult female population was estimated to be in excess of 40,000 individuals in 1947, but nesting numbers were below 1,000 by the mid-1980s (USFWS, 2014). However, increased nesting in the 1990s suggested that the decline had stopped, and the population is currently increasing (USFWS, 2000, as cited in NMFS, 2013). The number of nests observed at Rancho Nuevo and nearby beaches increased between 1985 and 1999 (TEWG, 2000), and data from all Mexican beaches show that the number of nests increased from 7,147 to 21,797 between 2004 and 2012 (a substantial decline occurred in 2010) (Gladys Porter Zoo nesting database 2013, as cited in NMFS, 2013). A small nesting population is apparently emerging in the United States (primarily in Texas), with the number of nests increasing from 6 in 1996 to 209 in 2012 (National Park Service data, as cited in NMFS, 2013).

Recent modeling suggests that Kemp's ridley populations may increase substantially in the future. Heppell et al. (2005) suggest that the population is expected to increase at least 12 to 16 percent per year, and that the population could reach at least 10,000 females nesting on Mexico beaches by 2015. Modeling reported by NMFS et al. (2011) predicts that the population is expected to increase 19 percent per year. Approximately 25,000 nests would be needed to reach an estimated 10,000 nesting females (based on an average 2.5 nests per nesting female). Despite the nesting decline in 2010, the nearly 22,000 nests recorded in 2012 suggest that the models may reasonably forecast actual population increases. However, as with any model, future data will be needed to confirm the projected population trajectory.

Threats

Threats to the Kemp's ridley sea turtle are generally the same as those described for the loggerhead sea turtle.

Atlantic Green Sea Turtle

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations which were listed as endangered. Due to the inability to distinguish between these populations away from nesting beaches, green turtles are considered endangered wherever they occur in U.S. waters.

Description, Distribution, and Population Structure

The green sea turtle is the largest hard-shelled sea turtle. Adults commonly reach 100 cm (39.4 in) in carapace length and 150 kg (331 lb) in weight (NMFS and USFWS, 1991b). The species is considered a tropical herbivore. Green turtles typically make dives shallower than 30 m (98 ft); however, a maximum dive depth of 110 m (361 ft) has been recorded in the Pacific Ocean. The maximum dive time recorded for a subadult green turtle is 66 minutes, with routine dives ranging from 9 to 23 minutes.

Green turtles are distributed circumglobally in tropical and subtropical waters (NMFS and USFWS, 1991b). Green turtles have been seen in the open ocean and can likely traverse an entire ocean basin during their life cycle. Nesting occurs in more than 80 countries worldwide (Hirth, 1997). The two largest nesting populations are found at Tortuguero (Caribbean coast of Costa Rica) and Raine Island (Great Barrier Reef in Australia). In the U.S., nesting occurs from Texas to North Carolina, as well as the U.S. Virgin Islands and Puerto Rico (NMFS and USFWS, 1991b; Dow et al., 2007). However, the great majority of nesting in the U.S. occurs in southeastern Florida, particularly Brevard to Broward Counties (Meylan et al., 1995) (Johnson and Ehrhart, 1994, as cited in NMFS, 2013). The green turtle nesting aggregation in Florida is recognized as a regionally significant colony (USFWS NFFO, 2009a).

In U.S. Atlantic and GOM waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern U.S. include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty, 1984) (Hildebrand, 1982 and Shaver, 1994; as cited in NMFS, 2013); the GOM off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr, 1957; Carr, 1984; as cited in NMFS, 2013); Florida Bay and the Florida Keys (Schroeder and Foley, 1995); the Indian River Lagoon system in Florida (Ehrhart, 1983, as cited in NMFS, 2013); and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart, 1992) (Wershoven and Wershoven, 1992, as cited in NMFS, 2013). The summer developmental habitat also encompasses estuarine and coastal waters from North Carolina to Long Island Sound (Musick and Limpus, 1997). Additional important foraging areas in the western Atlantic include coastal areas of Puerto Rico, Cuba, Nicaragua, Panama, Colombia, and Brazil (Hirth, 1971), and the northwestern coast of the Yucatán Peninsula.

Adults are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs (Hays et al., 2001), and are known to migrate seasonally between northern and southern areas. The existence of regional subpopulations is supported by genetic data (Bowen et al., 1992). However, turtles from different nesting origins are commonly found mixed together on foraging grounds throughout the species' range.

Life History

Green sea turtles have slow growth rates and do not reach maturity until 20 to 50 years of age (Hirth, 1997; Chaloupka and Musick, 1997, as cited in NMFS, 2013). The slow growth rate is believed to be a consequence of the largely herbivorous, low energy diet (Bjorndal, 1982, as cited in NMFS, 2013). Upon reaching maturity, females return to natal beaches to lay eggs (Balazs, 1982; Frazer and Ehrhart, 1985; as cited in NMFS, 2013) and can migrate hundreds to thousands of kilometers between foraging and nesting areas.

In the southeastern U.S., nesting occurs between June and September, with peak activity in June and July (Witherington and Ehrhart, 1989). Females nest every two to four years (Balazs, 1983), laying three to four clutches per nesting year (Johnson and Ehrhart, 1996). Mean clutch size is about 110 to 115 eggs (136 eggs in Florida). After emerging, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to reside for three to seven years, feeding close to the surface on a variety of marine algae and prey items associated with drift lines and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging habitats (protected lagoons and open coastal areas rich in seagrass and marine algae). Adult green turtles generally feed almost exclusively on seagrasses and algae in shallow bays, lagoons, and reefs (Rebel and Ingle, 1974, as cited in NMFS, 2013), although some populations also feed heavily on invertebrates (Carballo et al., 2002, as cited in NMFS, 2013). While in coastal habitats, green turtles exhibit foraging and nesting ground site fidelity and are able to return to these sites if displaced (McMichael et al., 2003, as cited in NMFS, 2013). Generally, adults are only occasionally found in the northern GOM. Most adult females off Florida appear to reside in nearshore foraging areas throughout the Florida Keys and in waters southwest of Cape Sable, with some post-nesting turtles also residing in Bahamian waters (NMFS and USFWS, 2007a).

Abundance and Trends

A summary of worldwide nesting data (NMFS and USFWS, 2007a) suggests that, of the 23 nesting sites where trends were discernible, 10 were increasing, 9 were stable, and 4 were decreasing. Generally, the Pacific, Western Atlantic, and Central Atlantic regions appeared to show more positive trends, while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends. The Atlantic Ocean regions had the most positive changes in abundance.

The green turtle 5-year status review identified eight geographic areas considered to be primary sites for nesting in the Atlantic/Caribbean, and reviewed the nest count trend for each (NMFS and USFWS, 2007a). The sites include 1) Yucatán Peninsula, Mexico; 2) Tortuguero, Costa Rica; 3) Aves Island, Venezuela; 4) Galibi Reserve, Suriname; 5) Isla Trindade, Brazil; 6) Ascension Island, United Kingdom; 7) Bioko Island, Equatorial Guinea; and 8) Bijagos Achipelago, Guinea-Bissau. Nesting at all sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago, where insufficient data were available to assess trends. Seminoff (2004) (as cited in NMFS, 2013) found similar results for nesting sites in the Atlantic, including sites on Florida beaches. The largest known nesting assemblage in the Atlantic Ocean occurs at Tortuguero, Costa Rica. There appears to be an increasing trend at this site since monitoring began in the early 1970s. Emergences increased from about 41,250 annually (1971 to 1975), to an average of 72,200 (1992 to 1996) (Bjorndal et al., 1999, as cited in NMFS, 2013). Similarly, Troëng and Rankin (2005) (as cited in NMFS, 2013) reported increasing trends between 1999 and 2003.

In the continental U.S., green turtle nesting occurs along the Atlantic coast, primarily along central and southeast Florida (Meylan et al., 1994; Weishampel et al., 2003; as cited in NMFS, 2013). Nesting has increased along the Atlantic coast of Florida, occurring on beaches where only loggerhead nesting was observed in the past (Pritchard, 1997, as cited in NMFS 2013). Nesting also occurs occasionally along the Gulf coast of Florida, including the Florida Panhandle (Meylan et al., 1995). Eglin AFB property supports the highest number of green sea turtle nests in northwest Florida. More recently, nesting has been documented on beaches of North Carolina, South Carolina, and Georgia.

Index beaches have been established in Florida in order to standardize data collection methods and effort on key nesting beaches. Since establishment of these beaches in 1989, the green turtle nesting pattern has consisted of biennial peaks with a generally positive trend. Between 1989 and 2012, nest counts across Florida have increased substantially, from a low of 267 in the early 1990s to a high of 10,701 in 2011. Modeling by Chaloupka et al. (2008) suggests that the Florida nesting stock at the Archie Carr National Wildlife Refuge is growing at an annual rate of 13.9 percent.

There are no reliable abundance estimates for immature green sea turtles in the coastal areas of the southeastern U.S., where they come to forage. Ehrhart et al. (2007) (as cited in NMFS, 2013) have documented a significant increase in abundance in the Indian River Lagoon area. It is likely that immature turtles foraging in the southeastern U.S. come from multiple genetic stocks. Therefore, the status in the southeastern U.S. may be surmised from trends of the main regional nesting beaches (Florida, Yucatán, and Tortuguero).

Threats

Threats to the green sea turtle are generally the same as those described for the loggerhead sea turtle. However, green turtles are apparently more affected by fibropapillomatosis disease than other sea turtle species.

Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969 (precursor to the ESA).

Description, Distribution, and Population Structure

The leatherback sea turtle is the largest sea turtle in the world. Mature adults can reach lengths of over 2 meters and weigh close to 900 kg (2,000 lb), although adults typically weigh between 200 and 700 kg (441 and 1,543 lb) (NMFS and USFWS, 1992). The leatherback is the only sea turtle that lacks a hard, bony shell. The carapace is approximately 4 cm thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged carapace and large flippers make the leatherback well equipped for long distance foraging migrations. Unlike other sea turtles which feed on hard-bodied prey, leatherbacks have pointed tooth-like cusps and sharp edged jaws that are used to consume soft-bodied pelagic prey such as jellyfish and salps (Pritchard, 1971, as cited in NMFS, 2013). The mouth and throat also have backward-pointing spines that help retain gelatinous prey.

The leatherback sea turtle is a far-ranging species with a broad thermal tolerance (NMFS and USFWS, 1995), foraging in temperate and subpolar regions worldwide and undergoing extensive migrations to and from tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS-SEFSC, 2001). Leatherbacks nest in the western Atlantic from the southeastern U.S. to southern Brazil, and in the eastern Atlantic from Mauritania to Angola. The most significant nesting beaches in the Atlantic, and perhaps in the world, are located in French Guiana and Suriname (NMFS-SEFSC, 2001).

Previous genetic analyses suggested that there were at least three genetically distinct nesting populations within the Atlantic basin. More recent genetic analyses, along with tagging data, have resulted in the identification of seven breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG, 2007). General differences in migration patterns and foraging grounds may occur between the groups, although data supporting this hypothesis are limited.

The leatherback is the deepest diving sea turtle, but the species may also enter shallow waters to locate prey items. The average dive depths from tagging studies off the continental shelf of

St. Croix are 35 to 122 m (115 to 400 ft), with estimated maximum depths of over 1,000 m (3,281 ft) (DON, 2007). Typical dive durations average 6.9 to 14.5 minutes per dive, with a maximum of 42 minutes. Routine dive lengths around St. Croix can range from 4 to 14.5 minutes. The maximum known dive length for a subadult is 7.7 minutes.

Life History

Leatherbacks are long-lived, with some individuals reaching 30 years of age or more. The age at which leatherbacks reach sexual maturity is unclear, with estimates ranging widely from 3 to 29 years of age (Rhodin, 1985; Zug and Parham, 1996; Avens and Goshe, 2007; as cited in NMFS, 2013). Females lay up to 10 nests during the nesting season (March through July in the U.S.) at 2 to 3 year intervals, with 100 or more eggs in each clutch (Schultz, 1975, as cited in NMFS, 2013). However, up to about 30 percent of the eggs can be infertile. Hatching occurs after 60 to 65 days. Leatherbacks forage in coastal waters but appear to remain primarily pelagic through all life stages (Heppell et al., 2003, as cited in NMFS, 2013).

There is limited information about the oceanic distribution of post-hatchling and early juvenile leatherbacks. These life stages are generally restricted to waters with temperatures greater than 26°C (79°F) and, in contrast to the other four sea turtle species found in U.S. waters, they are likely not associated with *Sargassum* (NMFS and USFWS, 1992; Eckert, 2002). Late juvenile and adult leatherback turtles are known to range from mid-ocean to the continental shelf and nearshore waters (Schroeder and Thompson, 1987; Shoop and Kenney, 1992). Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters. The distribution and movement of adult leatherbacks appear to be linked to seasonal availability of prey and to requirements of the reproductive cycle (Collard, 1990; Davenport and Balazs, 1991). The location and abundance of prey, including medusa, siphonophores, and salpae, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (NMFS and USFWS, 1995).

Abundance and Trends

The status of the Atlantic leatherback population is generally less clear than that of the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al., 2000; Sarti Martínez et al., 2007; as cited in NMFS, 2013). However, data collection and analyses by the Leatherback Turtle Expert Working Group has provided some information (TEWG, 2007). The Southern Caribbean/Guianas stock, which includes the Guianas, Trinidad, Dominica, and Venezuela, is the largest known Atlantic leatherback nesting aggregation (TEWG, 2007). Past analyses showed that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS-SEFSC, 2001). However, from 1979 to 1986, the number of nests was increasing at about 15 percent annually, which could indicate that the decline was part of a natural nesting cycle that coincides with the erosion cycle of Guiana beaches described by Schultz (1975) (as cited in NMFS, 2013). The cycle of beach erosion and reformation may result in shifting nesting beach locations throughout the region. It is possible that the Guianas and possibly Trinidad should be viewed as one population (Reichart et al., 2001, as cited in NMFS, 2013). Genetics studies support this hypothesis and have resulted in designation of the Southern Caribbean/Guianas stock. The TEWG has determined that the stock had demonstrated a long-term, positive population growth rate.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia, with the most intense nesting occurring in Costa Rica, Panama, and Colombia (Duque et al., 2000, as cited in NMFS, 2013). Data from three index nesting beaches in the region suggest the nesting population likely did not grow between 1995 and 2005 (TEWG, 2007). Other modeling (of Tortuguero only) indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng and Chaloupka, 2007, as cited in NMFS, 2013).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG, 2007). Similarly, the average annual growth rate was approximately 1.1 and 1.2 percent at the primary nesting beach on St. Croix and on Tortola, respectively, during the time frame of the 1980s through the mid-2000s (TEWG, 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800 and 900 per year in the 2000s following totals of fewer than 100 nests annually in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data, as cited in NMFS, 2013). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, followed by 265, 615, 552, and 625 nests over the next four years (FWC Index Nesting Beach Survey Database, as cited in NMFS, 2013). This pattern is thought to demonstrate a cyclical nesting pattern, similar to the biennial nesting cycle of green turtles. The overall trend shows rapid growth on Florida's east coast. Only infrequent nesting activity has been documented in northwest Florida. Until the spring of 2000, the only confirmed leatherback nesting in this region was in Franklin and Gulf Counties. In May and June 2000, nesting was documented for the first time in Okaloosa County on Eglin AFB's Santa Rosa Island property. Since then, one leatherback nest was found on Eglin's property in 2012.

The West African leatherback nesting stock is a large and important aggregation, but has not been well studied. Nesting occurs in various countries along Africa's Atlantic coast, but is generally undocumented. Gabon supports a large amount of nesting, with at least 30,000 nests in one season (Fretey et al., 2007). Due to the lack of survey effort and data collection, trend analyses are not available.

Two other small but growing nesting stocks utilize the beaches of Brazil and South Africa. The TEWG found a positive growth rate of about one percent for the Brazil and South Africa stocks between 1988 and 2003.

There is currently not a reliable estimate of total population size for Atlantic leatherback sea turtles due to inconsistent data. In 1996, the entire Western Atlantic population was characterized as stable at best (Spotila et al., 1996, as cited in NMFS, 2013), with a population of about 18,800 nesting females. Spotila et al. (1996) (as cited in NMFS, 2013) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 adult females. This is consistent with the estimate of 34,000 to 95,000 total adults determined by the TEWG (TEWG, 2007).

Threats

Threats to the leatherback sea turtle are generally the same as those described for the loggerhead sea turtle. However, leatherbacks seem to be more vulnerable to entanglement in fishing gear than other sea turtle species. This may be the result of body type, attraction to gelatinous organisms and algae that collect on buoys and buoy lines, method of locomotion, and possibly attraction to the lightsticks used in longline fisheries. In addition, leatherback turtles may be more prone to ingestion of marine debris due to their predominantly pelagic existence and tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migrating (Shoop and Kenney, 1992) (Lutcavage et al., 1997, as cited in NMFS, 2013). Leatherbacks may not always distinguish between prey items and plastic debris (Mrosovsky et al., 2009).

Juveniles/Hatchlings

Sea turtle hatchlings are present at certain times of the year within the Maritime WSEP test area. Loggerhead turtles nest every year on Santa Rosa Island. Green turtles nest every other year. Leatherback and Kemp's ridley turtles nest on the island infrequently. Nesting generally occurs between May and August, and the incubation period is approximately 60 days overall. Once hatchlings reach the GOM, at least some will be associated with floating mats of *Sargassum*. The mats provide shelter and a wide variety of food.

Sea Turtle Density

Density estimates for three sea turtle species (loggerhead, Kemp's ridley, and leatherback) were obtained from the same habitat modeling project described for bottlenose dolphins in the preceding subsection, *Marine Mammals* (Garrison, 2008). Please refer to that discussion for a more detailed description of the modeling effort. Similar to the results for bottlenose dolphins, sea turtle density estimates were provided at various spatial scales within the EGTTR. At the largest scale, density data were aggregated into four principal strata categories: north-inshore, north-offshore, south-inshore, and south-offshore. Densities for these strata were provided in the published survey report. It should be noted that these aggregated densities were not corrected for the availability of turtles at the surface, and the resulting negative bias is likely large. Unpublished densities were also provided for smaller blocks (subareas) corresponding to airspace units, and a number of these subareas were combined to form larger zones. Densities in these smaller areas were provided to Eglin AFB in Excel© spreadsheets by the report author. Unlike the aggregated estimates, subarea densities were corrected for animal surface availability.

Due to difficulties in distinguishing green and hawksbill sea turtles from the air, and to the fact that they overlap in the southern portion of the survey range, these two species were combined into a green/hawksbill category. Habitat modeling resulted in prediction of relatively high densities of this species category in warm, offshore waters of the northern GOM. However, Garrison (2008) cautions that this prediction is highly suspect, and that the results should only be applied from southwestern Florida to the Dry Tortugas. Therefore, habitat modeling results for the green sea turtle are not used in this document. Model results for leatherback turtles are also less reliable due to overall low observation numbers, but Garrison (2008) does not suggest discounting leatherback density estimates in the northern Gulf.

Density estimates for green sea turtles are derived from Epperly et al. (2002). Although the publication focuses on sea turtle bycatch, aerial surveys were conducted in conjunction with the studies. The surveys were conducted by NMFS personnel each fall between 1992 and 1996. Results were stratified into inshore (0 to 10 fathoms) and offshore (10 to 40 fathoms) areas, as well as into western and eastern geographic zones. The eastern offshore stratum is most applicable to the Maritime WSEP mission location. Results were also presented for upper and lower 95 percent confidence intervals. The density corresponding to the upper confidence interval of the 10 to 40 fathom stratum is used in this document. Density estimates were not adjusted for sighting or availability bias, likely resulting in underestimation of true density; therefore, the authors presented the values as minimum density estimates. To account for the potential for negative bias associated with sighting and availability bias, Eglin AFB adjusted the minimum density estimate for green sea turtles based on a 90 percent dive profile (i.e., sea turtles are assumed to spend an average of 90 percent of their time underwater and 10 percent at the surface).

Based on the preceding discussion, density estimates shown in Table 3-12 for loggerhead, Kemp's ridley, and leatherback sea turtles correspond to the median density in subarea 137, as presented by Garrison (2008). For all three species, CVs were acceptable for the months of February and March. Since Maritime WSEP test activities could occur any time during these two months, the density estimate associated with the highest five-year average was used for analysis, which was February in every case. CVs were 0.33, 0.41, and 0.35 for each respective species. The green sea turtle density estimate represents the minimum estimate provided by Epperly et al. (2002), adjusted by Eglin AFB according to the presumed dive profile.

Table 3-12. Sea Turtle Density Estimates

Species	Adjusted Density (animals/km^2)
Loggerhead sea turtle[1]	2.360
Kemp's ridley sea turtle[1]	1.904
Leatherback sea turtle[1]	0.601
Green sea turtle[2]	0.170

km^2 = square kilometers

1. Source: Garrison, 2008; adjusted for observer and availability bias by author.
2. Source: Epperly et al., 2002; not adjusted for sighting or availability bias by authors, but adjusted by Eglin AFB for this analysis.

Density is nearly always reported for an area (e.g., animals per square kilometer). Although the study area appears to represent only the surface of the water (two-dimensional), density actually implicitly includes animals anywhere within the water column under that surface area. Density estimates also usually assume that animals are uniformly distributed within the prescribed area, even though this is likely rarely true. Sea turtles may be clumped in areas of greater importance, for example, in areas of greater food availability. Density can occasionally be calculated for smaller areas, but usually there are insufficient data. Therefore, assuming an even distribution within the prescribed area is the typical approach.

In addition, assuming that marine animals are distributed evenly within the water column does not accurately reflect behavior. Databases of behavioral and physiological parameters obtained through tagging and other technologies have demonstrated that marine animals use the water column in various ways. Some species conduct regular deep dives while others may engage in much shallower dives, regardless of bottom depth. The assumption that all species are evenly distributed from surface to bottom is almost never accurate and can present a distorted view of species distribution in any region. Therefore, a depth distribution adjustment is applied to sea turtle densities in this document (Table 3-13). By combining turtle density with depth distribution information, a three-dimensional density estimate is possible. These estimates allow more accurate modeling of potential sea turtle exposures from explosive sources.

Table 3-13. Depth Distribution for Sea Turtles in the Maritime WSEP Test Area

Species	Depth Distribution	Reference
Leatherback sea turtle	28% at <6 m, 36% at 6-12 m, 24% at 13-51 m, 7% at 52-102 m, 3% at 103-150 m, and 2% at >150 m.	Eckert (2006)
Loggerhead sea turtle	33% at <1 m, 15% at 1-3 m, 12% at 4-6 m, 8% at 7-10 m, 25% at 11-25 m, and 7% at >25 m.	Dellinger and Freitas (2001)
Other hard-shelled sea turtles (Kemp's ridley and green)	33% at <1 m, 15% at 1-3 m, 12% at 4-6 m, 8% at 7-10 m, 25% at 11-25 m, and 7% at >25 m.	Dellinger and Freitas (2001)

m = meters

3.4.3 Environmental Consequences

3.4.3.1 Proposed Action

Marine Fish

Marine fish and habitats would not be affected by swarm missions occurring in the Gulf and Choctawhatchee Bay. There is a potential for surface or underwater detonations from live WSEP missions to affect marine fish in the Gulf. Underwater detonations can create very high sound pressures in the form of shock waves that propagate in all directions and have the potential to seriously harm cartilaginous and bony fish. Shock waves created by the detonation velocity are faster than the speed of sound. Thus, shock waves from underwater detonations are the primary cause of mortality/injury to aquatic life at great distances from the shot point. In addition, ordnance in open water that is not contained completely by structure will produce higher amplitude and higher frequency shock waves (Keevin and Hempen, 1997).

Underwater shock waves can rupture swim bladders and blood vessels of fish, tear their tissues, and rupture and hemorrhage the spleen, kidney, liver, and gonads (Wright, 1982; Lewis, 1996). In most cases, fish with swim bladders are more affected than fish without swim bladders (Lewis, 1996). Various factors can affect the extent of the effect of underwater detonations on fish. These factors include underwater topography and overall water depth, charge weight and type, position of munitions, animal size and position in the water column, and proximity to source. Fish feeding and/or swimming at the surface and/or in shallow water are generally more affected than fish at deeper depths within the water column (Lewis, 1996).

Marine fish species may be affected by detonation of live ordnance deployed during Maritime WSEP activities. Fish that are located in proximity to a detonation could be killed, injured, or disturbed by the impulsive sound. There currently is no generally accepted threshold for determining effects to fish from explosives other than mortality models. In general, underwater explosions are lethal to most fish species near the detonation regardless of size, shape, or internal anatomy (CSA, 2004). At farther distances, species with gas-filled swim bladders are more susceptible than those without swim bladders. Larger fish are generally less susceptible to death or injury than small fish. Species with elongated body forms that are round in cross section may be less susceptible to injury than deep-bodied forms, and orientation of fish relative to the shock wave may affect the extent of injury. Open water pelagic fish (e.g., mackerel) seem to be less affected than reef fish. Variations in the fish population, including numbers, species, sizes, orientation, and range from the detonation point, make it very difficult to predict mortalities at any specific site of detonation. Most fish species experience large numbers of natural mortalities, especially during early life stages and, therefore, any small level of mortality caused by Maritime WSEP activities would most likely be negligible to the population as a whole.

Behavioral changes and masking could occur due to detonations. Although some fish in the vicinity of the exercises may react negatively to the sound of underwater detonations, the sound would be relatively short term and localized. Behavioral changes are not expected to have lasting effects on the survival, growth, or reproduction of fish populations. Given that the energy distribution of an explosion covers a broad frequency spectrum, sound from underwater explosions might overlap with some environmental or biological cues significant to marine fish. However, the time scale of individual explosions is very limited, and test activities are dispersed in time. Thus, the likelihood of underwater detonations resulting in substantial masking is low.

It is not anticipated that fish protected under the ESA would be affected. Although the smalltooth sawfish historical range included the Florida Gulf coast, they are now only commonly found in southern Florida. This species typically resides within 1 mile of land in estuaries, shallow banks, sheltered bays, and river mouths. Occasionally, they are found offshore on reefs or wrecks and over hard or mud bottoms. Only a remote chance exists for this species to be in the test area.

The Gulf sturgeon is generally considered to occur near the shoreline, although factors such as water depth or prey distribution may be more important factors than distance from land, and Gulf sturgeons have been observed off the Suwannee River area as far as 16.7 km (10 miles) from shore (USFWS and NMFS, 2003). The USFWS has designated critical habitat for the Gulf sturgeon in the GOM (in addition to several rivers and bays). This protected Gulf habitat encompasses coastal waters from the mean high water line and out to 1.9 km (1 NM) offshore. However, given the offshore distance of the Maritime WSEP test area (17 miles), impacts to this species are considered unlikely. Maritime WSEP activities would occur well beyond the offshore critical habitat boundary. In addition, sturgeon occurrence in the Gulf could be decreased if testing was scheduled for March, as Gulf sturgeons generally begin migration back toward estuarine and riverine habitats in March. There would be no significant impacts to marine fish resulting from Maritime WSEP activities.

Essential Fish Habitat

The MSA requires federal agencies to assess potential impacts to EFH for managed commercial fisheries. In fulfillment of this requirement Eglin Natural Resources consulted with NMFS Sustainable Fisheries Division concerning impacts to federally-managed fisheries. NMFS concurred with the Eglin determination that adverse impacts to fish stocks would be temporary and minor. Adverse impacts to EFH are defined as those that reduce quality and/or quantity of EFH. The EFH constituents near the study area include estuaries, coral/hardbottom, all other substrates, and the water column. Maritime WSEP test activities would not occur in estuaries. No reef or other hardbottom habitat occurs within about 10 miles of the site. Known artificial reefs occur within the composite safety footprint, with the nearest being between two and three miles from the approximate target site (Figure 3-1). However, it is considered unlikely that ordnance or debris would affect artificial reefs or other hard bottom areas.

Impacts to substrate and the water column could occur due to metals and chemical materials, debris (including sunken targets), and anchoring of the GRATV. There would be no underwater detonations, and explosions at the water surface would not affect the seafloor. Therefore, there would be no effects to sediments or other substrates due to blast effects.

Metals typically used to construct bombs, missiles, and gunnery rounds include copper, aluminum, steel, and lead. Aluminum is also present in some explosive materials such as tritonal. Lead is present in batteries used in vessels such as the remotely controlled target boats. Metal debris would settle to the seafloor after munitions are detonated. Metal ions would slowly leach into the substrate and the water column, causing elevated concentrations in a small area around munitions fragments. Some of the metals, such as aluminum, occur naturally in the ocean at varying concentrations and would not necessarily degrade the substrate or water column. Other metals, such as lead, could cause toxicity in microbial communities in the substrate. However, such effects would be localized and would not significantly affect the overall habitat quality of sediments in the northeastern Gulf. In addition, metal fragments would corrode, degrade, and become encrusted over time.

Chemical materials include explosive byproducts and fuel, oil, and other fluids (including battery acid) associated with remotely controlled target boats. Explosive byproducts would be introduced into the water column through detonation of live munitions. Explosive materials associated with test ordnance include tritonal and research department explosive (RDX), among others. Tritonal is primarily composed of 2,4,6-trinitrotoluene (TNT). RDX is sometimes referred to as cyclotrimethylenetrinitramine. Various byproducts are produced during and immediately after detonation of TNT and RDX. During the very brief time that a detonation is in progress, intermediate products may include carbon ions, nitrogen ions, oxygen ions, water, hydrogen cyanide, carbon monoxide, nitrogen gas, nitrous oxide, cyanic acid, and carbon dioxide (Becker, 1995). However, reactions quickly occur between the intermediates, and the final products consist mainly of water, carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen gas, although small amounts of other compounds may persist or be produced as well.

Chemical materials introduced into the water column would be quickly dispersed by currents, tidal action, and waves, and would eventually become uniformly distributed throughout the northern GOM. A portion of the carbon compounds, such as CO and CO_2, would likely become integrated into the carbonate system (alkalinity and pH buffering capacity of seawater). Some of the nitrogen and carbon compounds, including petroleum products, would be metabolized or assimilated during protein synthesis by phytoplankton and bacteria. Most of the gas products that do not react with the water or become assimilated by organisms would be released to the atmosphere. Due to dilution, mixing, and transformation, none of the chemicals potentially released into the water column are expected to have significant impacts on the marine environment.

Explosive material that is not consumed in a detonation could sink to the substrate and bind to sediments. However, the quantity of such materials in expected to be inconsequential. Research has shown that if munitions function properly, nearly full combustion of the explosive materials will occur, and only extremely small amounts of raw materials will remain. In addition, TNT decomposes when exposed to sunlight/ultraviolet radiation and is also degraded by microbial activity (Becker, 1995). Several types of microorganisms have been shown to metabolize TNT. Similarly, RDX is decomposed by hydrolysis, ultraviolet radiation exposure, and biodegradation. There is potential for munitions to fail to detonate. In this case, intact explosive materials could eventually enter the water column. This process would probably happen slowly, as the munition casing degraded. In addition, it is expected that the dud rate will be low. The fate of chemical materials from UXO would be similar to that described above.

Direct physical impacts to the seafloor could occur due to debris and the barge anchoring system. Debris deposited on the seafloor would include spent munitions fragments, UXO (in the case of dud munitions), and possibly pieces of the target boats (fiberglass, plywood, etc.). Debris would not appreciably affect the sandy seafloor. Debris moved by water currents could scour the bottom, but sediments would quickly refill any affected areas, and overall effects to benthic communities would be minor. Large pieces of debris would not be as prone to movement on the seafloor and could result in beneficial effects by providing habitat for encrusting organisms, fish, and other marine fauna. Target boats have foam-filled hulls and most of the pieces are designed to float in order to facilitate collection for damage assessment. Overall, the quantity of material deposited on the seafloor would be small compared to other sources of debris in the GOM. Although missions will be planned to avoid hardbottom habitats and artificial reefs, there is some potential for debris to be carried by currents and cause minimal alteration to such habitats before becoming embedded in the sediments. However, the potential for such a scenario to cause significant damage in considered low, and effects to natural or artificial reefs are not expected.

The GRATV would be anchored to the seafloor with four anchors, one on each corner of the barge. The anchors would cover a small area of sandy seafloor habitat immediately surrounding the GRATV. In addition, water currents flowing around the anchors could cause some scouring of the substrate. These actions could result in mortality, injury, or displacement of benthic organisms. However, the area of affected seafloor would be insignificant compared to the amount of available similar habitat in the vicinity of the mission area, and in the nearshore waters of the northeastern GOM generally. In addition, the GRATV would leave the area after test missions are completed, and water currents would redistribute sediments.

If large pieces of target boats were to become embedded in the seafloor and function as fish habitat, there could be a greater potential for fish injury or mortality over the course of testing due to increased fish numbers in the test area. Multiple, large debris pieces in close proximity could magnify the potential for impacts. However, Maritime WSEP testing would be limited in duration and overall number of boats targeted, and only a fraction of boat strikes would result in deposition of large debris items. In addition, while stationary targets are generally located in close proximity, remotely controlled boats would likely be dispersed over a larger area when targeted. Therefore, it is not considered likely that the number of fish attracted to debris and subsequently impacted by further detonations would result in substantial adverse effects to any species.

In summary, there would be no reduction in EFH quality and/or quantity due to Maritime WSEP test activities.

Marine Birds

Ordnance operations during test activities have the potential to affect birds. Birds at rest on the water's surface and diving birds could be injured or killed if an underwater detonation occurred nearby. Marine birds generally spend a short period of time underwater, although those species that use pursuit diving to capture prey may be underwater for a more extended time. Overall, it is unlikely that a detonation will coincide with the dive of a marine bird in the vicinity of the test site. Little published literature exists on the effects of underwater detonations to diving birds. During studies conducted on seismic surveys, airguns were not found to have caused harm to the seabirds being studied (Turnpenny and Nedwell, 1994; Lacroix et al., 2003). Injuries due to explosives have been reported, but only when the seabirds occurred near the detonation (Yelverton et al., 1973; Damon et al., 1974; Turnpenny and Nedwell, 1994). Few, if any, individual birds are likely to be affected by test activities. Birds in swarm mission areas would not be affected.

Three bird species protected by federal law may occur in the test area, including the piping plover, wood stork, and bald eagle. Although the bald eagle has been removed from the federal list of endangered species, it remains protected under the Bald and Gold Eagle Protection Act. Critical habitat has been designated for the piping plover on Santa Rosa Island, the land mass nearest the Maritime WSEP test location. None of these species would typically be found on the marine water surface or in association with the target boats, and none are diving birds. Direct impacts would be limited to encounters of birds flying through the test area at the same time a detonation occurred and at a height above the water that placed them in the blast radius, or to direct strikes by weapons in flight. The likelihood of such scenarios, while not quantified, is considered low. Piping plover critical habitat would not be affected by test activities.

There would be no significant impacts to marine birds due to Maritime WSEP activities.

Marine Mammals

Potential causes of marine mammal impacts analyzed in this EA include debris and effects from noise and pressure waves produced by detonations. Due to the high mobility and hearing ability of dolphin species, vessel strikes in the Gulf and Choctawhatchee Bay are not considered to be an issue. Bottlenose and Atlantic spotted dolphins have the ability to move quickly through the water column and are sometimes seen riding the bow wave of boats. The possibility of a direct strike by munitions is also considered low and is not discussed in this document.

Debris

Fragments of exploded bombs, missiles, and gunnery rounds, as well as pieces of damaged targets, could be suspended in the water column or sink to the bottom. Debris can negatively impact marine species. Plastics introduced into the marine environment may cause potential injury or death through ingestion or entanglement. However, most of the Maritime WSEP debris would be wood, fiberglass or foam hull material that would be retrieved. Large debris that is not buoyant would sink to the bottom. This debris would eventually become encrusted and/or covered by sediments, although cycles of covering/exposure may occur due to water current movement. The Maritime WSEP mission team would recover surface debris to the extent practicable, employing several vessels for up to two to three hours. There would be no significant impacts to marine mammals due to direct effects of debris from Maritime WSEP tests. There would be no debris associated with swarm missions.

As discussed in the EFH subsection above, there is some potential for large debris pieces to attract fish, as well as other marine organisms such as cephalopods. These types of species are prey items for bottlenose and Atlantic spotted dolphins. Therefore, dolphins could be attracted to the test area due to aggregation of food sources over time, and could therefore be more likely to be present during live detonations. However, testing would be limited in duration, the total number of boats targeted, and the number of boats or large debris pieces deposited in any one area. Therefore, indirect impacts to marine mammals due attraction to the test are not considered likely.

Detonations

Dolphins spend their entire lives in the water and are entirely submerged below the surface for much of the time. When at the surface, unless engaging in behaviors such as jumping, the body is almost entirely below the water's surface, with only the dorsal fin and a small area around the blowhole exposed. This can make dolphins difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100 percent of the time because their ears are nearly always below the water's surface.

Dolphins may be potentially injured or harassed due to noise or pressure waves from detonation of live ordnance during Maritime WSEP tests. The potential effects of exposure to pressure waves are similar to those described above for marine fish, and may include tissue damage to air-filled structures of the body, hemorrhaging, and eardrum rupture, among others. At some distance from an underwater detonation, the pressure waves become diminished and acoustic energy (noise) becomes the dominant impact parameter. Sound is a compressional wave that moves outward in all directions from a source. As a sound wave moves further from the source, the sound level decreases due to energy loss resulting from spreading, absorption, reflection, and refraction. At distances relatively near an explosion, noise exposure can result in temporary or permanent hearing threshold changes. At further distances, where sound level is decreased, effects may be limited to behavioral reactions such as startle effects or disruption of normal activities. A more complete description of the potential effects of pressure waves and noise, as well as the associated metrics, is provided in following subsections.

Three key sources of information are necessary for quantitatively estimating potential noise effects on marine mammals: 1) the zone of influence, which is the distance from the explosion to which a particular energy or pressure threshold extends; 2) the density of animals potentially occurring within the zone of influence; and 3) the number of events.

Zone of Influence

The zone of influence (ZOI) is defined as the area or volume of ocean in which marine mammals could potentially be exposed to various noise thresholds associated with exploding ordnance. Marine mammals may be affected by certain energy and pressure levels resulting from the detonations. Criteria and thresholds generally used for impact assessment were originally developed for the shock trials of the *USS SEAWOLF* and *USS Winston S. Churchill* (DDG-81) and modified over the years as the science became better understood. The analysis of potential impacts to marine mammals adopts criteria and thresholds presented in Finneran and Jenkins (2012), which have been adopted by the National Marine Fisheries Service.

Criteria and thresholds for explosive sources are divided into physiological effects such as mortality, injury and loss of hearing, and behavioral effects, which might include an escape response, or interference with normal activities such as feeding or resting. The National Marine Fisheries Service considers temporary loss of hearing and changes in behavior in marine mammals to be forms of harassment, as legally defined in the Marine Mammal Protection Act.

The paragraphs below provide a general discussion of the various metrics, criteria, and thresholds used for impulsive or explosive noise impact assessment of marine mammals and sea turtles. More information on this topic is provided in Appendix B.

Metrics

Standard impulsive and acoustic metrics were used for the analysis of underwater energy and pressure waves in this document. Several different metrics are important for understanding risk assessment analysis of impacts to marine mammals and sea turtles.

Peak Pressure: This is the maximum positive pressure, or peak amplitude of impulsive sources, for an arrival. Units are in psi.

SPL: Sound pressure level. A ratio of the absolute sound pressure and a reference level. Units are in decibels re 1 micropascal (dB re 1μPa).

SEL: Sound exposure level. SEL is a measure of sound intensity and duration. When analyzing effects on marine animals from multiple moderate-level sounds, it is necessary to have a metric that quantifies cumulative exposures (American National Standards Institute, 1994). The sound exposure level can be thought of as a composite metric that represents both the intensity of a sound and its duration. Sound exposure level is determined by calculating the decibel level of the cumulative sum-of-squared pressures over the duration of a sound, with units of dB re 1 micropascal-squared seconds (μPa^2-s) for sounds in water.

Positive Impulse: This is the time integral of the pressure over the initial positive phase of an arrival. This metric represents a time-averaged pressure disturbance from an explosive source. Units are typically Pascal-second (Pa-s) or pounds per square inch per millisecond (psi-msec). The latter is used in this document. There is no decibel analog for impulse.

Energy flux density (EFD): For plane waves, which is assumed for acoustic energy produced by the actions described in this document, EFD is the time integral of the squared pressure divided by the impedance. EFD levels have units of Joules per square meter (J/m^2), inch-pounds per square inch ($in\text{-}lb/in^2$), or decibels referenced to 1 squared micropascal-second (dB re 1 μPa^2-s) (with the usual convention that the reference impedance is the same as the impedance at the field point). The latter unit is used in this document.

1/3-Octave EFD: This is the EFD in a 1/3-octave frequency band. A 1/3-octave band has upper and lower frequency limits with a ratio of $2^{1/3}$. Therefore, the band width is approximately 25 percent above and below center frequency. The 1/3 octave selected is the hearing range at which the subject's hearing is believed to be most sensitive.

Criteria and Thresholds: Mortality

Whereas a single mortality threshold was previously used in acoustic impacts analysis, species specific thresholds are used today. Thresholds are based on the level of underwater blast noise that would cause extensive lung injury from which 1 percent of animals exposed would not recover (Finneran and Jenkins, 2012). The threshold is conservative in that it represents the onset of mortality, and 99 percent of animals so exposed would be expected to survive. The lethal exposure level of blast noise, associated with the positive impulse pressure of the blast, is expressed as psi-msec and determined using the Goertner (1982) modified positive impulse equation. This equation considers factors of sound propagation, source/animal depths and the mass of a newborn calf for a given species. The threshold is conservative because animals of greater mass can withstand greater pressure shock waves, and newborn calves typically make up a very small percentage of cetacean group.

For the Proposed Action, two species are expected to occur within the study area, the Atlantic bottlenose dolphin and the Atlantic spotted dolphin. Finneran and Jenkins (2012) provide known or surrogate masses for newborn calves of several cetacean species. For the Atlantic bottlenose dolphin, this value is 14 kg; for the Atlantic spotted a surrogate species, the striped dolphin is used and the mass value of a newborn calf is 7 kg. The Goertner equation as presented in Finneran and Jenkins, and used in the acoustic model to develop impacts analysis in this EA is as follows:

$$I_M(M,D) = 91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$$

$I_M(M,D)$	mortality threshold, expressed in terms of acoustic impulse (Pa·s)
M	Animal mass (Table D-1)
D	Water depth (m)

Criteria and Thresholds: Injury (Level A Harassment)

The latest NMFS-endorsed guidance recognizes three types of blast related injury, gastrointestinal tract injury, slight lung injury and irrecoverable auditory damage. The injury categories are all types of Level A Harassment as defined in the MMPA.

Gastrointestinal Tract Injuries

Gastrointestinal tract injuries are correlated with peak pressure of a underwater detonation. For recoverable injury observed during experiments with small charges in the 1970s, the peak pressure of the shock wave was the causal agent of contusions in the gastrointestinal tract (Richmond et al., 1973 in Finneran and Jenkins, 2012). The experiments found that a peak sound pressure level of 237 dB re 1μPa predicts the onset of gastrointestinal tract injuries, which are independent of an animal's mass or size. Therefore, the unweighted peak sound pressure level of 237 dB re 1 μPa is used in explosive impacts assessments as the threshold for slight injury for all marine mammals.

Slight Lung Injury

Thresholds for slight lung injury to marine mammals exposed to underwater blasts are defined as a survivable occurrence of slight lung injury, from which all animals would survive. As with the mortality determination, the metric is positive impulse and the equation for determination is that of the Goertner injury model (1982), which is defined as:

$$I_S(M,D) = 39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2},$$

Where:

M = animal mass (kg),

D = animal depth (m),

I_S units = Pa·s.

As the equation incorporates species specific body masses, the mass of a newborn calf for Atlantic spotted and Atlantic bottlenose dolphins will apply to the Maritime WSEP study area.

Auditory Damage (Permanent Threshold Shift)

Another type of injury, permanent threshold shift or PTS is auditory damage that does not recover, and results in a permanent decrease in hearing sensitivity. As there have been no studies to determine the onset of PTS in marine mammals this threshold is estimated from available information. Jenkins and Finneran define PTS thresholds differently for three groups of cetaceans based on their hearing sensitivity: low-frequency, mid-frequency and high-frequency. Bottlenose and spotted dolphins that are the subject of the Maritime WSEP acoustic impacts analysis both fall within the mid-frequency hearing category. The PTS thresholds use a dual criterion, one based on sound exposure level (SEL) and one based on sound pressure level of an underwater blast. For a given analysis the most conservative of the two is applied to afford the most protection to marine mammals. The mid-frequency cetacean criteria for PTS are:

- 187 dB re 1μPa2·s and
- Peak SPL of 230 dB re 1 μPa.

Criteria and Thresholds: Noninjurious Impacts (Level B Harassment)

Public Law 108-136 (2004) amended the definition of Level B harassment under the MMPA for military readiness activities (Maritime WSEP testing qualifies for this category of activity). For such activities, Level B harassment is defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered." Thus, Level B harassment is limited to the noninjurious impacts, but physiological impact of temporary threshold shift (TTS), and behavioral impacts.

Temporary Threshold Shift (TTS)

According to Finneran and Jenkins (2012) the TTS onset thresholds for mid-frequency cetaceans are based on TTS data from a beluga whale exposed to an underwater impulse produced from a seismic watergun (Finneran et al., 2002). TTS thresholds also use a dual criterion, and in a given analysis the more conservative of the two criterion is applied. The TTS thresholds for Atlantic spotted and Atlantic bottlenose dolphins consist of the SEL of an underwater blast weighted to the hearing sensitivity of mid-frequency cetaceans, and a peak SPL measure of the same. The dual thresholds for TTS in mid-frequency cetaceans are:

- 172 dB re 1 µPa2·s and
- Peak SPL of 224 dB re 1 µPa.

Behavioral Impacts

Behavioral impacts are essentially disturbances that may occur at noise levels below those considered to cause TTS in marine mammals, particularly in cases of multiple detonations. Behavioral impacts may include decreased ability to feed, communicate, migrate, or reproduce, among others. Such effects, known as sub-TTS Level B harassment, are based on observations of behavioral reactions in captive dolphins and belugas to pure tones, a different type of noise than that produced from an underwater detonation (Finneran and Schlundt, 2004; Schlundt et al., 2000). The behavioral impacts threshold for mid-frequency cetaceans exposed to multiple, successive detonations is:

SEL (mid-frequency weighted) of 167 dB re 1 µPa2·s

Table 3-14 summarizes the thresholds and criteria discussed above and used in this document to estimate potential noise impacts to marine mammals. All criteria and thresholds for cetaceans are derived from Finneran and Jenkins (2012).

Table 3-14. Criteria and Thresholds Used for Impact Analyses

Mortality[1]	**Level A Harassment**			**Level B Harassment**	
	Slight Lung Injury[1]	**GI Tract Injury**	**PTS**	**TTS**	**Behavioral**
$91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	$39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	Unweighted SPL: 237 dB re 1 µPa	Weighted SEL: 187 dB re 1 µPa^2·s	Weighted SEL: 172 dB re 1 µPa^2·s	Weighted SEL: 167 dB re 1 µPa^2·s
			Unweighted SPL: 230 dB re 1 µPa	Unweighted SPL: 224 dB re 1 µPa (23 psi peak pressure)	

D = Water depth (meters); *M* = Animal mass based on species (kilograms); PTS = permanent threshold shift; SEL = sound exposure level; SPL = sound pressure level; TTS = temporary threshold shift; dB re 1 µPa = decibels referenced to 1 micropascal; dB re 1 µPa^2·s = decibels reference to 1 micropascal-squared – seconds.
1. Expressed in terms of acoustic impulse (Pascal – seconds [Pa·s]);

Marine Mammal Density

Density estimates for bottlenose and Atlantic spotted dolphins are provided in Section 3.4.2. The densities were derived from the results of published documents authored by NMFS personnel. Density is nearly always reported for an area (e.g., animals per square kilometer). Analyses of survey results may include correction factors for negative bias, such as that provided by Garrison (2008) for bottlenose dolphins. Even though Fulling et al. (2003) did not provide a correction for Atlantic spotted dolphins or unidentified bottlenose/spotted dolphins, Eglin AFB adjusted those densities based on information provided in other published literature (Barlow, 2003; 2006). Although the study area appears to represent only the surface of the water (two-dimensional), density actually implicitly includes animals anywhere within the water column under that surface area. Density estimates usually assume that animals are uniformly distributed within the prescribed area, even though this is likely rarely true. Marine mammals are often clumped in areas of greater importance, for example, in areas of high productivity, lower predation, safe calving, etc. Density can occasionally be calculated for smaller areas, but usually there are insufficient data to calculate density for such areas. Therefore, assuming an even distribution within the prescribed area is the typical approach.

In addition, assuming that marine mammals are distributed evenly within the water column does not accurately reflect behavior. Databases of behavioral and physiological parameters obtained through tagging and other technologies have demonstrated that marine animals use the water column in various ways. Some species conduct regular deep dives while others engage in much shallower dives, regardless of bottom depth. Assuming that all species are evenly distributed from surface to bottom is almost never appropriate and can present a distorted view of marine mammal distribution in any region. Therefore, a depth distribution adjustment is applied to marine mammal densities in this document (Table 3-15). By combining marine mammal density with depth distribution information, a three-dimensional density estimate is possible. These estimates allow more accurate modeling of potential marine mammal exposures from specific noise sources.

Table 3-15. Depth Distribution for Marine Mammals in the Maritime WSEP Test Area

Species	Depth Distribution	Reference
Bottlenose dolphin	Daytime: 96% at <50 m, 4% at >50 m; Nighttime: 51% at <50 m, 8% at 50-100 m, 19% at 101-250 m, 13% at 251-450 m, and 9% at >450 m.	Klatsky et al. (2007)
Atlantic spotted dolphin	76% at <10 m, 20% at 10-20 m, and 4% at 21-60 m.	Davis et al. (1996)

m = meters

Number of Events

The number of events for Maritime WSEP activities generally corresponds to the number of live weapons deployed, which is provided in Table 2-4. The 30 millimeter (mm) gunnery rounds were modeled as one burst each because it is the most conservative approach. The 7.62 mm/ .50 caliber rounds do not contain high explosives and therefore do not detonate and introduce energy or pressure into the water column.

Exposure Estimates

Refer to Appendix B, IHA Request, Acoustic Impact Modeling, for a description of the acoustic modeling methodology used in this analysis. Table 3-16 provides the maximum estimated winter range, or radius, from the detonation point to which the various thresholds extend for bottlenose dolphins. This range is then used to calculate the total area of the ZOI. The calculated ZOIs are combined with density estimates (adjusted for depth distribution) and the number of live munitions to provide an estimate of the number of marine mammals potentially exposed to the various impact thresholds (Table 3-17). Final exposure estimates were obtained from the results of acoustic modeling. Appendix B contains a description of the acoustic model used to determine the numbers of marine species potentially impacted by Maritime WSEP activities. For metrics with two criteria (e.g., 187 dB SEL and 230 peak SPL for Level A harassment), the criterion that yielded the higher exposure estimates are presented in bold in Table 3-16 and were used for impact calculations. In some cases, munitions are analyzed according to weight class in order to facilitate use of previous acoustic modeling. In these cases, the resulting impact estimates are conservative in that the NEW used for modeling is greater than the actual NEW. These measures are described in Chapter 5.

Table 3-16. Bottlenose Dolphin and Spotted Dolphin (in parentheses) Winter Threshold Radii for Maritime WSEP Ordnance for the Proposed Action and Alternative 1 (Subsurface Hellfire Missile)

Munition	Detonation Scenario	Mortality	Level A Harassment				Level B Harassment		
			Injury		PTS		TTS		Behavioral
			Lung Injury	GI Tract Injury 237 dB SPL	230 dB SPL	187 dB SEL	172 dB SEL	224 dB SPL (23 psi)	167 dB SEL
GBU-10 or GBU-24	Surface	199 (237)	350 (400)	340	**881**	698	**1,582**	1280	2,549
GBU-12 or GBU-54	Surface	111 (138)	233 (274)	198	**685**	409	**2,027**	752	2,023
AGM-65 (Maverick)	Surface	82 (101)	177 (216)	150	**568**	312	**1,414**	575	1,874
GBU-39 (LSDB)	Surface	59 (73)	128 (158)	112	**431**	234	**1,212**	433	1,543
AGM-114 (Hellfire)[1]	Subsurface	110 (135)	229 (277)	95	**367**	193	**2,070**	354	3,096
AGM-114	Surface	59 (73)	128 (158)	112	**431**	234	**1,212**	433	1,543
AGM-175 (Griffin)	Surface	38 (47)	83 (104)	79	**282**	165	**1,020**	305	1,343
2.75 Rockets	Surface	36 (45)	81 (100)	77	**267**	161	**1,010**	296	1,339
PGU-13 HEI 30 mm	Surface	0	7 (9)	16	24	**33**	**247**	60	492

AGM = air-to-ground missile; cal = caliber; CBU = cluster bomb unit; GBU = guided bomb unit; HEI = high-explosive incendiary; mm = millimeters; PGU = projectile gun unit
1. Alternative 1 only.

Table 3-17 indicates the potential for lethality, injury, and noninjurious harassment (including behavioral harassment) to marine mammals in the absence of mitigation measures. The numbers represent total impacts for all detonations combined. The CBU-105 would be detonated in air and is therefore not applicable for inclusion in the analysis. For all detonations analyzed mortality was calculated as 0.28 animal for bottlenose dolphin and about 0.05 animal for Atlantic spotted dolphin. It is expected that, with implementation of the management practices outlined in Chapter 5, potential impacts would be mitigated to the point that there would be no mortality takes. An application for an IHA under the MMPA has been submitted to NMFS for Maritime WSEP activities. The permit would be required prior to the conduct of this action. An IHA authorizes take by Level A and B harassment only; mortality takes are not authorized.

Table 3-17. Number of Dolphins Potentially Affected by the Proposed Action

Munition	NEW (lb)	Total #	Detonation Scenario	Mortality	Level A Harassment				Level B Harassment		
				Modified Goertner Model 1	Slight Lung Injury	GI Track Injury	PTS		TTS		Behavioral
					Modified Goertner Model 2	237 dB SPL	187 dB SEL	230 dB Peak SPL	172 dB SEL	23 psi	167 dB SEL
Bottlenose Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2	Surface	0.03	0.05	0.24	2.54	0.86	10.54	2.73	16.28
GBU-12 or GBU-54	192	6	Surface	0.05	0.10	0.33	4.23	1.17	19.55	3.37	31.44
AGM-65 (Maverick)	86	6	Surface	0.04	0.07	0.23	2.99	0.82	15.43	2.28	24.97
GBU-39 (LSDB)	37	4	Surface	0.01	0.03	0.10	1.24	0.38	7.82	1.05	12.75
AGM-114 (Hellfire)	20	15	Surface	0.01	0.03	0.10	1.24	0.38	7.82	1.05	12.75
AGM-175 (Griffin)	13	10	Surface	0.01	0.05	0.14	1.55	0.58	13.85	1.69	22.97
2.75 Rockets	12	100	Surface	0.13	0.46	1.33	14.34	5.55	135.21	16.34	223.15
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.01	0.20	0.66	1.64[1]	102.71	8.56	334.63
Total Bottlenose Dolphins Affected				**0.28**	**0.8**	**2.67**	**29.77**	**NA**	**312.93**	**NA**	**678.94**
Atlantic Spotted Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.01	0.02	0.39	0.05	1.78	0.12	2.79
GBU-12 or GBU-54	192	6	Surface	0.01	0.01	0.03	0.64	0.09	3.18	0.22	5.30
AGM-65 (Maverick)	86	6	Surface	0.00	0.01	0.02	0.45	0.07	2.50	0.18	4.13
GBU-39 (LSDB)	37	4	Surface	0.00	0.01	0.01	0.20	0.04	1.24	0.09	2.08
AGM-114 (Hellfire)	20	15	Surface	0.00	0.01	0.01	0.20	0.04	1.24	0.09	2.08
AGM-175 (Griffin)	13	10	Surface	0.00	0.01	0.02	0.28	0.07	2.14	0.17	3.70
2.75 Rockets	12	100	Surface	0.04	0.09	0.21	2.62	0.65	20.77	1.66	35.90
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.02	0.15	0.38	0.71[1]	21.09	2.27	53.64
Total Spotted Dolphins Affected				**0.05**	**0.17**	**0.47**	**5.49**	**NA**	**53.94**	**NA**	**109.62**
Unidentified[1] Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.09
GBU-12 or GBU-54	192	6	Surface	0.00	0.00	0.00	0.02	0.00	0.11	0.01	0.18
AGM-65 (Maverick)	86	6	Surface	0.00	0.00	0.00	0.02	0.00	0.08	0.01	0.14
GBU-39 (LSDB)	37	4	Surface	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.07
AGM-114 (Hellfire)	20	15	Surface	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.07
AGM-175 (Griffin)	13	10	Surface	0.00	0.00	0.00	0.01	0.00	0.07	0.01	0.13
2.75 Rockets	12	100	Surface	0.00	0.00	0.01	0.09	0.02	0.71	0.06	1.22
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.00	0.00	0.01	0.02[1]	0.72	0.08	1.82
Total Unidentified Dolphins Affected				**0**	**0**	**0.01**	**0.19**	**NA**	**1.83**	**NA**	**3.72**

AGM = air-to-ground missile; dB = decibels; GBU = Guided Bomb Unit; GI = Gastrointestinal; HEI = High Explosive Incendiary; LSDB = Laser Small Diameter Bomb; mm = millimeters; lb = pounds; PGU = Projectile Gun Unit; PTS = permanent threshold shift; SEL = sound exposure level; SPL = Sound Pressure Level; TTS = temporary threshold shifts

1. GBU-39 used as conservative surrogate for AGM-175 detonations at the surface.

Sea Turtles

Sea turtles could be impacted during Maritime WSEP test activities by boat strikes, debris, and potential effects from noise and pressure waves produced by detonations. Due to sea turtles' generally dispersed distribution and relatively short surface intervals, the possibility of direct strikes by munitions is considered low and is not considered further.

Boat Strikes

In addition to target boats, a number of surface vessels would be at the Maritime WSEP test area to secure the safety zone. Boat strikes could potentially affect sea turtles swimming or feeding at or just beneath the water surface. In addition, noise from surface vessel traffic may cause behavioral responses in sea turtles. However, the number of boats associated with the test would not appreciably change the typical background level of boat traffic in the area, where a large number of recreational and commercial fishing boats regularly operate. In addition, surveys for marine species would be conducted before test activities take place. The likelihood of a boat strike is considered low. Therefore, there would be no significant impacts to sea turtles resulting from boat strikes associated with Maritime WSEP activities.

Debris

Fragments of exploded bombs, missiles, and gunnery rounds would likely pass through the boat targets and settle on the Gulf floor. In addition, pieces of damaged targets could also be suspended in the water column or sink to the bottom. Debris can negatively impact marine species. In particular, plastics introduced into the marine environment are well documented to cause potential injury or death to sea turtles through ingestion or entanglement. However, Maritime WSEP missions would contribute only a comparatively small amount of debris within the region. Debris that sinks to the bottom will eventually become covered in the substrate, although cycles of covering/exposure may occur due to water current movement. The Maritime WSEP mission team would recover surface debris to the extent practicable. There would be no significant impacts to sea turtles due to direct effects of debris from Maritime WSEP tests.

As discussed in the EFH and marine mammal subsection above, there is some potential for large debris pieces to become embedded in the seafloor and provide resting, sheltering, and feeding habitat for species such as sea turtles. Therefore, turtle occurrence and possibly density could increase at the test area over time compared to existing conditions. However, testing would be limited in duration, the total number of boats targeted, and the number of boats or large debris pieces deposited in any one area. Indirect impacts to sea turtles due to attraction to the mission area are not considered likely.

Noise and Pressure Effects

Sea turtles spend nearly their entire lives at sea, coming ashore only to nest and, in rare circumstances and locations, to bask. When at the water surface, sea turtle bodies are almost entirely below the water's surface, typically with only the head above water. This makes sea turtles difficult to locate visually and also exposes them to effects of nearby underwater explosions. Detonation of live ordnance produces noise and pressure waves in the water column that could cause mortality, injury, or harassment (behavioral changes). The effects to a given individual turtle depend on the source of the sound/pressure wave, proximity of the turtle to the source, and the number of disturbances over time. Turtles near a detonation could be injured or killed as a result of tissue destruction caused by intense pressure waves. Tissue damage is most likely to occur where there is substantial impedance differences (e.g., across air/tissue interfaces in the ear canal, sinuses, lungs, and intestines).

Noise from mission activities may cause a startle reaction in sea turtles and produce temporary, sublethal stress. Startle reactions may include increased surfacing, rapid swimming, or diving (McCauley, 2000; Lenhardt, 1994, as cited in NMFS, 2013). Noise due to mission activities may affect habitat quality such that important biological behaviors may be disrupted (e.g., feeding, mating, and resting), and turtles may avoid the test area because of the noise. The magnitude of those effects may be affected by the frequency, periodicity, duration, and intensity of the sounds, as well as the behavior of the animals during the exposure.

Compared to marine mammals, little is known about the role of sound and hearing in sea turtle life history and behavior, and only rudimentary information is available about responses to anthropogenic noise. Lenhardt et al. (1983) (as cited in NMFS, 2013) suggested that sea turtles use acoustic signals as guideposts during migration and as a cue to identify natal beaches. Sea turtles appear to be most sensitive to low frequencies; greatest sensitivities were from 200 to 700 Hz for the green turtle (Ridgway et al., 1969) and around 250 Hz for juvenile loggerheads (Bartol et al., 1999, as cited in DON, 2008). The effective hearing range for marine turtles is generally considered to be between 100 and 1,000 Hz (Bartol et al., 1999, as cited in DON, 2008; Lenhardt, 1994; Moein, 1994, as cited in DON, 2008; Ridgway et al., 1969). Hearing thresholds below 100 Hz were found to increase rapidly (Lenhardt, 1994). Additionally, calculated in-water hearing thresholds at best frequencies (100 to 1,000 Hz) appear to be high, at 160 to 200 dB re 1μPa (Lenhardt, 1994; Moein et al., 1995, as cited in DON, 2008). A study on the effects of airguns on sea turtle behavior also suggests that they are most likely to respond to low-frequency sounds (McCauley et al., 2000). Green and loggerhead turtles noticeably increased their swimming speed, as well as swimming direction, when received levels reached 166 dB re 1 μPa, and their behavior became increasingly erratic at 175 dB re 1 μPa (McCauley et al., 2000). There is no information regarding the consequences that these disturbances may have on sea turtles in the long term, but short-term disruption to normal behaviors and temporary abandonment of habitat is likely in response to some noises produced by munitions testing.

The potential number of sea turtles affected by detonations is assessed in the following paragraphs. Similar to marine mammal analysis, three key sources of information are necessary for estimating potential effects: 1) the zone of influence; 2) the density of animals potentially occurring within the zone of influence; and 3) the number of events. Descriptions of the ZOI, density calculations, and the number of events are provided earlier in this document (refer to descriptions of sea turtles in the *Affected Environment* section and discussion of marine mammal pressure/noise impacts in preceding paragraphs of this *Environmental Consequences* section). Due to the general lack of information regarding sea turtle hearing thresholds, there are no acoustic energy or pressure impact threshold ranges that are currently endorsed by the NMFS. In the absence of such information, thresholds used for marine mammal analyses are typically used when evaluating potential effects to sea turtles (e.g., DON, 2008; DON, 2009). Specifically, thresholds are identified for mortality, injury, and harassment. The Level B behavioral harassment criterion is currently not used for turtle impacts analysis. A summary of the criteria currently used to estimate turtle impacts is provided in Table 3-18.

Table 3-18. Explosive Criteria Used for Estimating Sea Turtle Impacts

Effect	Criteria	Metric	Threshold
Mortality	Onset of extensive lung injury	Goertner modified positive impulse	30.5 psi-ms
Physiological	Onset slight lung injury	Goertner modified positive impulse	indexed to 13 psi-ms
Harassment	TTS	Greatest energy flux density level in any 1/3-octave band above 100 Hz - for total energy over all exposures	182 dB re 1 μPa^2-s
Harassment	TTS	Peak pressure over all exposures	23 psi

dB = decibels; Hz = hertz; ms = milliseconds; psi = per square inch; PTS = permanent threshold shift; TTS = temporary threshold shift

Exposure Estimates

Table 3-16 provides the maximum estimated winter range, or radius, from the detonation point to which the various thresholds extend. This range is then used to calculate the total area of the ZOI. The calculated ZOIs are combined with the density estimates (adjusted for depth distribution) and the number of live munitions to provide an estimate of the number of sea turtles potentially affected (Table 3-19). For harassment metrics with two criteria (e.g., 182 dB EFD and 23 psi), the larger number of the two are used in impacts analysis and presented in bold in Table 3-19. In some cases, munitions are analyzed according to weight class in order to facilitate use of previous acoustic modeling. As with marine mammal impact calculations, the resulting estimates are conservative. Appendix B, IHA Request, Acoustic Impact Modeling section, contains model results for all criteria. It should be noted that the impact estimates shown in the table do not account for required mitigation measures, which are expected to reduce the likelihood and extent of impacts. Mitigation measures are described in Chapter 5.

Table 3-19. Proposed Action Winter Threshold Radii (in meters) for Maritime WSEP Ordnance for Sea Turtles

Munition	Detonation Scenario	Mortality	Physiological	Behavioral	
		30.5 psi-msec	13 psi-msec	182 dB EFD[1]	23 psi
GBU-10 or GBU-24	Surface	202	362	932	**1280**
GBU-12 or GBU-54	Surface	114	243	687	**752**
AGM-65 (Maverick)	Surface	84	187	**605**	575
GBU-39 (LSDB)	Surface	84	187	**605**	575
AGM-114 (Hellfire)	Surface	46	105	**413**	353
AGM-175 (Griffin)	Surface	46	105	**413**	353
2.75 Rockets	Surface	46	105	**413**	353
PGU-13 HEI 30 mm	Surface	0	7	31	**60**
7.62 mm/.50 cal	Surface	0	0	0	0

AGM = air-to-ground missile; cal = caliber; EFD = energy flux density; GBU = Guided Bomb Unit; HEI = High Explosive Incendiary; mm = millimeters; PGU = Projectile Gun Unit; psi = per square inch; psi-msec = per square inch per millisecond
Bold denotes higher of dual thresholds used in analysis.
1. In greatest 1/3-octave band above 10 Hz or 100 Hz.

Table 3-20 indicates the potential for lethality, injury, and noninjurious harassment to sea turtles in the absence of mitigation measures. The numbers represent total impacts for all detonations combined. Mortality is considered unlikely for green turtles. For loggerhead, Kemp's ridley, and leatherback turtles, mortality was calculated as less than one animal combined. However, the potential for impacts from live munitions testing would be reduced with the implementation of the monitoring and mitigation measures outlined in Chapter 5.

Table 3-20. Number of Sea Turtles Potentially Affected by the Proposed Action

Species	Mortality	Physiological	Behavioral
Loggerhead sea turtle	0.393	0.918	39.345
Kemp's ridley sea turtle	0.317	0.74	31.743
Leatherback sea turtle	0.135	0.325	11.073
Green sea turtle	0.028	0.066	2.834
TOTAL	**0.873**	**2.049**	**84.995**

3.4.3.2 Alternative 1: Subsurface Hellfire Missiles (Preferred Alternative)

Under Alternative 1, Hellfire missiles would be detonated 10 feet below the surface. Potential impacts to biological resources would be similar in scope to those described for the Proposed Action. However, the likelihood of impacts, as well as the number of individual animals possibly affected, would increase due to the subsurface detonation scenario.

Marine fish located near a detonation could be killed, injured, or disturbed by the impulsive sound. Underwater explosions are generally lethal to most fish species near a detonation regardless of size, shape, or internal anatomy. At farther distances, species with gas-filled swim bladders are more susceptible than those without swim bladders. Effects may be influenced by factors such as fish size, body shape, and orientation relative to the shock wave. Most fish species experience large numbers of natural mortalities and, therefore, any small level of mortality caused by Maritime WSEP activities would most likely be negligible to the overall population. The likelihood of long-term behavioral changes or hearing masking is low. It is not anticipated that fish protected under the ESA (Gulf sturgeon and smalltooth sawfish) would be affected. Activities would not take place in Gulf sturgeon critical habitat. There would be no reduction in EFH quality and/or quantity. There would be no significant impacts to marine fish or fish habitat resulting from Maritime WSEP activities.

Birds at rest on the water's surface, diving for prey, or flying through the test area could be injured or killed if these behaviors coincided with a detonation. However, such an occurrence is considered unlikely. Few, if any, individual birds (including protected species) are expected to be affected by test activities. There would be no significant impacts to marine birds due to Maritime WSEP activities.

Similar to the Proposed Action, the potential for marine mammals to be affected by debris is low. Marine mammals could be affected by noise and pressure waves caused by detonations in higher numbers than that of the Proposed Action (Table 3-21). The CBU-105 would be detonated in air and is therefore not applicable for inclusion in the analysis.

Table 3-21. Number of Dolphins Potentially Affected by Alternative 1 (Preferred Alternative)

Munition	NEW (lb)	Total #	Detonation Scenario	Mortality	Level A Harassment				Level B Harassment		
				Modified	Slight Lung Injury	GI Track Injury	PTS		TTS		Behavioral
				Goertner Model 1	Modified Goertner Model 2	237 dB SPL	187 dB SEL	230 dB Peak SPL	172 dB SEL	23 psi	167 dB SEL
Bottlenose Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2	Surface	0.03	0.05	0.24	2.54	0.86	10.54	2.73	16.28
GBU-12 or GBU-54	192	6	Surface	0.05	0.10	0.33	4.23	1.17	19.55	3.37	31.44
AGM-65 (Maverick)	86	6	Surface	0.04	0.07	0.23	2.99	0.82	15.43	2.28	24.97
GBU-39 (LSDB)	37	4	Surface	0.01	0.03	0.10	1.24	0.38	7.82	1.05	12.75
AGM-114 (Hellfire)	20	15	10	0.20	0.64	0.38	4.57	1.64	100.21	5.52	196.34
AGM-175 (Griffin)	13	10	Surface	0.01	0.05	0.14	1.55	0.58	13.85	1.69	22.97
2.75 Rockets	12	100	Surface	0.13	0.46	1.33	14.34	5.55	135.21	16.34	223.15
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.01	0.20	0.66	1.64[1]	102.71	8.56	334.63
Total Bottlenose Dolphins Affected				**0.47**	**1.41**	**2.95**	**33.1**	**NA**	**405.32**	**NA**	**862.53**
Atlantic Spotted Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.01	0.02	0.39	0.05	1.78	0.12	2.79
GBU-12 or GBU-54	192	6	Surface	0.01	0.01	0.03	0.64	0.09	3.18	0.22	5.30
AGM-65 (Maverick)	86	6	Surface	0.00	0.01	0.02	0.45	0.07	2.50	0.18	4.13
GBU-39 (LSDB)	37	4	Surface	0.00	0.01	0.01	0.20	0.04	1.24	0.09	2.08
AGM-114 (Hellfire)	20	15	10	0.06	0.17	0.10	1.29	0.41	21.45	1.30	38.87
AGM-175 (Griffin)	13	10	Surface	0.00	0.01	0.02	0.28	0.07	2.14	0.17	3.70
2.75 Rockets	12	100	Surface	0.04	0.09	0.21	2.62	0.65	20.77	1.66	35.90
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.02	0.15	0.38	0.71[1]	21.09	2.27	53.64
Total Spotted Dolphins Affected				**0.11**	**0.33**	**0.56**	**6.58**	**NA**	**74.15**	**NA**	**146.41**
Unidentified[1] Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.09
GBU-12 or GBU-54	192	6	Surface	0.00	0.00	0.00	0.02	0.00	0.11	0.01	0.18
AGM-65 (Maverick)	86	6	Surface	0.00	0.00	0.00	0.02	0.00	0.08	0.01	0.14
GBU-39 (LSDB)	37	4	Surface	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.07
AGM-114 (Hellfire)	20	15	10	0.00	0.01	0.00	0.04	0.01	0.73	0.04	1.32
AGM-175 (Griffin)	13	10	Surface	0.00	0.00	0.00	0.01	0.00	0.07	0.01	0.13
2.75 Rockets	12	100	Surface	0.00	0.00	0.01	0.09	0.02	0.71	0.06	1.22
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.00	0.00	0.01	0.02[1]	0.72	0.08	1.82
Total Unidentified Dolphins Affected				**0**	**0.01**	**0.01**	**0.22**	**NA**	**2.52**	**NA**	**4.97**

AGM = air-to-ground missile; dB = decibels; GBU = Guided Bomb Unit; GI = Gastrointestinal; HEI = High Explosive Incendiary; LSDB = Laser Small Diameter Bomb; mm = millimeters; lb = pounds; PGU = Projectile Gun Unit; PTS = permanent threshold shift; SEL = sound exposure level; SPL = Sound Pressure Level; TTS = temporary threshold shifts; NA = column total not applicable as a more conservative threshold was used.

1. Highest value of the dual threshold and included in the total number affected.

Table 3-22 indicates the potential for lethality, injury, and noninjurious harassment (including behavioral harassment) to marine mammals in the absence of mitigation measures. Similar to the Proposed Action, the numbers represent total impacts for all detonations combined. Mortality was calculated as approximately 0.47 animals for bottlenose dolphins and 0.11 for spotted dolphins. It is expected that implementation of the management practices outlined in Chapter 5 would mitigate potential impacts so that there would be no mortality takes. An application for an incidental take permit under the MMPA has been submitted to NMFS for Maritime WSEP activities. The permit would be required prior to the conduct of this action.

Potential impacts to sea turtles resulting from boat strikes and debris under Alternative 1 are similar to those described for the Proposed Action and are not significant. However, turtles may be killed, injured, or harassed due to detonations. Table 3-22 shows the number potentially affected.

The table indicates the potential for lethality, injury, and noninjurious harassment to sea turtles in the absence of mitigation measures. Mortality is considered unlikely for any species, particularly with implementation of mitigation measures. A consultation with NMFS pursuant to the ESA is ongoing, initiated by the submission to NMFS of a Biological Assessment which concluded that the WSEP missions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of a critical habitat. (Appendix C). The Air Force is seeking a Biological Opinion from NMFS.

Table 3-22. Number of Sea Turtles Potentially Affected by Maritime WSEP Test Missions under Alternative 1 (Preferred Alternative)

Sea Turtle Species	Mortality	Physiological	Behavioral
Loggerhead	1.426	3.421	92.100
Kemp's ridley	1.150	2.760	74.305
Leatherback	0.512	1.184	28.510
Green	0.103	0.246	6.634
TOTAL	**3.191**	**7.611**	**201.549**

3.4.3.3 No Action Alternative

Under the No Action Alternative, Maritime WSEP test activities would not take place. There would be no impacts to marine species due to detonations and other support activities.

4. CUMULATIVE IMPACTS

Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the ROI. Cumulative impacts can result from individually minor but collectively substantial actions undertaken over a period of time by various agencies (federal, state, and local) or individuals. In accordance with NEPA, a discussion of cumulative impacts resulting from projects that are proposed, or anticipated over the foreseeable future, is required.

4.1 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS IN THE ROI

This section discusses the potential for cumulative impacts caused by implementation of the Proposed Action when combined with other past, present, and reasonably foreseeable actions occurring in the ROI. The ROI is defined in Chapter 0 as Warning Area W-151. However, activities occurring in the other adjacent northern warning areas (W-155 and W-470, shown on Figure 1-2) could also impact some of the same resources due to similarity of depth, topography, and benthic and water column habitat. Past, present, and reasonably foreseeable actions that could affect safety and GOM access, socioeconomics, physical resources, and biological resources in the vicinity are included.

4.1.1 Past and Present Actions

U.S. Air Force Special Operations Command Air-To-Surface Gunnery Testing and Training

The U.S. Air Force Special Operations Command (AFSOC) conducts air-to-surface gunnery testing and training missions within the EGTTR. All activities take place within W-151. Missions involve live fire of 25-mm, 40-mm, and 105-mm gunnery rounds at targets on the water surface (flares or towed boats). A maximum total of 70 missions with about 46,000 associated rounds may be conducted annually, although the actual number of missions has typically been smaller in the past. All munitions are fired from AC-130 gunship aircraft. Gunnery missions may occur in any month, during daytime or nighttime hours.

Marine mammals and sea turtles may be potentially harassed due to noise or pressure from gunnery operations. Through consultations with NMFS and USFWS, Eglin has estimated the number of dolphins and sea turtles that could be affected (Table 4-1). Other cetacean species were evaluated also but are not included in the table because these species would not be affected by Maritime WSEP activities.

Table 4-1. Marine Species Potentially Affected by Air-To-Surface Gunnery

Species	Mortality	Level A Harassment	Level B Harassment (TTS)	Level B Behavioral Harassment
Bottlenose dolphin	0.03	1.67	96.01	316.67
Atlantic spotted dolphin	0.02	1.33	76.49	252.08
Sea turtles (all species)	0	0.01	1.26	Not applicable

TTS = temporary threshold shift

The number of animals potentially affected in the above table does not account for mitigation measures required during gunnery missions. These measures consist of visual observation and operational practices. Target areas are monitored for the presence of protected species before, during, and after the mission using visual scans and the aircraft's instrumentation (infrared and low-light television). If a protected species is sighted, the mission is delayed or relocated to avoid impact. In order to facilitate visual monitoring, daytime missions are conducted only in sea states of 4 or less on the Beaufort scale. Eglin has implemented three operational mitigation measures. The first is development of a 105-mm training round that has only about 7 percent of the explosive material of that contained in regular rounds. Ramp-up procedures are also implemented, where missions begin with the smallest round and proceed to the largest round. Finally, as a conservation measure to avoid impacts to the federally listed sperm whale, AFSOC has agreed to conduct only 1 of the 70 potential missions beyond the 200-meter isobath.

Precision Strike Weapon

The U.S. Air Force Air Armament Center and U.S. Navy, in cooperation with the 96th Test Wing Precision Strike Division (46 OG/OGMTP), conducts precision strike weapon (PSW) test missions within two sites in W-151 of the EGTTR. The weapons involved in the testing include the Joint Air-to-Surface Stand-Off Missile (JASSM) AGM-158 A and B and the small-diameter bomb (SDB) GBU-39/B. The JASSM is a precision cruise missile containing approximately 300 pounds of TNT-equivalent NEW, while the SDB is a guided bomb with approximately 48 pounds of TNT-equivalent NEW. Up to two live and four inert JASSM missiles per year may be launched from an aircraft at a target located on the GOM water surface approximately 15 to 24 NM offshore. Detonation occurs either upon contact with the target or 120 milliseconds after contact, corresponding a depth of 70 to 80 feet. Up to 6 live and 12 inert SDBs per year may also be deployed against a target in the GOM. Detonation occurs either 10 to 25 feet above the target or upon contact with the target.

Eglin has estimated the maximum number of dolphins and sea turtles that could be affected by PSW missions (Table 4-2), although the numbers are derived from worst-case scenarios and in reality could be much smaller. Two other cetacean species were evaluated also but are not included in the table because these species would not be affected by Maritime WSEP activities.

Table 4-2. Marine Species Potentially Affected by PSW Missions

Species	Mortality	Level A Harassment	Level B Harassment (TTS)
Bottlenose dolphin	0.28	3.34	30.97
Atlantic spotted dolphin	0.23	2.66	24.65
Sea turtles (all species)[1]	0	1.00	27.00

PSW = precision strike weapon
1. The NMFS estimated 15 lethal or nonlethal takes for all sea turtle species combined over a five-year period

The number of animals potentially affected in the above table does not account for mitigation measures required during gunnery missions. These measures consist of visual monitoring from surface vessels and aircraft. Monitoring is conducted up to one hour before the mission and also after the mission is completed.

Patriot Missile Launches

Patriot missile testing consists of launching missiles from land sites on either the Eglin Reservation (no effects to marine resources) or Santa Rosa Island. Missiles launched from the island are intended to intercept drone or towed targets over the GOM. The intercept point is approximately 9 miles (15 km) from shore, depending on the specifications of the test scenario. After impact, debris from the Patriot missile and target fall into the Gulf and are not recovered. However, drones that are used to tow other targets will generally fall into the water intact and may be recovered. Up to 12 Patriot missile launches may occur on Santa Rosa Island per year.

Stand-Off Precision Guided Munition Testing

Stand-off precision guided munition (SOPGM) testing has occurred once at Eglin AFB, in 2009. During the test, three Griffin missiles with a NEW of 7.5 pounds TNT equivalent each were fired at boat targets in the GOM. The missiles were deployed over a two-day period. The test location was the same as the western site used for PSW testing described above, which was about 24 NM offshore in W-151. The visual observation requirements specified for PSW testing were also required for SOPGM events. NMFS concurred with Eglin's assessment that impacts to marine mammals would be within the scope of impacts evaluated for PSW missions. There are currently no further SOPGM tests planned.

Naval Explosive Ordnance Disposal School Training

Naval Explosive Ordnance Disposal School (NEODS) training activities are conducted 3 NM offshore of Eglin property, in approximately 60 feet of water in W-151. During a typical training scenario, five charges packed with C-4 explosive material (either 5-lb NEW or 10-lb NEW) are detonated adjacent to inert mines located on the seafloor. Training events occur up to eight times per year, resulting in up to 40 detonations annually. Eglin has estimated the maximum number of dolphins and sea turtles that could be affected by NEODS missions (Table 4-3), in the absence of mitigation measures.

Table 4-3. Marine Species Potentially Affected by NEODS Activities

Species	Mortality	Level A Harassment	Level B Harassment (TTS)	Level B Behavioral Harassment
Bottlenose dolphin	0	3.80	10.18	51.20
Sea turtles (all species)[1]	0	0.42	9.84	Not applicable

TTS = temporary threshold shift
1. NMFS estimated six lethal or nonlethal takes for all sea turtle species combined over a five-year period

Mitigation measures consist of visual monitoring before, during, and after the mission. Detonations are postponed if protected species or species indicators are sighted within the applicable survey radius. In addition, hardbottom habitats and artificial reefs are avoided to alleviate any potential impacts to protected habitats. As of the date of this EA, no NEODS missions have been conducted.

Naval Surface Warfare Center, Panama City Division Mission Activities

Naval Surface Warfare Center, Panama City Division (NSWC PCD) is the U.S. Navy's premier research and development organization focused on littoral (coastal region) warfare and expeditionary (designed for military operations abroad) maneuver warfare. NSWC PCD provides in-water research, development, test, and evaluation in support of a wide variety of operations. These activities may be generally categorized as air operations, surface operations, subsurface operations, sonar operations, electromagnetic operations, laser operations, ordnance operations, and projectile firing. The activities occur in W-151, W-155, and W-470. The NSWC PCD activities that primarily affect the resources described in this EA include 1) aerial delivery of inert shapes, rockets, and mines; 2) robotic "crawler" vehicle operation; 3) mooring and burying of mines; 4) sonar operation; and 5) ordnance operations (line charges and other detonations from 2 to 600 pounds NEW). In addition to impacts to the water column and seafloor, the Navy estimated bottlenose dolphin, Atlantic spotted dolphin, and sea turtle takes resulting from sonar and ordnance operations, as shown in Table 4-4. Other marine mammals were specified but are not included here because they would not be affected by Maritime WSEP activities.

Table 4-4. Marine Species Potentially Affected by NSWC PCD Sonar and Ordnance Operations

Species	Level A Harassment	Level B Harassment	Level B Harassment (behavioral)
Bottlenose dolphin	3	47	567
Atlantic spotted dolphin	3	24	447
Sea turtles (all species)	0	8	Not applicable

An extensive suite of mitigation measures are available for NSWC PCD activities, depending on the particular mission. Mitigation measures are identified specifically for each operations category, including safety, sonar use, and detonations. These measures are expected to decrease the potential for impacts to marine resources.

Atlantic Fleet Active Sonar Training

The U.S. Navy Atlantic Fleet conducts periodic training exercises using mid- and high-frequency active sonar technology and the improved/advanced extended echo ranging system. Training occurs in the Atlantic Ocean and GOM. Activities overlapping the geographic location of Maritime WSEP missions in the Gulf occur within the Pensacola/Panama City OPAREA, in W-151 and W-155 of the EGTTR. Training activities include the use of passive and active sonar, as well as small explosives (explosive source sonobuoy). Potential impacts to the water column, substrate, and marine species were analyzed. In the GOM (which includes other training areas in addition to the Pensacola/Panama City area), hundreds of bottlenose and Atlantic spotted dolphins were projected to be exposed to Level B harassment (TTS), while many thousands were estimated to be behaviorally harassed. A substantially smaller number was projected to be exposed to Level A harassment. Extensive mitigation measures are associated with the training, including personnel training, lookout requirements, and operating procedures.

4.1.2 Reasonably Foreseeable Future Actions

86 Fighter Weapons Squadron Maritime Weapon Systems Evaluation Program

The 86 Fighter Weapons Squadron (FWS) has indicated an interest in establishing a 5- to 10-year program for Maritime Weapon Systems Evaluation Program (WSEP) testing as described in this environmental assessment. This annual continuation of Maritime WSEP and swarm missions will be analyzed in conjunction with all other Eglin Gulf Test and Training Range activities in two comprehensive range EAs, the Eglin Gulf Test and Training Range EA and the Estuarine and Riverine Areas Range Environmental Assessment to be completed in 2015. Each of these range environmental assessments will have separate consultations. The EGTTR REA will require a 5-year MMPA Letter of Authorization. Proposed live munitions are shown in Table 4-5.

Table 4-5. Proposed Maritime WSEP 2016-2020 Annual Live Munitions

Type of Munition	# Live Munitions	Detonations Scenario	Warhead – explosive material	Net Explosive Weight per Munition
GBU-10 or GBU-24	2	Surface or Subsurface	MK-84 - Tritonal	945 lb
GBU-12 or GBU-54 (LJDAM)	6	Surface or Subsurface	MK-82 - Tritonal	192 lb
AGM-65 (Maverick)	6	Surface	WDU-24/B penetrating blast-fragmentation warhead	300 lb
CBU-105	4	Airburst	10 BLU-108 submunitions with 4 projectiles, parachute, rocket motor & altimeter. 10.69 lb NEW/submunition (includes 2.15 lb/projectile)	107.63 lb
GBU-39 (LSDB)	4	Airburst, Surface or Subsurface	AFX-757 (insensitive munition)	36 lb
AGM-114 (Hellfire)	30	Airburst or Surface, Subsurface	High Explosive Anti-Tank (HEAT) tandem anti-armor metal augmented charge. For subsurface (10 millisecond delay, maximum)	20 lb
GBU-53 (SDB II)	4	Airburst, Surface or Subsurface	PBX-N-109 Aluminized Enhanced Blast, Scored Frag Case, Copper Shape Charge	22.84 lb
AGM-176 (Griffin)	10	Airburst or Surface	Blast fragmentation	13 lb
Rockets (including APKWS)	100	Surface	Comp B-4 HEI	12 lb
PGU-13 HEI 30 mm	1,000	Surface	30 x 173 mm caliber with aluminized RDX explosive. Designed for GAU-8/A Gun System	0.1 lb
Aim-9X	4	Surface	PBXN-3	68 lb
7.62 mm/.50 caliber	5000	Surface	N/A	N/A

AGM = air-to-ground missile; AIM = air intercept missile; CBU = cluster bomb unit; GBU = guided bomb unit

4.2 POTENTIAL IMPACTS RESULTING FROM CUMULATIVE ACTIONS IN THE ROI

Safety/Restricted Access

Similar to Maritime WSEP activities, the actions listed above involve detonation of live ordnance, and most include dropping or firing ordnance from aircraft. Therefore, there is potential for human exposure to blast effects and debris strikes (intact weapons and target debris). All of the activities require the hazard area to be clear of nonparticipating personnel and vessels. Delineated human safety zones are established for some of the actions. Mission areas may also be surveyed from aircraft and/or on-site cameras. Thus, there would be no significant cumulative impacts to the safety of military personnel or civilian populations.

Restricted access associated with past, present, and foreseeable actions would result in additional instances of closure of portions of the GOM. However, the closures occur in discreet areas for specified time periods. Compared to the overall area of nearshore Gulf waters available in the region, the closed areas are small, and commercial and recreational users of the Gulf have access to similar nearby resources. Maritime WSEP testing is expected to be completed in less than a month. There would likely be some temporary public annoyance due to mission area closures, but economic and quality-of-life impacts would be minor. There would be no significant cumulative impact to Gulf access due to Maritime WSEP activities.

Socioeconomics

Restricted access, as described above, would most likely result in additional costs to local recreational and commercial fisherman due to delays and rerouting during testing activities. In addition, increased military activities along with potential increases in fishing limits and reduced seasons for certain fish species could result in more difficulty in planning fishing activities, which could affect commercial fishing income. However, any access restrictions would be temporary and minor, lasting only the duration of the testing activities. Continued coordination between the Air Force and fishermen, and advanced notification of testing times and dates through the use of NOTMARs and other media sources, would allow time for recreational and commercial fisherman to plan accordingly which could help minimize costs. Also, the Air Force would continue to employ commercial fishing boats to help maintain the safety zone, which could alleviate the potential loss of income for some during testing activities. Thus, there would be no significant cumulative impacts to socioeconomic resources.

Physical Resources

The actions described above involve incidental expenditure of chemical materials and debris into the water column and onto the seafloor. Chemical materials include metals associated with weapons and targets, explosive byproducts and, in some cases, petroleum products. Past and previous actions have been analyzed through NEPA documentation for effects to physical resources, and results indicate that the quantity of explosive byproducts and petroleum products cumulatively expended is small and results in overall insignificant effects to water or sediment quality. Chemical materials are quickly dispersed by waves and currents and are transformed by various processes such as assimilation into the carbonate system, metabolism and assimilation by microbial organisms, release in gaseous form to the atmosphere, and by photic and microbial degradation. Metal fragments from weapons and targets that sink to the seafloor may result in an elevated concentration of metal ions near the fragments. However, the contribution of metals resulting from the actions described above are not expected to affect a significant portion of Gulf habitat, and the metal fragments corrode and degrade over time. The quantity of debris is not considered sufficient to significantly affect the seafloor by scouring. Known hardbottom habitat is avoided. There would be no significant cumulative impact to physical resources due to Maritime WSEP activities.

Biological Resources

Localized loss or degradation of habitat, noise impacts, or direct physical impacts to species can have a cumulative impact when viewed on a regional scale if that loss or impact is compounded by other events with the same end results. The actions described above have the potential to impact fish, EFH, and protected marine species. Fish occurrence is difficult to predict in discreet GOM locations. However, given the spatial and temporal variations in fish populations and distribution along with intermittent timing of missions, cumulative impacts to fish species are not considered significant. Water column and benthic habitats are not likely to be significantly affected. Protected species (sea turtles and marine mammals) are potentially subjected to noise and pressure levels due to several of the cumulative actions. In particular, a large number of cetaceans are potentially affected. Mitigation measures (visual monitoring and other measures) that are required for all actions are expected to decrease the potential for impacts, particularly when monitoring in the affected area can continue until detonations occur. The actions have been analyzed individually and found to cause no significant effects. The action with the greatest potential for impact is the Atlantic Fleet active sonar training. For this action, most dolphin effects pertain to behavioral harassment, and the Navy concluded that testing would generally result in only short-term effects to individuals and would likely not affect annual rates of recruitment or survival.

4.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires that EAs include identification of any irreversible and irretrievable commitment of resources that would be involved in the implementation of the Proposed Action. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the Proposed Action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

Environmental consequences as a result of this project are considered short term and temporary. Resources irreversibly committed would be limited to aircraft fuel and test munitions and targets, although the quantity of these resources would be small in relation to similar testing routinely conducted at Eglin AFB. Maritime WSEP activities would not result in destruction of or impacts to environmental resources, including physical, biological, and cultural resources, to the degree that future use would be limited.

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5. MANAGEMENT PRACTICES

The following is a list of regulations, plans, permits, and management actions associated with the Proposed Action as described in Sections 2.1 and 2.2. The environmental impact analysis process for this EA identified the need for these requirements, and the proponent and interested parties involved in the Proposed Action cooperated to develop them. These requirements are, therefore, to be considered as part of the Proposed Action and would be implemented through the Proposed Action's initiation. The proponent is responsible for adherence to and coordination with the listed entities to complete the plans, permits, and management actions.

5.1 REGULATIONS, PLANS, AND PERMITS

Eglin AFB is seeking an Incidental Harassment Authorization (IHA) from NMFS pursuant to the MMPA for the incidental harassment of marine mammal species. NMFS may issue an IHA after concluding that Maritime WSEP test activities would have a negligible impact on marine mammal species and stocks, and that take would not have an unmitigable adverse impact on the availability of such species or stock for subsistence uses. In order to issue an IHA NMFS must first have a signed Finding of No Significant Impact from this EA. If issued, the proponent will adhere to all mitigation and management requirements associated with the IHA.

Eglin AFB initiated consultation with NMFS pursuant to the ESA through preparation of a Biological Assessment. Subsequently, NMFS prepared a Biological Opinion regarding the effects of Maritime WSEP test activities. NMFS and Eglin AFB have concluded that the Proposed Action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of a critical habitat. The proponent will adhere to all reasonable and prudent measure requirements, as well as conservation recommendations, provided by NMFS. The Biological Assessment also included an evaluation of potential impacts to EFH and federally managed fisheries. NMFS and Eglin AFB have concluded that the Proposed Action will not adversely affect EFH.

The CZMA requires all federal agency activities that affect land or water use or natural resource of the coastal zone be conducted in a manner consistent with the state management program. Eglin AFB prepared a Consistency Determination pursuant to the CZMA for the State of Florida (Appendix A). Eglin has received a letter from the Florida State Clearinghouse that provides concurrence with this Consistency Determination.

5.2 MANAGEMENT ACTIONS

The proponent is responsible for implementation of the following management actions.

5.2.1 Safety/Restricted Access

- Establish and maintain human safety buffer zones.
- Explosive Ordnance Disposal teams would deem safe boat targets and dispose of any surface UXO.

5.2.2 Socioeconomics

- Avoid testing activities during holidays and special events such as fishing tournaments.
- Continue to provide advanced notification to users through NOTMARs and other media sources to timely inform users of testing times and dates so that their activities can be planned accordingly.

5.2.3 Physical Resources

- None

5.2.4 Biological Resources

The following management action pertains to protection of EFH.

- Avoid known hardbottom and artificial reef locations.

In addition, a detailed plan has been developed to mitigate potential impacts to marine mammals and sea turtles, both of which are protected under federal law (MMPA and ESA). The complete mitigation plan is included below. This plan is also included in the associated Maritime WSEP IHA request and Biological Assessment. All mitigations and permit conditions as presented in the IHA and Biological Opinion will be included in the EA operational mitigation plan.

The potential marine mammal and sea turtle takes discussed in Chapter 3 represent the maximum expected number of animals that could be exposed to particular noise and pressure thresholds. The impact estimates do not take into account measures that would be employed to minimize impacts to marine species (these measures will help ensure human safety of test participants and nonparticipants as well). Mitigation measures consist of visual monitoring to detect the presence of protected marine species and possible indicators of these species (large schools of fish, flocks of birds, jellyfish aggregations, and *Sargassum* mats). Monitoring procedures are described in the following subsections.

Visual Monitoring

All aspects of visual monitoring procedures to be performed are described in detail in Appendix B, Request for Incidental Harassment Authorization of Marine Mammals. The information can be found in Section 11.

6. LIST OF PREPARERS AND CONTRIBUTORS

Name/Title	Project Role	Subject Area	Experience
Jamie McKee Environmental Scientist B.S., Marine Biology	Project Manager	Team Lead, Technical Review	29 years environmental science
Rick Combs Environmental Scientist M.S., Biology B.S., Biology B.S., Business Administration	Author	Biological Resources	12 years environmental science
Pam McCarty Economist/Environmental Analyst M.A., Applied Economics B.S., Business Administration, Economics	Author	Socioeconomics	8 years environmental science
Mike Nation Environmental Scientist B.S., Environmental Science/Policy, minor in Geography A.A., General Science	GIS Analysis		13 years environmental consultant, interagency coordination, GIS ArcView applications
Bob Bieri Senior Engineer PhD, Nuclear Engineering B.S., Physics	Acoustic Modeling Manager	Acoustic Modeling	20 years acoustics
Amanda Robydek Environmental Scientist B.S., Environmental Science	Author/Reviewer	Permits/Consultations	7 years environmental science
Mike Nunley Environmental Scientist M.S., Marine Ecology B.A., Biology	Author/Reviewer	Permits/Consultations	18 years environmental/marine science
Jason Koralewski Environmental Scientist M.A., Anthropology B.A., Anthropology	Author	Cultural Resources	19 years environmental science

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APPENDIX A

COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

MARJORY STONEMAN DOUGLAS BUILDING
3900 COMMONWEALTH BOULEVARD
TALLAHASSEE, FLORIDA 32399-3000

RICK SCOTT
GOVERNOR

CARLOS LOPEZ-CANTERA
LT. GOVERNOR

CLIFFORD D. WILSON III
INTERIM SECRETARY

December 2, 2014

Mr. Jamie McKee
Senior Project Manager
Leidos
1140 North Eglin Parkway
Shalimar, FL 32579

RE: Department of the Air Force – Draft Environmental Assessment – Maritime Weapons System Evaluation Program, Eglin Air Force Base – Gulf of Mexico.
SAI # FL201411077103C

Dear Jamie:

The Florida State Clearinghouse has coordinated a review of the subject Draft Environmental Assessment (EA) under the following authorities: Presidential Executive Order 12372; Section 403.061(42), *Florida Statutes*; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

The Florida Department of State (DOS) notes that there are recorded and likely unrecorded submerged historic resources within the offshore waters of the Gulf of Mexico. Although the nature of the proposed project is such that it is unlikely that historic resources will be adversely effected, Florida state offshore areas have the potential for shipwreck sites and other submerged historic and prehistoric resources. If unexpected discoveries such as prehistoric or historic artifacts, especially those associated with historic shipwrecks, are encountered at any time within the project site areas, the project should cease all activities involving disturbance in the immediate vicinity of such discoveries and a submerged remote sensing cultural resource survey must be conducted. Project activities should not resume without verbal and/or written authorization from the DOS Division of Historical Resources. Please refer to the enclosed DOS letter for further information.

Based on the information contained in the Draft EA and enclosed state agency comments, the state has determined that the proposed federal action is consistent with the Florida Coastal Management Program (FCMP). To ensure the project's continued consistency with the FCMP, the concerns identified by the DOS must be addressed prior to project implementation. The state's continued concurrence will be based on the activity's compliance with FCMP authorities, including federal and state monitoring of the activity to ensure its continued conformance, and the adequate resolution of issues identified during this and any subsequent reviews.

www.dep.state.fl.us

Mr. Jamie McKee
Page 2 of 2
December 2, 2014

Thank you for the opportunity to review the draft document. Should you have any questions regarding our letter, please don't hesitate to contact me at Lauren.Milligan@dep.state.fl.us or (850) 245-2170.

Yours sincerely,

Lauren P. Milligan

Lauren P. Milligan, Coordinator
Florida State Clearinghouse
Office of Intergovernmental Programs

Enclosure

cc: Timothy Parsons, DOS

www.dep.state.fl.us

FLORIDA DEPARTMENT *of* STATE

RICK SCOTT
Governor

KEN DETZNER
Secretary of State

Florida State Clearinghouse
Agency Contact and Coordinator (SCH)
Attn: Lauren Milligan
3900 Commonwealth Blvd. MS-47
Tallahassee, Florida 32399-3000

November 24, 2014

RE: DHR Project File No.: 2014-5309/ Received by DHR: November 12, 2014
Application No.: SAI FL201411077103C
Project: *Maritime Weapons System Evaluation program, Eglin AFB – Offshore in the Gulf of Mexico*

Dear Ms. Milligan,

Our office received and reviewed the project in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended and the *National Environmental Policy Act of 1969*. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties (archaeological, architectural, and historical resources) listed, or eligible for listing, in the National Register of Historic Places, assessing the project's effects, and considering alternatives to avoid or minimize adverse effects.

We note that there are recorded and likely unrecorded submerged historic resources within the offshore waters of the Gulf of Mexico. Florida state offshore areas have the potential for shipwreck sites and other submerged historic and or/prehistoric resources. The nature of the proposed project is such that it is unlikely that historic resources will be adversely effected. If unexpected discoveries such as prehistoric or historic artifacts, especially those associated with historic shipwrecks, are encountered at any time within the project site areas, this project should cease all activities involving disturbance in the immediate vicinity of such discoveries and a submerged remote sensing cultural resource survey must be conducted. The agency should contact the Compliance and Review Section, as well as the appropriate permitting agency. Project activities should not resume without verbal and/or written authorization from the Division of Historical Resources.

For any questions concerning our comments, please contact Mary Berman, Historic Sites Specialist, by phone at 850.245.6333 or by electronic mail at Mary.Berman@dos.myflorida.com.

Sincerely,

Timothy A. Parsons for

Robert F. Bendus, Director
Division of Historical Resources and State Historic Preservation Officer

VIVA FLORIDA

Division of Historical Resources
R.A. Gray Building • 500 South Bronough Street• Tallahassee, Florida 32399
850.245.6300 • 850.245.6436 (Fax) flheritage.com
Promoting Florida's History and Culture **VivaFlorida.org**

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FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION

Introduction

This document provides the State of Florida with the U.S. Air Force's Consistency Determination under CZMA Section 307 and 15 CFR Part 930 subpart C. The information in this Consistency Determination is provided pursuant to 15 CFR Section 930.39 and Section 307 of the Coastal Zone Management Act, 16 U.S.C. § 1456, as amended, and its implementing regulations at 15 CFR Part 930.

This federal consistency determination addresses the use of multiple types of live munitions in the Eglin Gulf Testing and Training Range (EGTTR) against small boat targets, for the Maritime Weapons System Evaluation Program (WSEP). Additionally, this determination addresses aircraft flight maneuver operations over formations of manned vessels in Choctawhatchee Bay and the Gulf of Mexico (GOM) called "Swarm Missions".

Proposed Federal Agency Action

The initial phases of the Maritime WSEP focused on detecting and tracking boats using various sensors, simulated weapons engagements, and testing with inert (containing no explosives) munitions. Alternative 1 (Preferred Alternative of the EA) represents the final phase of testing the effectiveness of live (containing explosive charges) munitions on small boat threats and provides additional discussion on vessel swarm missions in Choctawhatchee Bay and the GOM. Live munitions testing in the EGTTR would include: detonation above the water surface, at the water surface, and subsurface. The tests would occur on weekdays over a period of two to three weeks in February and March 2015, with a maximum of two tests per day. Test events would be conducted in various sea states and weather conditions, up to a wave height of approximately 4 feet.

Gulf Missions

Maritime WSEP missions would occur in the EGTTR in the northern GOM, at a location approximately 16.7 miles (14.5 nautical miles [NM]) offshore from Santa Rosa Island. The EGTTR is more accurately defined as the airspace over the GOM controlled by Eglin Air Force Base (AFB), beginning at a point 3 NM from shore. Figure 2-1 in the Environmental Assessment (EA) shows the target location within W-151 and the surrounding notional composite safety footprint, developed to encompass the flight and impact characteristics of all Maritime WSEP munitions. The actual safety footprint could be smaller or larger and shaped differently than the composite safety footprint, depending on the specific munitions and launch conditions.

Various military units would deliver ordnance from the aircraft listed in Table 2-1 of the EA. The number of each type of munition, height or depth of detonation, explosive material, and net explosive weight (NEW) of each munition is provided in Table 2-3 of the EA. Units would participate in the missions as interceptors and weapon release aircraft, with multiple dissimilar aircraft operating within the same airspace. Weapon releases will occur in W-151 airspace against unmanned static boat targets and/or boat targets towed by remote controlled High Speed

Marine Surface Target (HSMST) boats. The Gulf Range Armament Test Vessel (GRATV) instrumentation barge will be anchored next to the boat target operations area and will provide relay of HSMST control frequencies and camera video. Two HSMSTs will tow the target boats around the GRATV in a two to three NM radius circle. Two Unmanned Aerial Vehicles (UAVs) will transit to the target area and set up flight orbits to provide aerial video of weapon impacts on boat targets. Release missions will be controlled from the Eglin Central Control Facility (CCF) on Eglin main base.

Swarm Missions

Swarm missions involving electronic targeting and defeat of multiple fast-moving small boats would occur daily in Choctawhatchee Bay or within the GOM (W-151), after the live missions have been completed. Aircraft will not be carrying bombs and aircraft guns will be mechanically safed and unable to fire. Aircraft would conduct simulated weapon release runs by targeting the manned boats. The target vessels will consist of up to 30 manned boats, ranging in size from 20 to 45 feet in length and traveling at speeds of 20-40 knots depending on sea state. These missions will be controlled from the Eglin CCF. The CCF would be in communication with all aircraft and manned vessels.

Federal Consistency Review

Statutes addressed as part of the Florida Coastal Zone Management Program consistency review and considered in the analysis of Alternative 1 are discussed in the following table.

Pursuant to 15 CFR § 930.41, the Florida State Clearinghouse has 60 days from receipt of this document in which to concur with or object to this Consistency Determination, or to request an extension, in writing, under 15 CFR § 930.41(b). Florida's concurrence will be presumed if Eglin AFB does not receive its response on the 60th day from receipt of this determination.

Florida Coastal Management Program Consistency Review

Statute	Consistency	Scope
Chapter 161 *Beach and Shore Preservation*	Alternative 1 would not affect beach and shore management, specifically as it pertains to: • The Coastal Construction Permit Program. • The Coastal Construction Control Line (CCCL) Permit Program. Following declaration of the target area by Air Force Explosive Ordnance Disposal (EOD) personnel as safe to enter, several Air Force vessels will engage in retrieving target debris. Large mostly intact damaged target vessels may be towed while smaller pieces of debris will be netted or lifted aboard Air Force vessels and taken to shore for disposal. Therefore, Alternative 1 would be consistent with Florida's statutes and regulations regarding the protection of coastal areas.	This statute provides policy for the regulation of construction, reconstruction, and other physical activities related to the beaches and shores of the state. Additionally, this statute requires the restoration and maintenance of critically eroding beaches.
Chapter 163, Part II *Growth Policy, County and Municipal Planning: Land Development Regulation*	Alternative 1 would not affect local government comprehensive plans.	Provide for the implementation of comprehensive planning programs to guide and control future development of the state.
Chapter 186 *State and Regional Planning*	Alternative 1 would not affect state plans for water use, land development, or transportation.	Provides direction for the delivery of governmental services, a means for defining and achieving the specific goals of the state, and a method for evaluating the accomplishment of those goals in regards to the state comprehensive plan.
Chapter 252 *Emergency Management*	Alternative 1 would not affect the state's vulnerability to natural disasters. Alternative 1 would not affect emergency response and evacuation procedures.	Directs the state to reduce the vulnerability of its people and property to natural and manmade disasters; prepare for, respond to and reduce the impacts of disasters; and decrease the time and resources needed to recover from disasters.
Chapter 253 *State Lands*	Impacts to water column and substrate quality would be minor. Detonations would not be of sufficient strength to cause seafloor cratering. Scouring of the seafloor by debris pieces would be minor. Chemical materials and debris that could potentially be transported into state waters would have no significant adverse effects on water quality or sediments, as discussed in Section 3.3 of the EA. Alternative 1 would be consistent with Florida's statutes and regulations regarding the acquisition, administration, management, control, supervision, conservation, protection, and disposition of public lands.	Addresses the acquisition, administration, management, control, supervision, conservation, protection, and disposition of all state lands.
Chapter 258 *State Parks and Preserves*	Alternative 1 would not affect state parks, recreational areas and aquatic preserves.	Addresses the state's administration of state parks, aquatic preserves, and recreation areas.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 259 *Land Acquisitions for Conservation or Recreation*	Alternative 1 would result in intermittent, temporary closure of the test area for approximately four hours per test (maximum of two tests per day could occur) over a period of two to three weeks in February and March 2015. The Eglin Safety Office would issue a Notice to Mariners (NOTMAR) prior to the closure of the safety footprint around the target location. In addition, 96 RANSS personnel will distribute flyers and maps at the public docks and to vessels in Destin Pass explaining why the area will be closed. Alternative 1 would be consistent with Florida's statutes and regulations regarding tourism and/or outdoor recreation.	Addresses public ownership of natural areas for purposes of maintaining the state's unique natural resources; protecting air, land, and water quality; promoting water resource development to meet the needs of natural systems and citizens of this state; promoting restoration activities on public lands; and providing lands for natural resource based recreation.
Chapter 260 *Florida Greenways and Trails Act*	Alternative 1 would not affect the Greenways and Trails Program.	Statewide system of greenways and trails established in order to conserve, develop, and use the natural resources of Florida for healthful and recreational purposes.
Chapter 267 *Historical Resources*	The National Oceanic and Atmospheric Administration's Automated Wreck and Obstruction Information System was consulted to determine areas of avoidance to ensure testing would not impact cultural resources. A remote sensing survey of a 1-mile square region around the target area was conducted using side scan sonar, a magnetometer, and a subbottom profiler to confirm the presence or absence potential historic shipwrecks; no shipwrecks or obstructions were found within the planned area of activity. Analysis in Section 3.3 of the EA concludes that the potential for chemical or physical impacts to the sea floor would be remote. This implies that impacts to unknown archaeological resources positioned within the sediments or deeper portion of the water column would be unlikely. Section 1.7.1 of the EA summarizes the potential for impacts to historical resources and concludes that the possibility is so low that detailed analysis is not carried forward in the document. Therefore, Alternative 1 would be consistent with Florida's statutes and regulations regarding the state's archaeological and historical resources.	Addresses the management and preservation of the state's archaeological and historical resources.
Chapter 288 *Commercial Development and Capital Improvements*	Alternative 1 would not affect future business opportunities on state lands, or the promotion of tourism in the region.	Promotes and develops general business, trade, and tourism components of the state economy
Chapter 334 *Transportation Administration*	Alternative 1 would not affect transportation.	Addresses the state's policy concerning transportation administration.
Chapter 339 *Transportation Finance and Planning*	Alternative 1 would not affect the finance and planning needs of the state's transportation system.	Addresses the finance and planning needs of the state's transportation system.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 373 *Water Resources*	Water resources could be affected by metals and chemical materials introduced through spent munitions, explosive byproducts, and petroleum products. There is potential for chemicals or debris to subsequently move into state waters, including estuarine waters and wetlands. However, analysis in Section 3.3 of the EA concludes that impacts to water quality would be negligible. There would be no adverse impacts to fish or other wildlife due to water quality degradation (see Section 3.4 of the EA). Therefore, Alternative 1 would be consistent with Florida's statutes and regulations regarding water resources of the state.	Addresses sustainable water management; the conservation of surface and ground waters for full beneficial use; the preservation of natural resources, fish, and wildlife; protecting public land; and promoting the health and general welfare of Floridians.
Chapter 375 *Outdoor Recreation and Conservation Lands*	Alternative 1 would not affect opportunities for recreation on state lands.	Addresses the development of a comprehensive multipurpose outdoor recreation plan, with the purpose to document recreational supply and demand, describe current recreational opportunities, estimate the need for additional recreational opportunities, and propose the means to meet the identified needs.
Chapter 376 *Pollutant Discharge Prevention and Removal*	There is potential for munitions to fail to detonate, resulting in unexploded ordnance (UXO) within the test area (see Section 3.1 of the EA). Although the dud rate of the various munitions is not quantified, it is expected to be low (less than five percent), possibly resulting in a small number of unexploded gunnery rounds or larger ordnance remaining on intact target boats or on the sea floor. After the mission, targets still afloat would be inspected by the Eglin EOD team to identify any munitions components that would be considered UXO, including fuzes or intact munitions. UXO would be blown in-place, which could result in sinking of target vessels. Floating non-UXO debris that is not recovered could pose a strike hazard to vessels operating in the area. However, the amount of such material is expected to be small because the Eglin Marine Operations Team would collect as much floating debris from the mission site as possible. Large pieces of the targets, such as boat hulls or large fragments of plywood or other materials, would be towed back to Eglin AFB for analysis. Smaller debris would be collected with dip nets and transported to shore for analysis or disposal. Clearance of surface UXO by the Eglin EOD team would be required prior to military and civilian personnel reentering the target area. Alternative 1 would be consistent with Florida's statutes and regulations regarding the transfer, storage, transportation of pollutants, and cleanup of pollutant discharges.	Regulates transfer, storage, and transportation of pollutants, and cleanup of pollutant discharges.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 377 *Energy Resources*	Alternative 1 would not affect energy resource production, including oil and gas, and/or the transportation of oil and gas.	Addresses regulation, planning, and development of the energy resources of the state; provides policy to conserve and control the oil and gas resources in the state.
Chapter 379 *Fish and Wildlife Conservation*	Eglin AFB Natural Resources is currently conducting a Section 7 formal consultation and obtaining an Incidental Harassment Authorization (IHA) permit with the National Marine Fisheries Service pursuant to the Endangered Species Act and Marine Mammal Protection Act regarding protected species. All requirements resulting from the consultation and IHA would be followed. Further potential impacts to biological resources are addressed in Section 3.4 of the EA. Therefore, Alternative 1 would be consistent with Florida's statutes and regulations regarding the protection of fish and wildlife resources of the state.	Establishes the framework for the management and protection of the state of Florida's wide diversity of fish and wildlife resources.
Chapter 380 *Land and Water Management*	Under Alternative 1, development of state lands with regional impacts would not occur. No changes to coastal infrastructure such as capacity increases of existing coastal infrastructure, or use of state funds for infrastructure planning, designing or construction would occur.	Establishes land and water management policies to guide and coordinate local decisions relating to growth and development.
Chapter 381 *Public Health, General Provisions*	Alternative 1 would not affect the state's policy concerning the public health system.	Establishes public policy concerning the state's public health system.
Chapter 388 *Mosquito Control*	Alternative 1 would not affect mosquito control efforts.	Addresses mosquito control efforts in the state.
Chapter 403 *Environmental Control*	Air quality is addressed in Section 1.7.1 of the EA. Air emissions resulting from munitions use, surface craft, and aircraft are not expected to impact air quality of the region. Due to the short duration of each test event, emissions are not anticipated to have any impact on ambient air quality. The amount of solid waste produced by testing would be small and may consist of weapons, weapon fragments, and target fragments. Any unexploded ordnance issues would be addressed by Eglin AFB (see Section 3.1 of the EA). There would be no significant impacts to water quality, impacts to the water column and substrate quality would be minor. Scouring of the seafloor by debris pieces would be minor (see Section 3.3 of the EA). Therefore, Alternative 1 would be consistent with the State's policies concerning air quality, water quality, pollution control, solid waste management, and other environmental control efforts.	Establishes public policy concerning environmental control in the state.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 553 *Building and Construction Standards*	Alternative 1 would not include construction of buildings.	Addresses building construction standards and provides for a unified Florida Building Code.
Chapter 582 *Soil and Water Conservation*	Alternative 1 would not affect soil erosion or water conservation efforts.	Provides policy regarding the control and prevention of soil erosion.
Chapter 597 *Aquaculture*	Alternative 1 would not affect state aquaculture or the conservation of aquatic resources.	Establishes public policy concerning the cultivation of aquatic organisms of the state. Addresses state aquaculture plan which provides for the coordination and prioritization of state aquaculture efforts, the conservation and enhancement of aquatic resources and provides mechanisms for increasing aquaculture production.

APPENDIX B

REQUEST FOR INCIDENTAL HARASSMENT AUTHORIZATION OF MARINE MAMMALS

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

Mr. Bruce W. Hagedorn
Acting Chief, Eglin Natural Resources
501 De Leon Street, Suite 101
Eglin AFB FL 32542-5133

DEC 1 2014

Ms. Jolie Harrison
Acting Division Chief, Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Dear Ms. Harrison:

This letter and attachment is being submitted to the National Marine Fisheries Service (NMFS) to revise the Incidental Harassment Authorization (IHA) application under the Marine Mammal Protection Act of 1972 for activities under the Maritime Weapon Systems Evaluation Program (WSEP) Operational Testing to be conducted in the Eglin Gulf Test and Training Range (EGTTR) near Eglin Air Force Base (AFB). The Maritime WSEP missions are a high national defense priority for the Department of Defense (DoD). Discussions between the Air Force, NMFS, and the Marine Mammal Commission (Commission) prompted changes to the original IHA application. Updated acoustic analyses, impact ranges, and survey requirements are included in the revised IHA application and analyze the potential impacts to bottlenose dolphins and Atlantic spotted dolphins from Maritime WSEP Operational Testing.

The Proposed Action involves the use of multiple types of live munitions against small boat targets in the EGTTR. Net explosive weight of the weapons ranges from 0.1 to 945 pounds. Maritime WSEP Operational Testing includes the deployment of 36 live bombs/missiles, 100 rockets, and 6,000 gunnery rounds (7.62 and 30 millimeter) over a timeframe of a few weeks in February and March 2015, with missions firmly scheduled to begin on February 6, 2015. Multiple munitions will be released per day from several types of aircraft including fighter jets, bombers, and gunships.

Eglin Natural Resources is requesting small numbers of takes of bottlenose dolphins and Atlantic spotted dolphins by Level A (tympanic-membrane [TM] rupture) harassment, Level B (Temporary Threshold Shift [TTS]) harassment, and Level B behavioral harassment. During the early stages of development of this request, NMFS introduced Eglin to new acoustic criteria and thresholds developed by the Navy for explosive sources that have been adopted as interim guidelines. Also, communication with the Commission prompted an updated analysis and monitoring plan. Given the short timeframe in which to obtain the IHA to meet the mission's schedule, Eglin requests that the IHA will be issued prior to the scheduled mission start date of February 6, 2015.

Furthermore, adherence to the monitoring and mitigation measures in Chapter 11 of the application will eliminate any small potential for mortality of either species; therefore no mortality takes are being requested. The NMFS will be notified immediately if any of the components of this proposed action are modified. Any modifications or conditions resulting from consultation or permitting with the NMFS will be implemented prior to commencement of activities.

Eglin Natural Resources believes this submittal fulfills all requirements for the permitting process to proceed. If you have any questions regarding this IHA application or any of the proposed activities, please do not hesitate to contact either Mr. Jeremy Preston (850) 883-1153 or myself at (850) 882-8421.

Sincerely,

"For" BRUCE W. HAGEDORN GS-12

Attachment:
Revised Request for an Incidental Harassment Authorization of Marine Mammals Resulting From Maritime Weapon Systems Evaluation Program Operational Testing

REQUEST FOR AN INCIDENTAL HARASSMENT AUTHORIZATION OF MARINE MAMMALS RESULTING FROM MARITIME WEAPON SYSTEMS EVALUATION PROGRAM OPERATIONAL TESTING

EGLIN AIR FORCE BASE, FLORIDA

Submitted To:

Office of Protected Resources
National Marine Fisheries Service (NMFS)
1315 East-West Highway
Silver Spring, MD 20910-3226

FINAL

Submitted By:

Department of the Air Force
96 CEG/CEIEA

Natural Resources Office
501 DeLeon Street, Suite 101
Eglin AFB, FL 32542-5133

REVISED

DECEMBER 2014

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

96 TW	96th Test Wing
AFB	Air Force Base
AGL	Above Ground Level
AGM	Air-To-Ground Missile
BA	Biological Assessment
CBU	Cluster Bomb Unit
CV	Coefficient of Variation
dB re 1 μPs^2-s	Decibel referenced to one squared microPascal-second
E	Endangered
EA	Environmental Assessment
EFD	Energy Flux Density
EFH	Essential Fish Habitat
EGTTR	Eglin Gulf Test and Training Range
EO	Executive Order
ESA	Endangered Species Act
FMC	Fishery Management Council
FMP	Fishery Management Plan
ft	Feet
GBU	Guided Bomb Unit
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GSMFC	Gulf States Marine Fisheries Commission
HAPC	Habitat Area of Particular Concern
HEI	High Explosive Incendiary
in	Inch
in-lb/in^2	Inch-pound per square inch
J/in^2	Joules per square inch
kg	Kilogram
KIAS	Knots Indicated Air Speed
km	Kilometer
km^2	Square Kilometer
lbs	Pounds
m	Meters
mi	Mile
min	Minute
mm	Millimeter
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEW	Net Explosive Weight
NM	Nautical Mile
NM^2	Square Nautical Mile
NMFS	National Marine Fisheries Service
Pa-s	Pascal-second
PGU	Projectile Gun Unit
Psi-msec	Pounds per square inch-millisecond
SEFSC	Southeast Fisheries Science Center
SEL	Sound exposure level
SPL	Sound pressure level
SST	Sea Surface Temperature
T	Threatened
TA	Test Area
TTP	Tactics, Techniques, and Procedures
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
WSEP	Weapon Systems Evaluation Program
ZOI	Zone of Impact

12/1/2014 **Revised Request for an IHA for the Incidental Taking of Marine Mammals Resulting from Maritime WSEP Operational Testing** **Page iv**

EXECUTIVE SUMMARY

With this revised submittal, Eglin Air Force Base requests an Incidental Harassment Authorization (IHA) for the incidental taking, but not intentional taking (in the form of noise-related and/or pressure-related impacts), of marine mammals incidental to Maritime WSEP Operational Testing within the Eglin Gulf Test and Training Range (EGTTR), as permitted by the Marine Mammal Protection Act (MMPA) of 1972, as amended. Maritime WSEP Operational Testing is a military readiness activity and high priority for the Department of Defense (DoD). The Maritime WSEP missions are firmly scheduled to begin on 6 February 2015. An application was originally submitted to NMFS on August 5, 2014. Revisions to the application were deemed necessary based on updated acoustic thresholds and criteria for explosive sources as well as other items that were identified during consultation with NMFS to ensure adequacy and completeness of the application.

The missions may expose cetaceans within the EGTTR to noise or pressure levels currently associated with mortality, Level A harassment, and Level B harassment. Noise and pressure metrics associated with exploding ordnance were determined to be the only activities during Maritime WSEP missions with potential for significant impacts to marine species, as analyzed in the associated Environmental Assessment (U.S. Air Force, 2014; in preparation). Maritime WSEP missions involve the use of multiple types of live munitions against small boat targets in the EGTTR (Gulf of Mexico). Net explosive weight of the weapons ranges from 0.1 to 945 pounds, and detonations will occur above the water surface, at the water surface, and below the water surface. Maritime WSEP Operational Testing includes deployment of 45 live bombs/missiles, 100 rockets, and 6,000 live gunnery rounds (30 millimeter [mm] and 7.62 mm) over a timeframe of a few weeks in February and March 2015, with multiple munitions being released per day. All ordnance will be delivered by multiple types of aircraft including fighter jets, bombers, and gunships. The targets would consist of stationary, towed, and remotely controlled high speed boats. Some boats would contain simulated crews made of plywood. The mission location is approximately 17 miles offshore of Santa Rosa Island, in a water depth of 35 meters (115 feet).

The potential takes outlined in Section 6 represent the maximum expected number of animals that could be affected. Mitigation measures will be employed to substantially decrease the number of animals potentially affected. Using the most applicable density estimates for each species, the zone of influence (ZOI) of each type of ordnance deployed, and the total number of planned detonations, an estimate of the potential number of animals exposed to noise and/or pressure thresholds is analyzed using the most recent guidance provided by the Navy (Finneran and Jenkins, 2012). Without mitigation measures in place, the total number of marine mammals potentially exposed to the acoustic impulse levels associated with mortality is less than one animal, including about 0.47 bottlenose dolphins and 0.11 Atlantic spotted dolphins. A maximum of up to approximately 40 marine mammals (all species combined) could potentially be exposed to injurious (PTS) Level A harassment. A maximum of approximately 482 marine mammals could potentially be exposed to non-injurious (TTS) Level B harassment. Approximately 1,014 animals could potentially be exposed to noise corresponding to the behavioral threshold of 167 decibels (dB) sound exposure level. It is anticipated that mitigation measures, identified in Chapter 11, will reduce the probability of all forms of take, specifically mortality, thus an IHA is being requested as opposed to a Letter of Authorization (LOA).

Executive Summary

Marine mammal species potentially affected by Maritime WSEP activities include four bottlenose dolphin stocks and one Atlantic spotted dolphin stock. The Maritime WSEP test site is located in an area associated with the Northern Gulf of Mexico spotted dolphin stock, which is not considered strategic. The test site is located within a depth range corresponding to the Northern Gulf of Mexico Continental Shelf stock of bottlenose dolphins (20 to 200 meters depth), which is not a strategic stock. However, other strategic stocks are defined in relatively close proximity and could possibly enter the test area. Three bay, sound, and estuary stocks, as well as the Northern Coastal stock (shoreline to 20 meters water depth), occur near the Maritime WSEP location and are considered strategic. Individuals from the Oceanic stock, which is not considered strategic, are unlikely to enter the test area, as this stock is defined beyond the 200 meter isobath.

The information and analyses provided in this application are presented to fulfill the permit request requirements of Title I, Sections 101(a)(5)(A) and 101(a)(5)(F) of the MMPA.

1. DESCRIPTION OF ACTIVITIES

This section describes Air Force Maritime Weapon System Evaluation Program (WSEP) Operational Testing activities conducted in the Eglin Gulf Test and Training Range (EGTTR) that could result in takes under the Marine Mammal Protection Act (MMPA) of 1972, as amended. The actions include air-to-surface test missions involving detonations of live munitions above the water, at the water surface, and below the water surface with the potential to affect cetaceans that may be present within the action area. The mission is described in the following sections.

1.1 INTRODUCTION

The Eglin Air Force Base (86th Fighter Weapons Squadron [86 FWS]) seeks the ability to conduct live ordnance testing and training in the Gulf of Mexico (GOM) as part of the Maritime WSEP Operational Testing. The proposed missions are very similar to Maritime Strike Operations (Maritime Strike Incidental Harassment Authorization issued 13 August 2013). The Maritime WSEP test objectives are to evaluate maritime deployment data, evaluate tactics, techniques and procedures (TTPs), and to determine the impact of TTPs on Combat Air Force training. The results of this test will be used to develop publishable TTPs for inclusion in Air Force TTP 3-1 series manuals. The need to conduct this type of testing has arisen in response to increasing threats at sea posed by operations conducted from small boats. There has been limited Air Force (AF) aircraft and munitions testing on engaging and defeating small boat threats. Small boats can carry a variety of weapons, can be employed in large or small numbers by many nations and groups, and may be difficult to locate, track, and engage in the marine environment. Therefore, the Air Force proposes to employ live munitions against boat targets in the GOM in order to continue development of TTPs to train U.S. Air Force strike aircraft to counter small maneuvering surface vessels.

1.2 MISSION DESCRIPTION

Maritime WSEP activities include the release of multiple types of inert and live munitions in the GOM against small boat targets. Maritime WSEP Operational Testing will occur within the EGTTR, in Warning Area 151 (W-151) (Figure 1-1). The specific planned mission location is approximately 17 miles offshore from Santa Rosa Island, in nearshore waters of the continental shelf. Water depth is about 35 meters (115 feet). Test events and training missions will be conducted in various sea states and weather conditions, up to a wave height of four feet.

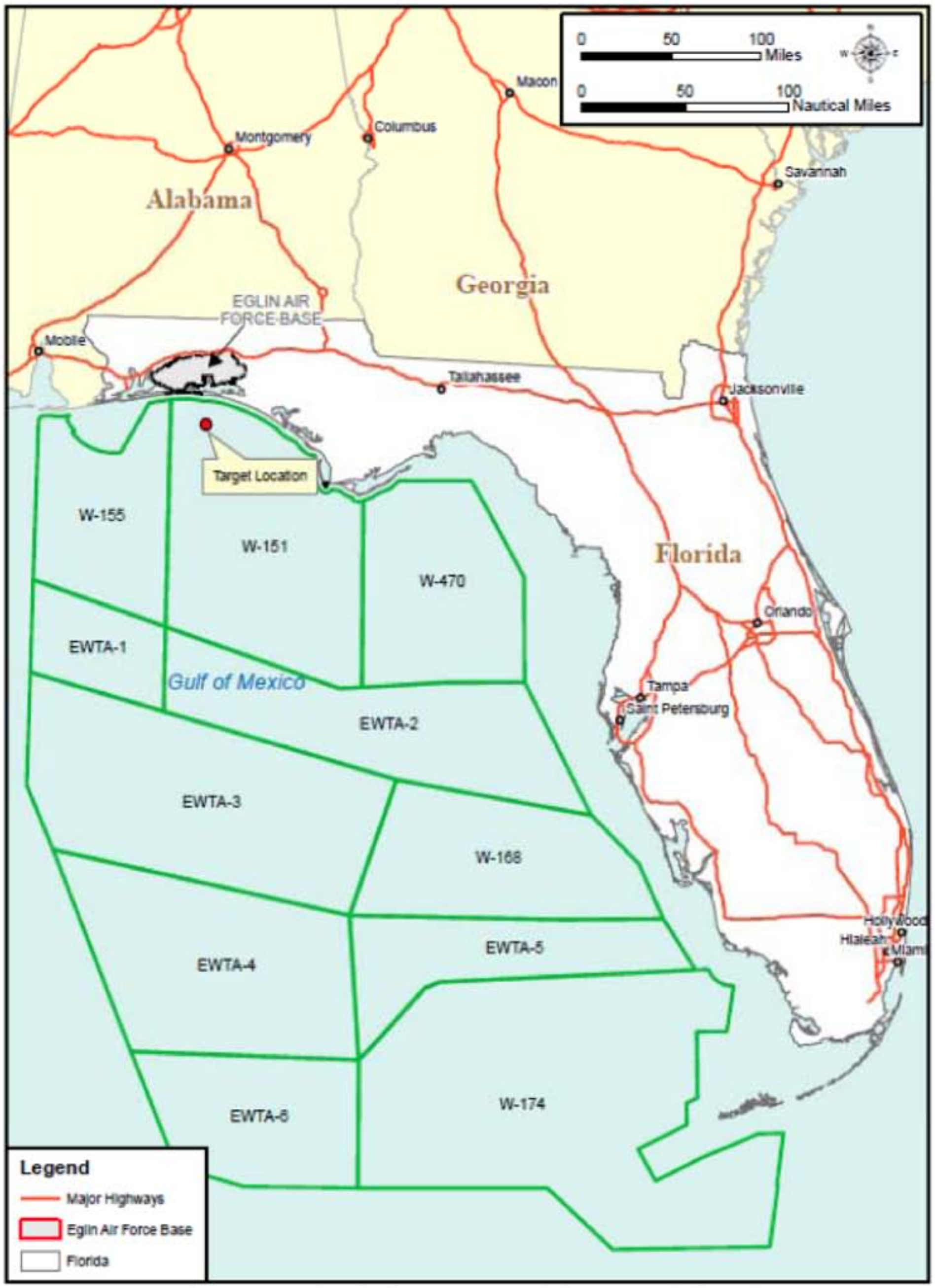

Figure 1-1. Eglin Gulf Test and Training Range (EGTTR)

Multiple munitions and aircraft will be used to meet the objectives of the Maritime WSEP Operational Tests (Table 1-1). Munition types include bombs, missiles, and gunnery rounds. Because the tests will focus on weapon/target interaction, no particular aircraft will be specified for a given test as long as it meets the delivery parameters. The munitions will be deployed against static, towed, and remotely controlled boat targets. Static and controlled targets consist of stripped boat hulls with plywood simulated crews and systems. Damaged boats will be recovered for data collection. Test data collection and operation of remotely controlled boats will be conducted from an instrumentation barge known as the Gulf Range Armament Test Vessel (GRATV) that is anchored on-site and will also provide a platform for cameras and weapon-tracking equipment. Target boats will be positioned approximately 600 feet from the GRATV, depending on the munition.

Table 1-1. Live Munitions and Aircraft

Munitions	Aircraft (not associated with specific munitions)
GBU-10 laser-guided Mk-84 bomb	F-16C fighter aircraft
GBU-24 laser-guided Mk-84 bomb	F-16C+ fighter aircraft
GBU-12 laser-guided Mk-82 bomb	F-15E fighter aircraft
GBU-54 Laser Joint Direct Attack Munition, laser-guided Mk-82 bomb	A-10 fighter aircraft
CBU-105 (WCMD)	B-1B bomber aircraft
AGM-65 Maverick air-to-surface missile	B-52H bomber aircraft
GBU-38 Small Diameter Bomb II (Laser SDB)	MQ-1/9 unmanned aerial vehicle
AGM-114 Hellfire air-to-surface missile	AC-130 gunship
AGM-175 Griffin air-to-surface missile	
2.75 Rockets	
PGU-13/B high explosive incendiary 30 mm rounds	
7.62 mm/.50 Cal	

AGM = air-to-ground missile; Cal = caliber; CBU = Cluster Bomb Unit; GBU = Guided Bomb Unit; Mk = Mark; mm = millimeters; PGU = Projectile Gun Unit

Maritime WSEP testing will include three fuzing options: detonation above the water surface, at the water surface, and below the water surface. The number of each type of munition, height or depth of detonation, explosive material, and net explosive weight (NEW) of each munition is provided in Table 1-2. The quantity of live munitions tested is considered necessary to provide the intended level of tactics and weapons evaluation, including a number of replicate tests sufficient for an acceptable statistical confidence level regarding munitions capabilities.

Table 1-2. Maritime WSEP Munitions

Type of Munition	Total # of Live Munitions	Detonation Type	Warhead – explosive material	Net Explosive Weight per Munition
GBU-10 or GBU-24	2	Surface	MK-84 - Tritonal	945 lbs
GBU-12 or GBU- 54 (LJDAM)	6	Surface	MK-82 - Tritonal	192 lbs
AGM-65 (Maverick)	6	Surface	WDU-24/B penetrating blast-fragmentation warhead	86 lbs
CBU-105 (WCMD)	4	Airburst	10 BLU-108 sub-munitions each containing 4 projectiles parachute, rocket motor and altimeter	83 lbs
GBU-38 (Laser Small Diameter Bomb)	4	Surface	AFX-757 (Insensitive munition)	37 lbs
AGM-114 (Hellfire)	15	Subsurface (10 msec delay)	High Explosive Anti-Tank (HEAT) tandem anti-armor metal augmented charge	20 lbs
AGM-176 (Griffin)	10	Surface	Blast fragmentation	13 lbs
2.75 Rockets	100	Surface	Comp B-4 HEI	Up to 12 lbs
PGU-12 HEI 30 mm	1,000	Surface	30 x 173 mm caliber with aluminized RDX explosive. Designed for GAU-8/A Gun System	0.1 lbs
7.62 mm/.50 cal	5,000	Surface	N/A	N/A

AGL = above ground level; AGM = air-to-ground missile; CBU = Cluster Bomb Unit; GBU = Guided Bomb Unit; JDAM = Joint Direct Attack Munition; LJDAM = Laser Joint Direct Attack Munition; mm = millimeters; msec = millisecond; lbs = pounds; PGU = Projectile Gun Unit; HEI = high explosive incendiary

A human safety zone will be established around the area prior to each live mission, and will be enforced by a large number of safety boats (approximately 20 to 25). The size of this zone will vary, depending upon the particular munition used in a given test event or training mission. A composite safety footprint was developed, which incorporates all munitions being deployed and averages them out. The composite safety footprint consisted of approximately a 19 mile-wide diameter (9.5 mile-wide radius from the detonation point). Non-participating vessels (such as recreational and commercial fishermen) will be excluded from entering the safety footprint while it is active, which is expected to be up to four hours per mission on test days. The Eglin Safety Office will position the safety support vessels around the safety footprint to ensure commercial and recreational boats do not accidentally enter the area. Before delivering the ordnance, mission aircraft may make a dry run over the target area to ensure that it is clear of non-participating vessels, although this action would not necessarily be performed before all releases.

In addition, measures designed to avoid or minimize impacts to protected marine species have been developed in cooperation with the National Marine Fisheries Service (NMFS). A separate zone around the target will be established for marine species protection, based on the distance to which energy- and pressure-related impact zones could extend for the various types of ordnance listed in Tables 1-2 and 1-3. This zone will not necessarily be the same size as the human safety zone. Trained marine species observers will survey the species protection zone before and after each mission. In addition, AF personnel will be within the mission area performing various tasks and will observe for protected marine species as feasible throughout test preparation. A detailed description of mitigation measures is provided in Chapter 11.

At least two ordnance delivery aircraft will participate in each live weapon release mission. Prior to the test, AF pilots aboard mission aircraft may make a dry run over the target area to ensure it is clear of non-participating vessels before ordnance is deployed. Due to the limited flyover duration and potentially high speed and altitude, pilots will not survey for marine species.

In addition to surveys conducted from boats, three video cameras will be positioned on the GRATV anchored on-site. The camera(s) will be used to document the weapons' performance against the targets and to monitor for the presence of protected species. An Eglin Natural Resources representative will be located in the Eglin's Central Control Facility (CCF), along with mission personnel, to view the video feed before and during test activities. Missions would not proceed until the target area is clear of protected marine species. Furthermore, if the cameras are not operational for any reason, the mission will not be conducted. A detailed description of mitigation measures is provided in Chapter 11.

After each mission, a team of AF personnel would collect debris and retrieve damaged targets from the mission site. These vessels would be separate from dedicated protected species observer vessels that would conduct the post-mission surveys to assess potential impacts from the mission. On test days involving the release of CBU-105s, the Eglin Air Force Explosive Ordnance Disposal (EOD) team would be on hand to inspect floating targets and identify and render safe any unexploded ordnance (UXO), including fuzes, classified components, or intact munitions. In the rare instance that UXO cannot be removed, proper disposal methods would be employed; however these types of scenarios are not considered likely. Once the area has been cleared by the Eglin EOD team (typically one hour after the release of CBU-105s), the range will be re-opened for the debris clean-up team and the protected species survey vessels.

2. DURATION AND LOCATION OF THE ACTIVITIES

Maritime WSEP missions are scheduled to occur over an approximate two- to three-week period in February/March 2015. Missions would occur on weekdays during daytime hours only with multiple live munitions being released each day. All activities would take place within the EGTTR, which is defined as the airspace over the GOM controlled by Eglin AFB, beginning at a point three NM from shore. The EGTTR is subdivided into blocks consisting of Warning Areas W-155, W-151, W-470, W-168, and W-174, as well as Eglin Water Test Areas 1 through 6 (Figure 2-1). Warning Area W-155, which is controlled by the Navy, is used occasionally to support Eglin missions. Over 102,000 square nautical miles (NM^2) of GOM surface waters exist under the EGTTR air space. However, activities described in this document will occur only in W-151, and specifically in sub-area W-151A (Figure 2-1). Descriptive information for all of W-151 and for W-151A is provided below.

W-151

The inshore and offshore boundaries of W-151 are roughly parallel to the shoreline contour. The shoreward boundary is 3 NM from shore, while the seaward boundary extends approximately 85 to 100 NM offshore, depending on the specific location. W-151 covers a surface area of approximately 10,247 NM^2 (35,145 square kilometers [km^2]), and includes water depths ranging from about 20 to 700 meters. This range of depth includes continental shelf and slope waters. Approximately half of W-151 lies over the shelf.

W-151A

W-151A extends approximately 60 NM offshore and has a surface area of 2,565 NM^2 (8,797 km^2). Water depths range from about 30 to 350 meters and include continental shelf and slope zones. However, most of W-151A occurs over the continental shelf, in water depths less than 250 meters. Maritime WSEP missions will occur in the shallower, northern inshore portion of the sub-area, in a water depth of about 35 meters (115 feet).

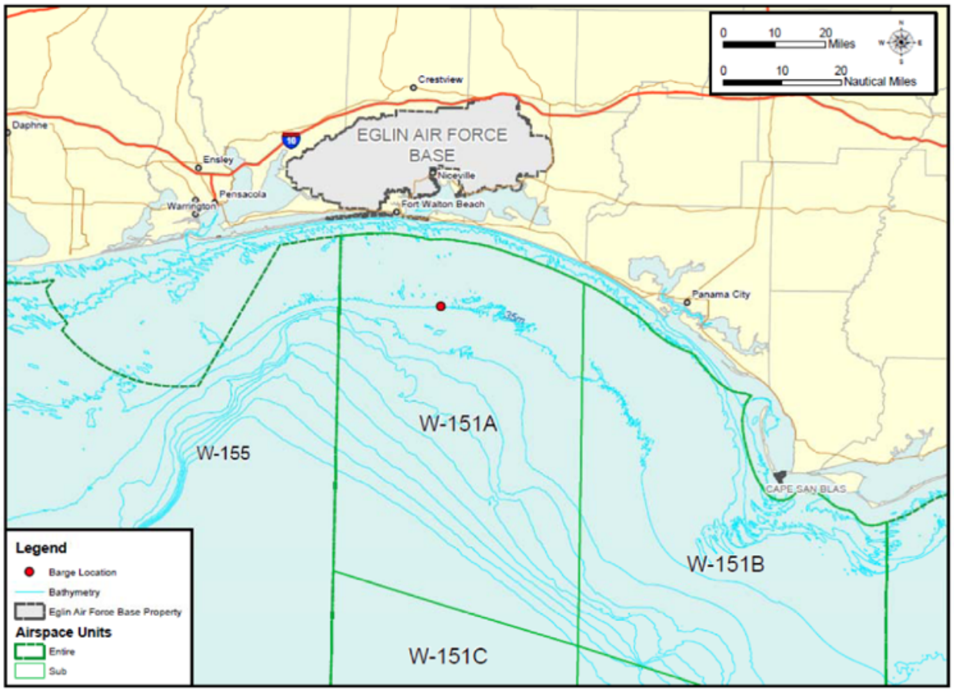

Figure 2-1. Maritime WSEP Operational Testing Location in W-151A

3. MARINE MAMMAL SPECIES AND NUMBERS

Marine mammals that potentially occur within the northeastern GOM include numerous species of cetaceans and one sirenian, the Florida manatee (*Trichechus manatus latirostris*). Manatees primarily inhabit coastal and inshore waters, and are rarely sighted offshore. Maritime WSEP missions will be conducted approximately 17 miles off the coast. Therefore manatee occurrence is considered unlikely, and further discussion of marine mammal species is limited to cetaceans.

Up to 28 cetacean species occur in the northern GOM. However, species with likely occurrence in the test area, and therefore evaluated in this document, are limited to the bottlenose dolphin (*Tursiops truncatus*) and Atlantic spotted dolphin (*Stenella frontalis*). These two species are frequently sighted in the northern Gulf over the continental shelf, in a water depth range that encompasses the Maritime WSEP testing location (Garrison, 2008; DON, 2007; Davis et al., 2000). Dwarf sperm whales (*Kogia sima*) and pygmy sperm whales (*Kogia breviceps*) are occasionally sighted over the shelf, but are not considered regular inhabitants (Davis et al., 2000). The remaining cetacean species are primarily considered to occur at and beyond the shelf break (water depth of approximately 200 meters), and are therefore not included.

Bottlenose and spotted dolphin density estimates used in this document were obtained from two sources. Bottlenose dolphin estimates were obtained from a habitat modeling project conducted for portions of the EGTTR, including the Maritime WSEP mission area, as described in Garrison (2008). As part of the modeling effort, personnel from NOAA Fisheries' Southeast Fisheries Science Center (SEFSC) conducted line transect aerial surveys of the continental shelf and coastal waters of the eastern GOM during winter (February 2007; water temperatures of 12-15°Celsius) and summer (July/August 2007; water temperatures >26°Celsius). The surveys covered nearshore and continental shelf waters (to a maximum depth of 200 meters), with the majority of effort concentrated in waters from the shoreline to 20 meters depth. Marine species encounter rates during the surveys were corrected for sighting probability and the probability that animals were available on the surface to be seen. The survey data were combined with remotely sensed environmental data/habitat parameters (water depth, sea surface temperature [SST], and chlorophyll-*a* concentration) to develop habitat models. The technical approach, described as Generalized Regression and Spatial Prediction, spatially projects the species-habitat relationship based on distribution of environmental factors, resulting in predicted densities for un-sampled locations and times. The spatial density model can therefore be used to predict relative density in unobserved areas and at different times of year based upon the monthly composite SST and chlorophyll datasets derived from satellite data. Similarly, the spatial density model can be used to predict relative density for any sub-region within the surveyed area.

Garrison (2008) produced bottlenose dolphin density estimates at various spatial scales within the EGTTR. At the largest scale, density data were aggregated into four principal strata categories: North-Inshore, North-Offshore, South-Inshore, and South-Offshore. Densities for these strata were provided in the published survey report. Unpublished densities were also provided for smaller blocks (sub-areas) corresponding to airspace units, and a number of these sub-areas were combined to form larger zones. Densities in these smaller areas were provided to Eglin AFB in Excel© spreadsheets by the report author.

For both large areas and sub-areas, regions occurring entirely within waters deeper than 200 meters were excluded from predictions, and those straddling the 200 meter isobath were clipped to remove deep water areas. In addition, because of limited survey effort, density estimates beyond 150 meters water depth are considered invalid. The environmental conditions encountered during the survey periods (February and July/August) do not necessarily reflect the range of conditions potentially encountered throughout the year. In particular, the transition seasons of spring (April-May) and fall (October-November) have a very different range of water temperatures. Accordingly, for predictions outside of the survey period or spatial range, it is necessary to evaluate the statistical variance in predicted values when attempting to apply the model. The coefficient of variation (CV) of the predicted quantity is used to measure the validity of model predictions. According to Garrison (2008), the best predictions have CV values of approximately 0.2. When CVs approach 0.7, and particularly when they exceed 1.0, the resulting model predictions are extremely uncertain and are considered invalid.

Based upon the preceding discussion, the bottlenose dolphin density estimate used in this document is the median density corresponding to sub-area 137 (Figure 3-1). The planned Maritime WSEP test area lies within this sub-area. Within this block, Garrison (2008) provided densities based upon one year (2007) and five-year monthly averages for SST and chlorophyll. The five year average is considered preferable. Only densities with a CV rounded to 0.7 or lower (i.e., 0.64 and below) were considered. Maritime WSEP test activities could occur any time during February or March. Accordingly, the density estimate associated with the highest monthly five-year average with an acceptable corresponding CV value was used for this analysis. Density estimate of bottlenose dolphins for February is 1.019 and for March is 1.194, therefore the higher of the two estimates was used in this analysis. The CV for March in this particular block is 0.28.

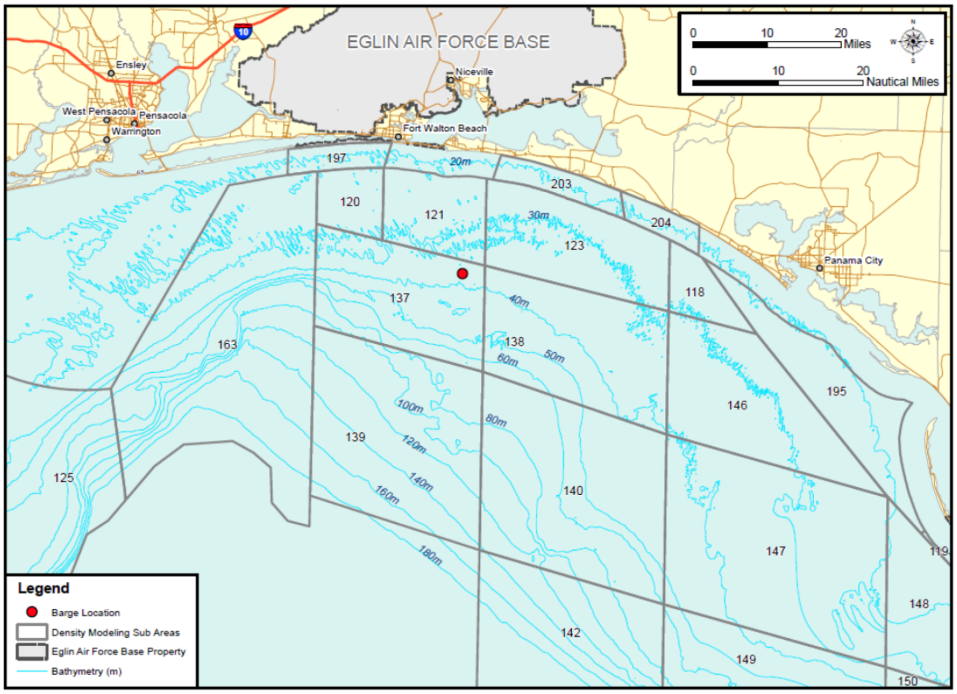

Figure 3-1. Sub-Areas Included in Garrison (2008)

Atlantic spotted dolphin density was derived from Fulling et al. (2003), which describes the results of mammal surveys conducted in association with fall ichthyoplankton surveys from 1998 to 2001. The surveys were conducted by SEFSC personnel from the U.S.-Mexico border to southern Florida, in water depths of 20 to 200 meters. Using the software program DISTANCE©, density estimates were generated for East and West regions, with Mobile Bay as the dividing point. The East region is used in this document. Densities were provided for Atlantic spotted dolphins and unidentified *T. truncatus*/*S. frontalis* (among other species). The unidentified *T. truncatus*/*S. frontalis* category is treated as a separate species group with a unique density. Density estimates from Fulling et al. (2003) were not adjusted for sighting probability (perception bias) or surface availability (availability bias) [g(0) = 1] in the original survey report, likely resulting in underestimation of true density. Perception bias refers to the failure of observers to detect animals, although they are present in the survey area and available to be seen. Availability bias refers to animals that are in the survey area, but are not able to be seen because they are submerged when observers are present. Perception bias and availability bias result in the underestimation of abundance and density numbers (negative bias).

Fulling et al. (2003) did not collect data to correct density for perception and availability bias. However, in order to address this negative bias, Eglin AFB has adjusted density estimates based on information provided in available literature. There are no published g(0) correction factors for Atlantic spotted dolphins. However, Barlow (2006) estimated g(0) for numerous marine mammal species near the Hawaiian Islands, including offshore pantropical spotted dolphins (*Stenella attenuata*). Separate estimates for this species were provided for group sizes of 1 to 20 animals [g(0) = 0.76], and greater than 20 animals [g(0) = 1.00]. Although Fulling et al. (2003) sighted some spotted dolphin groups of more than 20 individuals, the 0.76 value is used as a more conservative approach. Barlow (2006) provides the following equation for calculating density:

$$\text{Density (\# animals/km}^2\text{)} = \frac{(n)\,(S)\,(f_0)}{(2L)\,(g_0)}$$

Where n = number of animal group sightings on effort
S = mean group size
f(0) = sighting probability density at zero perpendicular distance (influenced by species detectability and sighting cues such as body size, blows, and number of animals in a group)
L = transect length completed (km)
g(0) = probability of seeing a group directly on a trackline (influenced by perception bias and availability bias)

Because (n), (S), and (f_0) cannot be directly incorporated as independent values due to lack of the original information, we substitute the variable $X_{species}$ which incorporates all three values, such that $X_{species}$ = (n)(S)(f_0) for a given species. This changes the density equation to:

$$D = \frac{X_{species}}{(2L)\,(g_0)}$$

Using the minimum density estimates provided in Fulling et al. (2003) for Atlantic spotted dolphins and solving for $X_{SpottedDolphin}$:

$$0.201 = \frac{X_{Spotted\ Dolphin}}{(2)\,(816)\,(1.0)}$$

$$X_{SpottedDolphin} = 328.032.$$

Placing this value of $X_{SpottedDolphin}$ and the revised g(0) estimate (0.76) in the original equation results in the following adjusted density estimate for Atlantic spotted dolphin:

$$D_{Adjusted} = \frac{328.032}{(2)(816)(0.76)}$$

$$D_{Adjusted} = 0.265$$

Using the same method, adjusted density for the unidentified *T. truncatus/S. frontalis* species group is 0.009 animals/km^2. There are no variances attached to either of these recalculated density values, so overall confidence in these values is unknown.

Table 3-1 shows the densities for each species and species group used in this document to calculate potential takes.

Table 3-1. Marine Mammal Density Estimates

Species	Adjusted Density (animals/km^2)
Bottlenose dolphin[1]	1.194
Atlantic spotted dolphin[2]	0.265
Unidentified bottlenose dolphin/Atlantic spotted dolphin[2]	0.009

[1]Source: Garrison, 2008; adjusted for observer and availability bias by the author
[2]Source: Fulling et al., 2003; adjusted for negative bias based on information provided by Barlow (2003; 2006)

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

Information on each dolphin species, including general descriptions, status, and occurrence, is provided below. Descriptions include Potential Biological Removal (PBR). PBR is defined as the maximum number of animals that may be removed, not including natural mortalities, from a stock while allowing that stock to reach or maintain its optimal sustainable population. In addition, the NMFS has identified certain cetacean stocks as strategic. A "strategic stock" is a marine mammal stock considered likely to be listed under the Endangered Species Act of 1973 (ESA), currently listed under the ESA, currently listed as depleted under the MMPA, or for which the level of non-natural mortality or serious injury (e.g. from commercial fishing) exceeds the PBR level.

Distribution of cetaceans in the Gulf is influenced by hydrographic and bathymetric features. The dominant hydrographic feature in the Gulf is the Loop Current that, though generally south of the continental slope, can generate anti-cyclonic (clockwise circulating) and cyclonic (counterclockwise) eddies that move onto or influence the slope and shelf regions. Davis et al. (2000) noted during 1997-98 surveys of the northern Gulf of Mexico that cetaceans were concentrated along the continental slope and in or near cyclonic eddies. Cetaceans may also be associated with seafloor features such as the DeSoto Canyon, Florida Escarpment, Mississippi Canyon, and Mississippi River Delta. These and other bathymetric features are shown on Figure 4-1.

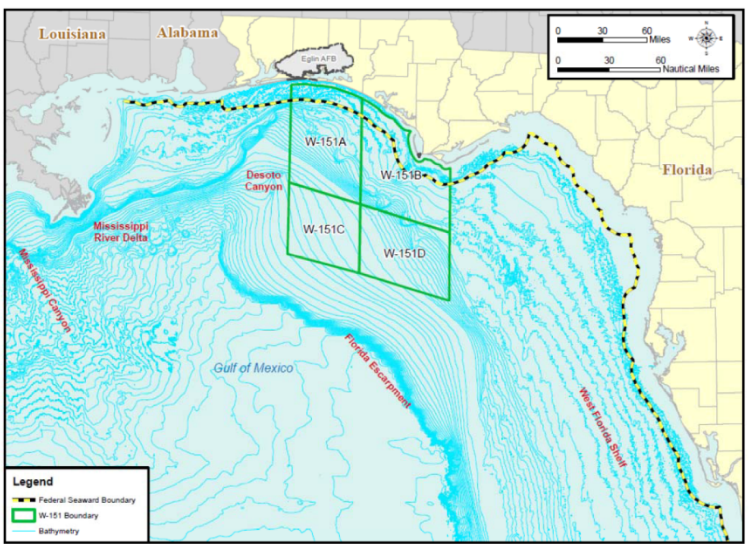

Figure 4-1. Topographical Features of the Gulf of Mexico in Relation to W-151

4.1 BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*)

4.1.1 Description

Bottlenose dolphins are large and robust, varying in color from light gray to charcoal. The genus *Tursiops* is named for its short, stocky snout that is distinct from the melon (Jefferson et al., 1993). The dorsal fin is tall and falcate. There are regional variations in body size, with adult lengths from 1.9 to 3.8 m (6.2 to 12.5 ft) (Jefferson et al., 1993).

Scientists currently recognize a nearshore (coastal) and an offshore form of bottlenose dolphins, which are distinguished by external and cranial morphology, hematology, diet, and parasite load (Duffield et al., 1983; Hersh and Duffield, 1990; Mead and Potter, 1995; Curry and Smith, 1997). There is also a genetic distinction between nearshore and offshore bottlenose dolphins worldwide (Curry and Smith, 1997; Hoelzel et al., 1998). It has been suggested that the two forms should be considered different species (Curry and Smith, 1997; Kingston and Rosel, 2004), but no official taxonomic revisions have been made.

4.1.2 Status

In the northern GOM, there are coastal stocks; a continental shelf stock; an oceanic stock; and 32 bay, sound, and estuarine stocks (Waring et al., 2006). Sellas et al. (2005) reported the first evidence that the coastal stock off west central Florida is genetically separated from the adjacent inshore areas. Table 4-1 summarizes information on bottlenose dolphin stocks that occur in the north-central Gulf of Mexico, although not all these stocks have an equal probability of occurrence in the Maritime WSEP test area. More detailed descriptions follow the table. Descriptions were obtained from stock assessment reports available on the NMFS website.

Table 4-1. Bottlenose Dolphin Stocks in the North-Central Gulf of Mexico

Stock		Distribution	Strategic Stock	Estimated Abundance	PBR
Bay, Sound, & Estuarine Stocks:	Choctawhatchee Bay	Areas of contiguous, enclosed, or semi-enclosed water bodies	Yes	179 resident, 53 transient	1.7
	Pensacola/East Bay		Yes	33	U
	St. Andrew Bay		Yes	124	U
Gulf of Mexico Northern Coastal		Waters from shore to the 20-meter (66-foot) isobath, from the Mississippi River delta to the Florida Big Bend region	Yes	2,473	20
Northern Gulf of Mexico Continental Shelf		Waters between the 20- and 200-meter (66- and 656-foot) isobaths, from Texas to Key West	No	17,777	U
Northern Gulf of Mexico Oceanic		Waters from the 200-meter (656-foot) isobath to the seaward extent of the U.S. Exclusive Economic Zone	No	5,806	42

PBR = Potential Biological Removal; U = undetermined

Genetic, photo-identification, and tagging data support the concept of relatively discrete bay, sound, and estuarine stocks. The NMFS has provisionally identified 32 such stocks which inhabit areas of contiguous, enclosed, or semi-enclosed water bodies adjacent to the northern GOM. The stocks are based on a description of dolphin communities in some areas of the Gulf coast. A community is generally defined as resident dolphins that regularly share a large portion of their range; exhibit similar distinct genetic profiles; and interact with each other to a much greater extent than with dolphins in adjacent waters. Although the shoreward boundary of W-151 is beyond these environments, individuals from these stocks could potentially enter the study area. Movement between various communities has been documented (Waring et al., 2009), and Fazioli et al. (2006) reported that dolphins found within bays, sounds, and estuaries on the west central Florida coast move into the nearby Gulf waters used by coastal stocks. Maritime WSEP activities will occur seaward of the area considered to be occupied by the Choctawhatchee Bay stock. The best abundance estimate for this stock, as provided in the Stock Assessment Report, is 179 resident dolphins, with an additional 232 transient dolphins. Stocks immediately to the west and east of Choctawhatchee Bay include Pensacola/East Bay and St. Andrew Bay stocks. PBR for the Choctawhatchee Bay stock is 1.7 individuals. NMFS considers all 32 stocks to be strategic.

Three coastal stocks have been identified in the northern GOM, occupying waters from the shore to the 20-meter (66-foot) isobath: Eastern Coastal, Northern Coastal, and Western Coastal stocks. The Western Coastal stock inhabits nearshore waters from the Texas/Mexico border to the Mississippi River Delta. The Northern Coastal stock's range is considered to be from the Mississippi River Delta to the Big Bend region of Florida (approximately 84°W). The Eastern Coastal stock is defined from 84°W to Key West, Florida. Of the coastal stocks, the Northern Coastal is geographically most closely associated with the Maritime WSEP mission area. PBR is 20 individuals. Prior to 2012, this stock was not considered strategic. However, the Draft 2012 Stock Assessment Report identifies an ongoing Unusual Mortality Event of unprecedented size and duration (since February 2012) that has resulted in NMFS' reclassification of this stock as strategic.

The Northern GOM Continental Shelf stock is defined as bottlenose dolphins inhabiting the waters from the Texas/Mexico border to Key West, Florida, between the 20- and 200-meter (66- and 656-foot) isobaths. The continental shelf stock probably consists of a mixture of coastal and offshore ecotypes. PBR is undetermined, and the stock is not considered strategic.

The Oceanic stock is provisionally defined as bottlenose dolphins inhabiting waters from the 200-meter (656-foot) isobath to the seaward extent of the U.S. Exclusive Economic Zone. This stock is believed to consist of the offshore form of bottlenose dolphins. The continental shelf stock may overlap with the oceanic stock in some areas and may be genetically indistinguishable. PBR is 42 individuals, and the stock is not considered strategic.

4.1.3 Diving Behavior

Dive durations as long as 15 minutes are recorded for trained individuals (Ridgway et al., 1969). Typical dives, however, are more shallow and of a much shorter duration. Mean dive durations of Atlantic bottlenose dolphins typically range from 20 to 40 seconds at shallow depths (Mate et al., 1995) and can last longer than 5 minutes during deep offshore dives (Klatsky et al., 2005). Offshore bottlenose dolphins regularly dive to 450 meters (1,476 feet) and possibly as deep as 700 meters (2,297 feet) (Klatsky et al., 2005).

4.1.4 Acoustics and Hearing

Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Clicks and whistles have a dominant frequency range of 110 to 130 kiloHertz (kHz) and a source level of 218 to 228 decibels referenced to one micropascal-meter (dB re 1 μPa-m peak-to-peak) (Au, 1993) and 3.4 to 14.5 kHz and 125 to 173 dB re 1 μPa-m peak-to-peak, respectively (Ketten, 1998). Whistles are primarily associated with communication and can serve to identify specific individuals (i.e., signature whistles) (Caldwell and Caldwell, 1965; Janik et al., 2006). Up to 52 percent of whistles produced by bottlenose dolphin groups with mother-calf pairs can be classified as signature whistles (Cook et al., 2004). Sound production is also influenced by group type (single or multiple individuals), habitat, and behavior (Nowacek, 2005). Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fishes in some regions (Janik, 2000). Additionally, whistle production has been observed to increase while feeding (Acevedo-Gutiérrez and Stienessen, 2004; Cook et al., 2004). Furthermore, both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (e.g., feeding, milling, traveling, and socializing) (Jones and Sayigh, 2002; Zaretsky et al., 2005; Baron, 2006).

Bottlenose dolphins can hear within a broad frequency range of 0.04 to 160 kHz (Au, 1993; Turl, 1993). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles (Ridgway, 2000). Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz (Nachtigall et al., 2000). Recent research on the same individuals indicates that auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at lower (10 kHz) and higher (80 and 100 kHz) frequencies (Finneran and Houser, 2006).

Temporary threshold shifts (TTS) in hearing have been experimentally induced in captive bottlenose dolphins using a variety of noises (i.e., broad-band, pulses) (Ridgway et al., 1997; Schlundt et al., 2000; Nachtigall et al., 2003; Finneran et al., 2005; Mooney et al., 2005; Mooney, 2006). For example, TTS has been induced with exposure to a 3 kHz, one-second pulse with sound exposure level (SEL) of 195 decibels referenced to one squared micropascal per second (dB re 1 μPa^2-s) (Finneran et al., 2005), one-second pulses from 3 to 20 kHz at 192 to 201 decibels referenced to one microPascal-meter (dB re 1μPa-m) (Schlundt et al., 2000), and octave band noise (4 to 11 kHz) for 50 minutes at 179 dB re 1 μPa-m (Nachtigall et al., 2003). Preliminary research indicates that TTS and recovery after noise exposure are frequency dependent and that an inverse relationship exists between exposure time and sound pressure level associated with exposure (Mooney et al., 2005; Mooney, 2006). Observed changes in behavior were induced with an exposure to a 75 kHz one-second pulse at 178 dB re 1 μPa-m (Ridgway et al., 1997; Schlundt et al., 2000). Finneran et al. (2005) concluded that a SEL of 195 dB re 1 μPa^{2-}s is a reasonable threshold for the onset of TTS in bottlenose dolphins exposed to mid-frequency tones.

4.1.5 Distribution

Bottlenose dolphins are distributed worldwide in tropical and temperate waters. The species occurs in all three major oceans and many seas. In the western North Atlantic, bottlenose dolphins occur as far north as Nova Scotia but are most common in coastal waters from New England to Florida, the Gulf of Mexico, the Caribbean, and southward to Venezuela and Brazil (Würsig et al., 2000). Bottlenose dolphins occur seasonally in estuaries and coastal embayments as far north as Delaware Bay (Kenney, 1990) and in waters over the outer continental shelf and inner slope, as far north as Georges Bank (CETAP, 1982; Kenney, 1990).

The bottlenose dolphin is by far the most widespread and common cetacean in coastal waters of the GOM (Würsig et al., 2000). Bottlenose dolphins are frequently sighted near the Mississippi River Delta (Baumgartner et al., 2001) and have even been known to travel several kilometers up the Mississippi River.

Gulf of Mexico

Bottlenose dolphins are abundant in continental shelf waters throughout the northern GOM (Fulling et al., 2003; Waring et al. (2006), including the outer continental shelf, upper slope, nearshore waters, the DeSoto Canyon region, the West Florida Shelf, and the Florida Escarpment. Mullin and Fulling (2004) noted that in oceanic waters, bottlenose dolphins are encountered primarily in upper continental slope waters (less than 1,000 meters in bottom depth) and that highest densities are in the northeastern Gulf. Significant occurrence is expected near all bays in the northern Gulf.

The results of a recent survey effort of nearshore and continental shelf waters of the eastern GOM (Garrison, 2008) identified four areas where bottlenose dolphins were clustered in winter: nearshore waters off Louisiana, the Florida Panhandle, north of Tampa Bay, and southwestern Florida. Dolphins were also common over the entire shelf. In summer, the number of group sightings was comparatively lower than in winter (162 versus 281), and bottlenose dolphins were more evenly distributed throughout coastal and shelf waters.

4.2 ATLANTIC SPOTTED DOLPHIN (*STENELLA FRONTALIS*)

4.2.1 Description

The Atlantic spotted dolphin has features that resemble the bottlenose dolphin. In body shape, it is typically somewhat larger than the inshore bottlenose dolphin ecotype, with a moderately long, thick beak. The dorsal fin is tall and falcate and there is generally a prominent spinal blaze. Adults are up to 2.3 meters (7.5 feet) long and can weigh as much as 143 kilograms (315 pounds) (Jefferson et al., 1993). Atlantic spotted dolphins are born spotless and develop spots as they age (Perrin et al., 1994; Herzing, 1997). Some individuals become so heavily spotted that the dark cape and spinal blaze are difficult to see (Herzing, 1997).

There is marked regional variation in adult body size of the Atlantic spotted dolphin (Perrin et al., 1987). In addition, there are two forms: a robust, heavily spotted form that inhabits the continental shelf, usually found within 250 to 350 km (135 to 189 NM) of the coast, and a smaller, less-spotted form that inhabits offshore waters (Perrin et al., 1994). The largest body size occurs in waters over the continental shelf of North America (East Coast and Gulf of Mexico) and Central America (Perrin, 2002). The smaller, offshore form is not known to occur in the GOM.

4.2.2 Status

The most recent abundance estimate, as provided in the 2012 Draft Stock Assessment Report, is 37,611 individuals in the northern GOM (outer continental shelf and oceanic waters). The northern GOM population is considered genetically differentiated from the western North Atlantic populations. PBR for this species is undetermined. This is not considered a strategic stock

4.2.3 Diving Behavior

Information on diving depth for this species is available from a satellite-tagged individual in the Gulf of Mexico (Davis et al., 1996a). This individual made short, shallow dives to less than 10 meters (33 feet) and as deep as 60 meters (197 feet), while in waters over the continental shelf on 76 percent of dives.

4.2.4 Acoustics and Hearing

A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin. Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz) (Lammers et al., 2003). Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 0.1 to 8 kHz (Thomson and Richardson, 1995). Recorded echolocation clicks had two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (i.e., lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels (Au and Herzing, 2003). Echolocation click source levels as high as 210 dB re 1 µPa-m peak-to-peak have been recorded (Au and Herzing, 2003). Spotted dolphins in The Bahamas were frequently recorded during agonistic/aggressive interactions with bottlenose dolphins (and their own species) to produce squawks (0.2 to 12 kHz broad band burst pulses; males and females), screams (5.8 to 9.4 kHz whistles; males only), barks (0.2 to 20 kHz burst pulses; males only), and synchronized squawks (0.1-15 kHz burst pulses; males only in a coordinated group) (Herzing, 1996).

Hearing ability for the Atlantic spotted dolphin is unknown. However, odontocetes are generally adapted to hear high-frequencies (Ketten, 1997).

4.2.5 Distribution

Atlantic spotted dolphins are distributed in warm-temperate and tropical Atlantic waters from northern New England to Venezuela, including the GOM and the Caribbean Sea (Perrin et al., 1987). Atlantic spotted dolphins may occur in both continental shelf and offshore waters (Perrin et al., 1994). In oceanic waters, this species usually occurs near the shelf break and upper continental slope waters (Davis et al., 1998; Mullin and Hansen, 1999).

Gulf of Mexico

Atlantic spotted dolphins in the northern GOM are abundant in continental shelf waters (Fulling et al., 2003; Waring et al., 2006). In the GOM, Atlantic spotted dolphins are most abundant east of Mobile Bay (Fulling et al., 2003). On the West Florida shelf, spotted dolphins are more common in deeper waters than bottlenose dolphins (Griffin and Griffin, 2003); Griffin and Griffin (2004) reported higher densities of spotted dolphins in this area during November through May.

In winter, there may be occurrence in waters over the continental shelf and along the shelf break throughout the entire northern GOM. Stranding data suggest that this species may be more common than the survey data demonstrate.

Occurrence during spring is primarily in the vicinity of the shelf break from central Texas to southwestern Florida. Sighting data reflect high usage of the Florida Shelf by this species.

In summer, occurrence is primarily in waters over the continental shelf, along the shelf break throughout the entire northern GOM, and over the Florida Escarpment. Sighting data shows increased usage of the Florida Shelf, as well as the Florida Panhandle and inshore of DeSoto Canyon. An additional area of increased occurrence is predicted in shelf waters off western Louisiana.

In fall, the sighting data demonstrate occurrence in waters over the continental shelf and along the shelf break throughout the entire northern GOM. There are numerous sightings in the Mississippi River delta region and Florida Panhandle. This is the season with the least amount of systematic survey effort, and inclement weather conditions can make sighting cetaceans difficult during this time of year.

5. TAKE AUTHORIZATION REQUESTED

The Marine Mammal Protection Act (MMPA) established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The act further regulates "takes" of marine mammals in the high seas by vessels or persons under U.S. jurisdiction. The term *take*, as defined in Section 3 (16 United States Code [USC] 1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." *Harassment* was further defined in the 1994 amendments to the MMPA, which provided for two levels thereof, Level A (potential injury) and Level B (potential disturbance).

The National Defense Authorization Act of fiscal year 2004 (Public Law 108-136) amended the definition of harassment for military readiness activities. Military readiness activities, as defined in Public Law 107-314, Section 315(f), includes all training and operations related to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat. This definition, therefore, includes Maritime WSEP activities occurring in the EGTTR mission area. The amended definition of harassment for military readiness activities is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment"), or

- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including but not limited to migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") (16 USC 1362 [18][B][i],[ii]).

Section 101(a)(5) of the MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (exclusive of commercial fishing) within a specified geographic region. These incidental takes may be allowed if the National Marine Fisheries Service (NMFS) determines the taking will have a negligible impact on the species or stock and the taking will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses.

Pursuant to Section 101(a)(5), an Incidental Harassment Authorization (IHA) for the incidental taking (but not intentional taking) of marine mammals is requested for Maritime WSEP Operational Testing activities within the EGTTR. Take is requested for harassment only, including Level A and Level B (physiological and behavioral) harassment. Taking into consideration the mitigation measures identified in Chapter 11, no takes in the form of mortality are anticipated or requested. The subsequent analyses in this request will identify the applicable types of take.

6. NUMBERS AND SPECIES TAKEN

Cetaceans spend their entire lives in the water and are entirely submerged below the surface most of the time (greater than 90 percent for most species). When at the surface, unless engaging in behaviors such as jumping, spyhopping, etc., the body is almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This can make cetaceans difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100 percent of the time because their ears are nearly always below the water's surface. Marine mammals may be potentially injured or harassed due to noise or pressure waves from detonation of live ordnance during Maritime WSEP tests. The potential numbers and species taken are assessed in this section. Appendix A includes a description of the acoustic modeling methodology used to estimate exposures as well as model results.

Three key sources of information are necessary for estimating potential noise effects on marine mammals: 1) the zone of influence, which is the distance from the explosion to which a particular energy or pressure threshold extends; 2) the density of animals potentially occurring within the zone of influence; and 3) the number of events.

6.1 ZONE OF INFLUENCE

The zone of influence (ZOI) is defined as the area or volume of ocean in which marine mammals could potentially be exposed to various noise thresholds associated with exploding ordnance. Marine mammals may be affected by certain energy and pressure levels resulting from the detonations. Criteria and thresholds generally used for impact assessment were originally developed for the shock trials of the *USS SEAWOLF* and *USS Winston S. Churchill* (DDG-81) and modified over the years as the science became better understood. The analysis of potential impacts to marine mammals adopts criteria and thresholds presented in Finneran and Jenkins (2012), which have been recently adopted by NMFS.

The paragraphs below provide a general discussion of the various metrics, criteria, and thresholds used for impulsive or explosive noise impact assessment of marine mammals. More information on this topic is provided in Appendix A.

6.2 METRICS

Standard impulsive and acoustic metrics were used for the analysis of underwater energy and pressure waves in this document. Several different metrics are important for understanding risk assessment analysis of impacts to marine mammals.

SPL (Sound pressure level): A ratio of the absolute sound pressure and a reference level. Units are in decibels re 1 micro Pascal (dB re 1μPa).

SEL (Sound exposure level): SEL is a measure of sound intensity and duration. When analyzing effects on marine animals from multiple moderate-level sounds, it is necessary to have a metric that quantifies cumulative exposures (American National Standards Institute 1994). SEL can be thought of as a composite metric that represents both the intensity of a sound and its duration. SEL is determined by calculating the decibel level of the cumulative sum-of-squared pressures over the duration of a sound, with units of dB re 1 micro Pascal-squared seconds ($\mu Pa^2 \cdot s$) for sounds in water.

Positive Impulse: This is the time integral of the pressure over the initial positive phase of an arrival. This metric represents a time-averaged pressure disturbance from an explosive source. Units are typically Pascal-second (Pa·s) or pounds per square inch per millisecond (psi·msec). There is no decibel analog for impulse.

6.3 CRITERIA AND THRESHOLDS

6.3.1 Mortality

Whereas a single mortality threshold was previously used in acoustic impacts analysis, species specific thresholds are used today. Thresholds are based on the level of underwater blast noise that would cause extensive lung injury from which 1% of animals exposed would not recover (Finneran and Jenkins, 2012). The threshold is conservative in that it represents the onset of mortality, and 99% of animals exposed would be expected to survive. The lethal exposure level of blast noise, associated with the positive impulse pressure of the blast, is expressed as Pa·s and determined using the Goertner (1982) modified positive impulse equation. This equation considers factors of sound propagation, source/animal depths and the mass of a newborn calf for a given species. The threshold is conservative because animals of greater mass can withstand greater pressure shock waves, and newborn calves typically make up a very small percentage of any cetacean group.

For the Proposed Action, two species are expected to occur within the study area, the bottlenose dolphin and the Atlantic spotted dolphin. Finneran and Jenkins (2012) provide known or surrogate masses for newborn calves of several cetacean species. For the bottlenose dolphin, this value is 14 kg; for the Atlantic spotted a surrogate species, the striped dolphin is used and the mass value of a newborn calf is 7 kg. Impacts analysis for unidentified dolphins conservatively used the mass of the smaller Atlantic spotted dolphin, as this species category is assumed to be comprised of both bottlenose and Atlantic spotted dolphins. The Goertner equation as presented in Finneran and Jenkins, and used in the acoustic model to develop impacts analysis in this IHA request is as follows:

$$I_M(M,D) = 91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$$

$I_M(M,D)$	mortality threshold, expressed in terms of acoustic impulse (Pa·s)
M	Animal mass (Table D-1)
D	Water depth (m)

6.3.2 Injury (Level A Harassment)

The latest NMFS-endorsed guidance recognizes three types of blast related injury: gastrointestinal tract injury, slight lung injury and irrecoverable auditory damage. The injury categories are all types of Level A Harassment as defined in the MMPA.

6.3.2.1 *Gastrointestinal Tract Injuries*

Gastrointestinal (GI) tract injuries are correlated with peak pressure of an underwater detonation. For recoverable injury observed during experiments with small charges in the 1970s, the peak pressure of the shock wave was the causal agent of contusions in the GI tract (Richmond et al., 1973 in Finneran and Jenkins, 2012). The experiments found that a peak SPL of 237 dB re 1μPa predicts the onset of GI tract injuries, which are independent of an animal's mass or size. Therefore, the unweighted peak SPL of 237 dB re 1 μPa is used in explosive impacts assessments as the threshold for slight GI tract injury for all marine mammals.

6.3.2.2 *Slight Lung Injury*

Thresholds for slight lung injury to marine mammals exposed to underwater blasts are defined as a survivable occurrence of slight lung injury, from which all animals would survive. As with the mortality determination, the metric is positive impulse and the equation for determination is that of the Goertner injury model (1982), which is defined as:

$$I_S(M,D) = 39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2},$$

where M is the animal mass (kg), D is the animal depth (m), and the units of I_S are Pa·s.

As the equation incorporates species specific body masses, the mass of a newborn calf for bottlenose and Atlantic spotted dolphins will apply to the Maritime WSEP study area. For unidentified dolphins the mass of Atlantic spotted dolphins is used as it was with the mortality equation.

6.3.2.3 *Auditory Damage (Permanent Threshold Shift)*

Another type of injury, permanent threshold shift or PTS is auditory damage that does not recover, and results in a permanent decrease in hearing sensitivity. As there have been no studies to determine the onset of PTS in marine mammals this threshold is estimated from available information. Jenkins and Finneran define PTS thresholds differently for three groups of cetaceans based on their hearing sensitivity: low-frequency, mid-frequency and high-frequency. Bottlenose and Atlantic spotted dolphins that are the subject of the Maritime WSEP acoustic impacts analysis both fall within the mid-frequency hearing category. The PTS thresholds use a dual criterion, one based on SEL and one based on SPL of an underwater blast. For a given analysis the more conservative of the two is applied to afford the most protection to marine mammals. The mid-frequency cetacean criteria for PTS are:

- SEL (mid-frequency weighted) of 187 dB re 1 μPa^2·s and
- Peak SPL (unweighted) of 230 dB re 1 μPa.

6.3.3 Non-injurious Impacts (Level B Harassment)

Public Law 108-136 (2004) amended the definition of Level B harassment under the MMPA for military readiness activities (Maritime WSEP testing qualifies for this category of activity). For such activities, Level B harassment is defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered." Thus, Level B harassment is limited to the non-injurious impacts, but physiological impact of temporary threshold shift (TTS), and behavioral impacts.

6.3.3.1 *Temporary Threshold Shift (TTS)*

According to Finneran and Jenkins (2012) the TTS onset thresholds for mid-frequency cetaceans are based on TTS data from a beluga whale exposed to an underwater impulse produced from a seismic watergun (Finneran et al., 2002). TTS thresholds also use a dual criterion and in a given analysis the more conservative of the two criteria is applied. The TTS thresholds for bottlenose and Atlantic spotted dolphins consist of the SEL of an underwater blast weighted to the hearing sensitivity of mid-frequency cetaceans, and a peak SPL measure of the same. The dual thresholds for TTS in mid-frequency cetaceans are:

- SEL (mid-frequency weighted) of 172 dB re 1 μPa^2·s and
- Peak SPL (unweighted) of 224 dB re 1 μPa.

6.3.3.2 *Behavioral Impacts*

Behavioral impacts are essentially disturbances that may occur at noise levels below those considered to cause TTS in marine mammals, particularly in cases of multiple detonations. Behavioral impacts may include decreased ability to feed, communicate, migrate, or reproduce, among others. Such effects, known as sub-TTS Level B harassment, are based on observations of behavioral reactions in captive dolphins and belugas to pure tones, a different type of noise than that produced from an underwater detonation (Finneran and Schlundt, 2004; Schlundt *et al.*, 2000). The behavioral impacts threshold for mid-frequency cetaceans exposed to multiple, successive detonations is:

- SEL (mid-frequency weighted) of 167 dB re 1 μPa^2·s

Table 6-1 summarizes the thresholds and criteria discussed above and used in this document to estimate potential noise impacts to marine mammals. All criteria and thresholds for cetaceans are derived from Finneran and Jenkins (2012).

Table 6-1. Criteria and Thresholds Used for Impact Analyses

Mortality*	Level A Harassment			Level B Harassment	
	Slight Lung Injury*	GI Tract Injury	PTS	TTS	Behavioral
$91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	$39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	Unweighted SPL: 237 dB re 1 µPa	Weighted SEL: 187 dB re 1 µPa²·s	Weighted SEL: 172 dB re 1 µPa²·s	Weighted SEL: 167 dB re 1 µPa²·s
			Unweighted SPL: 230 dB re 1 µPa	Unweighted SPL: 224 dB re 1 µPa (23 psi peak pressure)	

*Expressed in terms of acoustic impulse (Pacsal – seconds [Pa·s]); M = Animal mass based on species (kilograms); D = Water depth (meters); PTS = permanent threshold shift; TTS = temporary threshold shift; SPL = sound pressure level; SEL = sound exposure level; dB re 1 µPa = decibels referenced to 1 microPascal; dB re 1 µPa²·s = decibels reference to 1 microPascal-squared – seconds.

6.4 MARINE MAMMAL DENSITY

Density estimates for marine mammals occurring in the EGTTR are provided in Table 3-1. As discussed in Chapter 3, densities were derived from the results of published documents authored by NMFS personnel. Density is nearly always reported for an area (e.g., animals per square kilometer). Analyses of survey results may include correction factors for negative bias, such as the Garrison (2008) report for bottlenose dolphins. Even though Fulling et al. (2003) did not provide a correction for Atlantic spotted dolphins or unidentified bottlenose/spotted dolphins, Eglin AFB adjusted those densities based on information provided in other published literature (Barlow 2003; 2006). Although the study area appears to represent only the surface of the water (two-dimensional), density actually implicitly includes animals anywhere within the water column under that surface area. Density estimates usually assume that animals are uniformly distributed within the prescribed area, even though this is likely rarely true. Marine mammals are often clumped in areas of greater importance, for example, in areas of high productivity, lower predation, safe calving, etc. Density can occasionally be calculated for smaller areas, but usually there are insufficient data to calculate density for such areas. Therefore, assuming an even distribution within the prescribed area is the typical approach.

In addition, assuming that marine mammals are distributed evenly within the water column does not accurately reflect behavior. Databases of behavioral and physiological parameters obtained through tagging and other technologies have demonstrated that marine animals use the water column in various ways. Some species conduct regular deep dives while others engage in much shallower dives, regardless of bottom depth. Assuming that all species are evenly distributed from surface to bottom is almost never appropriate and can present a distorted view of marine mammal distribution in any region. Therefore, a depth distribution adjustment is applied to marine mammal densities in this document (Table 6-2). By combining marine mammal density with depth distribution information, a three-dimensional density estimate is possible. These estimates allow more accurate modeling of potential marine mammal exposures from specific noise sources.

Table 6-2. Depth Distribution for marine Mammals in the Maritime WSEP Test Area

Species	Depth Distribution	Reference
Bottlenose dolphin	Daytime: 96% at <50 m, 4% at >50 m; Nightime: 51% at <50 m, 8% at 50-100 m, 19% at 101-250 m, 13% at 251-450 m, and 9% at >450 m.	Klatsky et al. (2007)
Atlantic spotted dolphin	76% at <10 m, 20% at 10-20 m, and 4% at 21-60 m.	Davis et al. (1996)

m = meters

6.5 NUMBER OF EVENTS

The number of events for Maritime WSEP activities generally corresponds to the number of live weapons deployed, which is provided in Table 1-2. The 30 millimeter (mm) gunnery rounds were modeled as one burst each because it is the most conservative approach. The 7.62 mm/.50 cal rounds do not contain high explosives and therefore do not detonate and introduce energy or pressure into the water column.

6.6 EXPOSURE ESTIMATES

Refer to Appendix A for a description of the acoustic modeling methodology used in this analysis. Table 6-3 provides the maximum estimated winter range, or radius, from the detonation point to which the various thresholds extend for bottlenose and Atlantic spotted dolphins. This range is then used to calculate the total area of the ZOI. The calculated ZOIs are combined with density estimates (adjusted for depth distribution) and the number of live munitions to provide an estimate of the number of marine mammals potentially exposed to the various impact thresholds (**Error! Reference source not found.** 6-4). Final exposure estimates ere obtained from the results of acoustic modeling. Appendix A contains a description of the acoustic model used to determine the numbers of marine species potentially impacted by Maritime WSEP activities. For metrics with two criteria (e.g., 187 dB SEL and 230 peak SPL for Level A harassment), the criterion that yielded the higher exposure estimates are presented and used for impact calculations and do not take into account the mitigation and monitoring measures described in Chapter 11.

Table 6-3. Winter Threshold Radii (in meters) for Maritime WSEP Ordnance

Munition	NEW (lbs)	Total #	Detonation Scenario	Mortality	Level A Harassment					Level B Harassment		
					Slight Lung Injury	GI Track Injury	PTS			TTS		Behavioral
				Modified Goertner Model 1	Modified Goertner Model 2	237 dB SPL	187 dB SEL	230 dB Peak SPL		172 dB SEL	224 dB Peak SPL	167 dB SEL
Bottlenose Dolphin												
GBU-10 or GBU-24	945	2	Surface	199	350	340	965	698		1582	1280	2549
GBU-12 or GBU-54	192	6	Surface	111	233	198	726	409		2027	752	2023
AGM-65 (Maverick)	86	6	Surface	82	177	150	610	312		1414	575	1874
GBU-39 (LSDB)	37	4	Surface	59	128	112	479	234		1212	433	1543
AGM-114 (Hellfire)	20	15	(10 ft depth)	110	229	95	378	193		2070	354	3096
AGM-175 (Griffin)	13	10	Surface	38	83	79	307	165		1020	305	1343
2.75 Rockets	12	100	Surface	36	81	77	281	161		1010	296	1339
PGU-13 HEI 30 mm	0.1	1000	Surface	0	7	16	24	33		247	60	492
Atlantic Spotted Dolphin and Unidentified Dolphin[1]												
GBU-10 or GBU-24	945	2	Surface	237	400	340	965	698		1582	1280	2549
GBU-12 or GBU-54	192	6	Surface	138	274	198	726	409		2027	752	2023
AGM-65 (Maverick)	86	6	Surface	101	216	150	610	312		1414	575	1874
GBU-39 (LSDB)	37	4	Surface	73	158	112	479	234		1212	433	1543
AGM-114 (Hellfire)	20	15	(10 ft depth)	135	277	95	378	193		2070	354	3096
AGM-175 (Griffin)	13	10	Surface	47	104	79	307	165		1020	305	1343
2.75 Rockets	12	100	Surface	45	100	77	281	161		1010	296	1339
PGU-13 HEI 30 mm	0.1	1000	Surface	0	9	16	24	33		247	60	492

AGM = air-to-ground missile; cal = caliber; CBU = Cluster Bomb Unit; ft = feet; GBU = Guided Bomb Unit; HEI = high explosive incendiary; lbs = pounds; mm = millimeters; N/A = not applicable; NEW = net explosive weight; PGU = Projectile Gun Unit; SDB = small diameter bomb; PTS = permanent threshold shift; TTS = temporary threshold shift; WCMD = wind corrected munition dispenser

[1]Unidentified dolphin can be either bottlenose or Atlantic spotted dolphin. Mortality and slight lung injury criteria are conservatively based on the mass of a newborn Atlantic spotted dolphin.

Table 6-4 indicates the potential for lethality, injury, and non-injurious harassment (including behavioral harassment) to marine mammals in the absence of mitigation measures. The numbers represent total impacts for all detonations combined. Mortality was calculated as less than half an animal (0.47) for bottlenose dolphins**,** 0.11 animals for Atlantic spotted dolphin and zero animals for unidentified dolphins. It is expected that, with implementation of the mitigation and monitoring measures outlined in Chapter 11, potential impacts would be mitigated to the point that there would be no mortality takes.

Table 6-4. Number of Marine Mammals Potentially Affected by Maritime WSEP Test Missions

Species	Mortality	Level A Harassment (PTS)	Level B Harassment (TTS)	Level B Harassment (Behavioral)
Bottlenose dolphin	0.47	33.10	405.32	862.53
Atlantic spotted dolphin	0.11	6.58	74.15	146.41
Unidentified bottlenose dolphin/Atlantic spotted dolphin	0.00	0.22	2.52	4.97
TOTAL	**0.58**	**39.90**	**481.99**	**1,013.91**

7. IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

Based on the low mortality exposure estimates calculated by the acoustic model combined with the implementation of mitigation measures identified in Chapter 11, zero marine mammals are expected to be affected by acoustic impulse levels associated with mortality. Therefore, Eglin AFB is requesting an IHA, as opposed to an LOA.

A maximum of up to approximately 40 marine mammals could potentially be exposed to injurious Level A harassment (approximately 33 bottlenose dolphins and 7 Atlantic spotted dolphins). Level A harassment could result from acoustic impulse resulting in slight lung injury, peak SPL resulting in GI track injury, or one of the thresholds resulting in the onset of PTS. Since the threshold with the highest exposure estimates was used to determine takes, impacts are associated with the 187 dB SEL threshold, which corresponds to the onset of PTS, or a permanent decrease in hearing sensitivity.

A maximum of approximately 482 marine mammals could potentially be exposed to non-injurious (TTS) Level B harassment. TTS results from fatigue or damage to hair cells or supporting structures and may cause disruption in the processing of acoustic cues. However, hearing sensitivity is recovered within a relatively short time. Similar to Level A harassment, SEL metric (172 dB re 1 $\mu Pa^2 \cdot s$) results in higher exposure estimates compared to the peak SPL metric (224 dB re 1 μPa).

Approximately 1,014 animals could potentially be exposed to noise corresponding to the behavioral threshold of 167 dB SEL during Maritime WSEP missions. Behavioral harassment occurs at distances beyond the range of structural damage and hearing threshold shift. Possible behavioral responses to a detonation include panic, startle, departure from an area, and disruption of activities such as feeding or breeding.

None of the above estimates take into account the mitigation measures outlined in Chapter 11, which may significantly reduce the number of exposures.

Atlantic spotted dolphins potentially affected by Maritime WSEP test activities are part of the Northern Gulf of Mexico stock, which is considered to occur over the continental shelf from 10 to 200 meters depth, and onto the continental slope. This stock is not considered strategic. Four bottlenose dolphin stocks occur in the north-central GOM and could theoretically be affected by test activities. The Choctawhatchee Bay stock occurs north of the test site and is considered strategic. It is not probable that large numbers of dolphins from this stock would be affected, given that Maritime WSEP activities will occur about 17 miles seaward of Choctawhatchee Bay. However, individuals may move into deeper water at times, and therefore potentially occur in the test area. In addition, individuals from other adjacent bay, sound, and estuarine stocks, such as the Pensacola/East Bay and St. Andrew Bay stocks (also considered strategic), could potentially transit through the area. Bottlenose dolphins affected by test activities are most likely to be associated with the Northern Coastal stock (shoreline to 20 meter depth; considered strategic) and Northern GOM Continental Shelf stock (20 meter to 200 meter depth; not considered strategic). Individuals from the Oceanic stock, which is not strategic, are unlikely to be affected because of their provisional distribution beyond the 200 meter isobath.

8. IMPACT ON SUBSISTENCE USE

Potential impacts resulting from the proposed activities will be limited to individuals of marine mammal species located in the Gulf of Mexico that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9. IMPACTS TO MARINE MAMMAL HABITAT AND THE LIKELIHOOD OF RESTORATION

The primary sources of marine mammal habitat impact are noise and pressure waves resulting from live Maritime WSEP missions. However, neither the noise nor overpressure constitutes a long-term physical alteration of the water column or bottom topography. In addition, they are not expected to affect prey availability, are of limited duration, and are intermittent in time. Surface vessels associated with the missions are present in limited duration and are intermittent as well. Therefore, it is not anticipated that marine mammals will stop utilizing the waters of W-151, either temporarily or permanently, as a result of noise associated with mission activities.

Other factors related to Maritime WSEP activities that could potentially affect marine mammal habitat include the introduction of metals and chemical materials into the water column via spent munitions and explosive byproducts. The effects of each were analyzed in the Maritime WSEP Environmental Assessment (EA) (U.S. Air Force, 2014, in preparation) and were determined to be insignificant. The analysis in the EA is summarized in the following paragraphs.

Metals typically used to construct bombs, missiles, and gunnery rounds include copper, aluminum, steel, and lead, among others. Aluminum is also present in some explosive materials. These materials would settle to the seafloor after munitions are detonated. Metal ions would slowly leach into the substrate and the water column, causing elevated concentrations in a small area around munitions fragments. Some of the metals, such as aluminum, occur naturally in the ocean at varying concentrations and would not necessarily impact the substrate or water column. Other metals, such as lead, could cause toxicity in microbial communities in the substrate. However, such effects would be localized to a very small distance around munitions fragments and would not significantly affect the overall habitat quality of sediments in the northeastern Gulf. In addition, metal fragments would corrode, degrade, and become encrusted over time.

Chemical materials include explosive byproducts and also fuel, oil, and other fluids associated with remotely controlled target boats. Explosive byproducts would be introduced into the water column through detonation of live munitions. Explosive materials include 2,4,6-trinitrotoluene (TNT) and RDX, among others. Various byproducts are produced during and immediately after detonation of TNT and RDX. During the very brief time that a detonation is in progress, intermediate products may include carbon ions, nitrogen ions, oxygen ions, water, hydrogen cyanide, carbon monoxide, nitrogen gas, nitrous oxide, cyanic acid, and carbon dioxide (Becker, 1995). However, reactions quickly occur between the intermediates, and the final products consist mainly of water, carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen gas, although small amounts of other compounds are typically produced as well.

Chemicals introduced to the water column would be quickly dispersed by waves, currents, and tidal action, and eventually become uniformly distributed. A portion of the carbon compounds such as CO and CO_2 would likely become integrated into the carbonate system (alkalinity and pH buffering capacity of seawater). Some of the nitrogen and carbon compounds, including petroleum products, would be metabolized or assimilated by phytoplankton and bacteria. Most of the gas products that do not react with the water or become assimilated by organisms would be released to the atmosphere. Due to dilution, mixing, and transformation, none of these chemicals are expected to have significant impacts on the marine environment.

Explosive material that is not consumed in a detonation could sink to the substrate and bind to sediments. However, the quantity of such materials is expected to be inconsequential. Research has shown that if munitions function properly, nearly full combustion of the explosive materials will occur, and only extremely small amounts of raw material will remain. In addition, any remaining materials will be naturally degraded. TNT decomposes when exposed to sunlight (ultraviolet radiation), and is also degraded by microbial activity (Becker, 1995). Several types of microorganisms have been shown to metabolize TNT. Similarly, RDX is decomposed by hydrolysis, ultraviolet radiation exposure, and biodegradation.

10. IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

Based on the discussions in Section 9, marine mammal habitat will not be lost or modified.

11. MEANS OF AFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS

The potential takes discussed in Section 6 represent the maximum expected number of animals that could be exposed to particular noise and pressure thresholds. The impact estimates do not take into account measures that will be employed to minimize impacts to marine species (these measures will help ensure human safety of test participants and non-participants as well). Mitigation measures consist of visual monitoring to detect the presence of marine mammals and marine mammal indicators (large schools of fish and flocks of birds). Monitoring procedures are described in the following subsections.

11.1 VISUAL MONITORING

Visual monitoring will be required during Maritime WSEP missions from surface vessels and high-definition video cameras. A large number of range clearing boats (approximately 20 to 25) will be stationed around the test site to prevent non-participating vessels from entering the human safety zone. Based on the composite footprint, range clearing boats will be located approximately 15,289 meters (9.5 miles) from the detonation point (Figure 11-1). Actual distance will vary based on the size of the munition being deployed, but as a comparison tool, this distance is used for the mitigation plan.

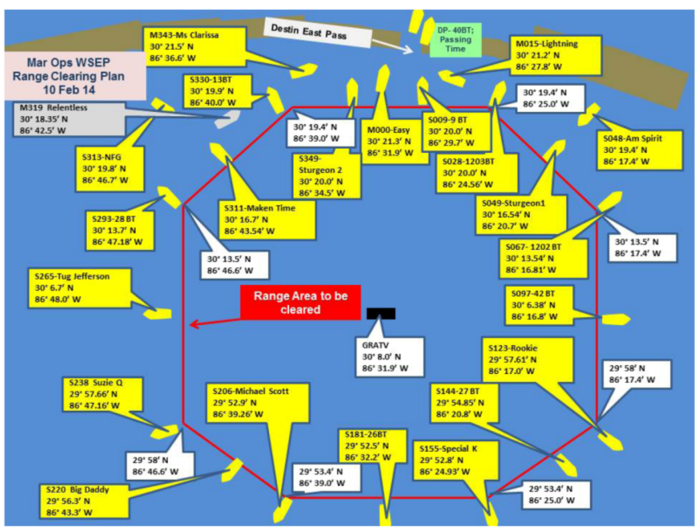

Figure 11-1. Range Area to be Cleared for Human Safety Zone

Trained marine species observers will be aboard five of these boats and will conduct protected species surveys before and after each test. The protected species survey vessels will be dedicated solely to observing for marine species during the pre-mission surveys while the remaining safety boats clear the area of non-authorized vessels.

11.1.1 Determination of Survey Areas

The ranges that are presented in Table 6-3 represent a radius of impact for a given threshold from a single detonation of each munition/detonation scenario. They do not consider accumulated energies from multiple detonation occurring within the same 24-hour time period. For calculating take estimates, the single detonation approach is considered more conservative as it multiplies the exposures from a single detonation by the number of munitions and assumes a fresh population of marine mammals is being impacted each time. This approach is taken because it is unknown exactly which munitions will be released on a given day. Multiple variables, such as weather, aircraft mechanical issues, munition malfunctions, target availability, etc… may prevent munitions to be released as planned. Therefore it is extremely difficult to state with full accuracy the number of munitions of each type will be released on any given day. By treating each detonation as a separate event and summing those impacts accordingly, the proponent will have maximum operational flexibility to conduct the missions without limitations on either the total number of munitions allowed to be dropped in a day, or on the specific combinations of munitions that can be released. While this methodology overestimates the overall potential takes presented in Chapter 6, the ranges do not accurately represent the actual area acoustically impacted for a given threshold from multiple detonations in a given mission day.

The total acoustic impact area for two identical bombs detonating within a given timeframe is less than twice the impact area of a single bomb's detonation. This has to do with the accumulated energy from multiple detonations occurring sequentially. When one weapon is detonated, a certain level of transmission loss is required to be calculated to achieve each threshold level which can then be equated to a range. By releasing a second munition in the same event (same place and close in time), even though the total energy is increased, the incremental impact area from the second detonation is slightly less than that of the first; however the impact range for the two munitions is larger than the impact range for one. Since each additional detonation adds energy to the SEL metric, all the energy from all munitions released in a day is accumulated. By factoring in the transmission loss of the first detonation added with the incremental increases from the second, third, fourth, etc… the range of the cumulative energy that is below each threshold level can be determined. Unlike the energy component, peak pressure is not an additive factor, therefore thresholds expressed as either acoustic impulse or peak SPL metrics (i.e., mortality, slight lung injury, G.I Tract Injury) are not considered in these calculations. A sample day has been created that would reflect the maximum number of munitions that could be released and that would result in the greatest impact in a single mission day. This scenario is only a representation and may not accurately reflect how actual operations will be conducted. However, it is used as the most conservative assumption to calculate the impact range for mitigation strategies. The sum of all energies from these detonations are combined and compared against thresholds with energy metric criteria to generate the accumulated energy ranges for this scenario. These ranges are shown in Table 11-1.

Table 11-1. Threshold Ranges (in meters) for an Example Mission Day

Munition	NEW (lbs)	Total # per Day	Detonation Scenario	Level A Harassment	Level B Harassment	
				PTS	TTS	Behavioral
				187 dB SEL	172 dB SEL	167 dB SEL
GBU-10 or GBU-24	945	1	Surface	5,120	12,384	15,960
GBU-12 or GBU-54	192	1	Surface			
AGM-65 (Maverick)	86	1	Surface			
GBU-39 (LSDB)	37	1	Surface			
AGM-114 (Hellfire)	20	3	(10 ft depth)			
AGM-175 (Griffin)	13	2	Surface			
2.75 Rockets	12	12	Surface			
PGU-13 HEI 30 mm	0.1	125	Surface			

AGM = air-to-ground missile; cal = caliber; CBU = Cluster Bomb Unit; ft = feet; GBU = Guided Bomb Unit; HEI = high explosive incendiary; lbs = pounds; mm = millimeters; N/A = not applicable; NEW = net explosive weight; PGU = Projectile Gun Unit; SDB = small diameter bomb; PTS = permanent threshold shift; TTS = temporary threshold shift; WCMD = wind corrected munition dispenser

Based on the ranges presented in Table 11-1 and factoring operational limitations associated with survey-based vessel support for the missions, the proposed area to be monitored during pre-mission surveys will be approximately 5 km (3.1 miles) from the target area, which corresponds to the Level A PTS threshold range. The same sized area will be surveyed for each mission day, regardless of the planned munition expenditures. By clearing the Level A PTS harassment range of protected species, animals that may enter the area after the pre-mission surveys have been completed and prior to detonation would not reach the smaller slight lung injury or mortality zones (presented in Table 6-3). Because of human safety issues, observers will be required to leave the test area at least 30 minutes in advance of live weapon deployment and move to a position on the safety zone periphery, approximately 9.5 miles (15 km) from the detonation point. Observers will continue to scan for marine mammals from the periphery, but effectiveness will be limited as the boat will remain at a designated station.

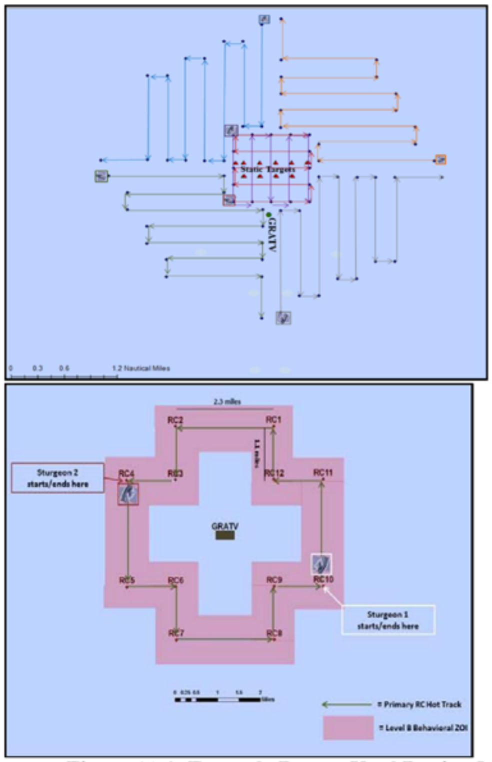

Figure 11-2. Example Routes Used During Maritime Strike Missions in 2013 and 2014.

11.1.2 Additional Monitoring Assets

AF personnel will be within the mission area (on boats and the GRATV) on each day of testing well in advance of weapon deployment, typically near sunrise. They will perform a variety of tasks including target preparation, equipment checks, etc., and will opportunistically observe for marine mammals and indicators as feasible throughout test preparation. However, such observations are considered incidental and would only occur as time and schedule permits. Any sightings would be relayed to the Lead Biologist, as described in the detailed mitigation procedures below.

In addition to vessel-based monitoring, three video cameras will be positioned on the GRATV anchored on-site, as described in Section 2.1.1, to allow for real-time monitoring for the duration of the mission. The camera configuration used would depend on specific mission requirements. In addition to monitoring the area for mission objective issues, the cameras will also be used to monitor for the presence of protected species. A trained marine species observer from Eglin Natural Resources would be located in Eglin's CCF, along with mission personnel, to view the video feed before and during test activities. The distance to which objects can be detected at the water surface by use of the cameras is considered generally comparable to that of the human eye.

Targets would be positioned from several hundred meters up to 2.5 miles away from the GRATV. The mortality threshold ranges correspond to the modified Goertner model adjusted for the weight of an Atlantic spotted dolphin calf, and extend from 0 to 237 meters (0 to 778 feet) from the target, and the slight lung injury threshold ranges for both bottlenose and Atlantic spotted dolphins extend from 7 to 400 meters (23 to 1,312 feet [0.2 miles]) from the target, depending on the ordnance and harassment criterion. Given these distances, observers could reasonably be expected to view a substantial portion of the mortality zone in front of the camera, although a small portion would be behind or to the side of the camera view. Some portion of the Level A harassment zone could also be viewed, although it would be less than that of the mortality zone (a large percentage would be behind or to the side of the camera view). Representative screen shots from three different cameras are shown in Figures 11-3 through 11-5. If the situation arises such that no cameras are operational due to equipment malfunctions, weather impacts, or other issues, then the mission would not be conducted.

Figure 11-3. Representative Screen Shot, Camera 1

Figure 11-4. Representative Screen Shot, Camera 2

Figure 11-5. Representative Screen Shot, Camera 3

At least two ordnance delivery aircraft will participate in each live weapon release mission. Prior to the test, AF pilots aboard mission aircraft may make a dry run over the target area to ensure it is clear of non-participating vessels before ordnance is deployed. Observation effectiveness may vary among aircraft types. Jets will fly at a minimum speed of 300 knots indicated air speed (approximately 345 miles per hour, depending on atmospheric conditions) and at a minimum altitude of 1,000 feet (305 meters). Due to the limited flyover duration and potentially high speed and altitude, observation for marine species would probably be only marginally effective at best, and pilots would, therefore, not participate in species surveys.

11.2 ENVIRONMENTAL CONSIDERATIONS

Weather conducive for marine mammal monitoring is required to effectively implement the surveys. Wind speed and the resulting surface conditions of the GOM are critical factors affecting observation effectiveness. Higher winds typically increase wave height and create "white cap" conditions, both of which limit an observer's ability to locate marine species at or near the surface. Maritime WSEP missions will be delayed or rescheduled if the sea state is greater than number 4 of Table 11-1 at the time of the test. The Lead Biologist aboard one of the survey vessels will make the final determination of whether conditions are conducive for sighting protected species or not. In addition, the missions will occur no earlier than two hours after sunrise and no later than two hours prior to sunset to ensure adequate daylight for pre- and post-mission monitoring

Table 11-1. Sea State Scale for Maritime WSEP Surveys

Sea State Number	Sea Conditions
0	Flat calm, no waves or ripples.
1	Light air, winds 1-2 knots; wave height to 1 foot; ripples without crests.
2	Light breeze, winds 3-6 knots; wave height 1-2 feet; small wavelets, crests not breaking.
3	Gentle breeze, winds 7-10 knots; wave height 2-3.5 feet; large wavelets, scattered whitecaps.
4	Moderate breeze, winds 11-16 knots; wave height 3.5-6 feet; breaking crests, numerous whitecaps.

11.3 AIR FORCE SUPPORT VESSELS

AF support vessels will consist of a combination of Air Force and civil service/civilian personnel. Vessel-based and video monitoring will be conducted for all missions. The Eglin Range Safety Officer, in cooperation with the Santa Rosa Island Tower Control at Test Site A-13B and CCF, will coordinate and manage all range clearing and protected species observation efforts. All support vessels will be in radio contact with one another and with Tower Control on the government VHF channel 81a or 82a. CCF will monitor all radio communications, but Tower will relay messages between the vessels and CCF. The Safety Officer and Tower Control will also be in continual contact with the Test Director throughout the mission and will coordinate information regarding range clearing. Final decisions regarding mission execution, including possible mission delay or cancellation based on marine mammal sightings, will be the responsibility of the Safety Officer, with concurrence from the Test Director. Lines of communication for marine mammal surveys are shown in Figure 11-6. Responsibilities of each survey component are described in the following paragraphs.

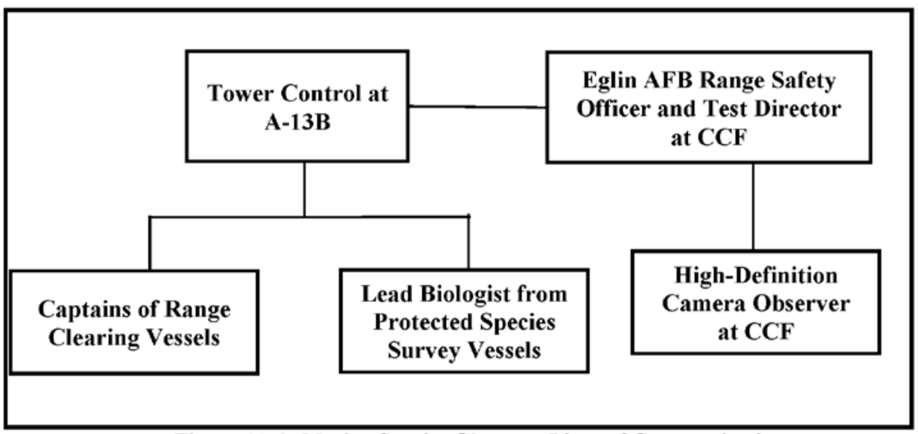

Figure 11-6. Marine Species Observer Lines of Communication

11.4 ROLES AND RESPONSIBILITIES OF DEDICATED OBSERVERS

The following subsections describe the roles and responsibilities of each component of the entire monitoring team. The overall objective of these efforts is to provide sufficient and continual monitoring support before, during, and after each mission that will enable effective observations without putting undue burden on the mission.

11.4.1 Protected Species Survey Vessels

Protected species and species indicator monitoring would be conducted from five surface vessels, with emphasis being focused on the mortality and slight lung injury zones. These survey vessels will run pre-determined line transects, or survey routes, that will provide sufficient coverage of the survey area within a one hour timeframe. Monitoring activities will be conducted from the highest point feasible on the vessels (Figure 11-7). Each vessel will have at least two dedicated observers who are trained in identifying protected marine species and indicators of protected species occurrence, such as large schools of fish and flocks of birds. One vessel will contain the Lead Biologist who will be the point of contact between all survey vessels and Tower Control.

Figure 11-7. Marine Species Observer Example

11.4.2 High-Definition Video Camera Observer

Maritime WSEP missions will be monitored from the GRATV via live high-definition video feed. Video monitoring would, in addition to facilitating assessment of the mission, make possible remote viewing of the area for determination of environmental conditions and the presence of marine species right up to the release of live munitions. For the duration of the mission, a trained marine species observer from Eglin Natural Resources will be in CCF monitoring all live video feed. Although not part of the surface vessel survey team, the Eglin Natural Resources representative will report any marine mammal sightings to the Range Safety Officer, who will also be sitting in CCF. The entire ZOI will not be visible through the video feed for all missions, however the targets and immediately surrounding areas will be in the field of view of the cameras and the observer will be able to identify any protected species that may enter the target area right before the detonations and determine if any were injured immediately following the detonations. Should a protected marine species be detected on the live video, the weapon release can be stopped almost immediately because the video camera observer is in direct contact with Test Director and Safety Officer at CCF. If all of the cameras are not operational for any reason, the mission will not be conducted.

11.5 LINES OF COMMUNICATION

The protected species survey vessels and the video camera observer will have open lines of communication to facilitate real-time reporting of marine mammals and other relevant information, such as safety concerns and presence of non-participating vessels in the human safety zone. Direct radio communication between all surface vessels, GRATV personnel, and the Tower Control will be maintained throughout the mission. The Range Safety Officer will monitor all radio communications from CCF and information between the Safety Officer and the support vessels will relayed via Tower Control. All sighting information from pre-mission surveys will be communicated to the Lead Biologist on a separate radio channel than the range clearing vessels to reduce overall radio chatter and potential confusion. After compiling all the sighting information from the other survey vessels, the Lead Biologist will inform Tower Control on whether the area is clear of protected species or not. If the range is not clear, the Lead Biologist will provide recommendations on whether the mission should be delayed or cancelled. A mission delay recommendation would occur, for example, if a small number of protected species are in the ZOI but appear to be on a heading away from the mission area. On the other hand, a mission cancellation recommendation could occur if one or more protected species in the ZOI are found and there is no indication that they would leave the area on their own preference within a reasonable timeframe. Tower Control will relay the Lead Biologist's recommendation to the Safety Officer in CCF. The Safety Officer and Test Director will collaborate regarding range conditions based on the information provided by the Lead Biologist and the status of range clearing vessels. Ultimately, the Safety Officer will have final authority on decisions regarding delays and cancellations of missions.

11.6 DETAILED MITIGATION PLAN

A 5-km radius area (from Table 11-1) will be monitored for the presence of marine mammals and indicators. Maritime WSEP mitigations will be regulated by AF safety parameters. Any mission may be delayed or cancelled due to technical issues or range clearing issues. Should a delay occur during pre-mission surveys, all mitigation procedures would continue either for the duration of the delay or until the mission is cancelled. To ensure the safety of survey personnel, the team will depart the mission area approximately 30 minutes to one hour before live ordnance delivery. Stepwise mitigation procedures for the Maritime WSEP missions are outlined below.

<u>Pre-mission Monitoring</u>: The purposes of pre-mission monitoring are to 1) evaluate the mission site for environmental suitability, and 2) verify that the ZOI is free of visually detectable marine mammals, as well as potential indicators of these species. On the morning of the mission, the Test Director and Safety Officer will confirm that there are no issues that would preclude mission execution and that weather is adequate to support mitigation measures.

(a) Sunrise or Two Hours Prior to Mission

AF range clearing vessels and protected species survey vessels will be on site at least two hours prior to the mission. Lead Biologist on board one survey vessel will assess the overall suitability of the mission site based on environmental conditions (sea state) and presence/absence of marine mammal indicators. This information will be communicated to Tower Control and relayed to the Safety Officer in CCF.

(b) One and One-Half Hours Prior to Mission

Vessel-based surveys will begin approximately one and one-half hours prior to live weapon deployment. Surface vessel observers will survey the ZOI and relay all marine species and indicator sightings, including the time of sighting, GPS location, and direction of travel, if known, to the Lead Biologist. The Lead Biologist will document all sighting information on report forms to be submitted to Eglin Natural Resources after each mission. Surveys will continue for approximately one hour. During this time, AF personnel in the mission area will also observe for marine species as feasible. If marine mammals or indicators are observed within the ZOI, the range will be declared "fouled," a term that signifies to mission personnel that conditions are such that a live ordnance drop cannot occur (e.g., protected species or civilian vessels are in the mission area). If no marine mammals or indicators are observed, the range will be declared clear of protected species.

(c) One-Half Hour Prior to Mission

At approximately 30 minutes to one hour prior to live weapon deployment, marine species observers will be instructed to leave the mission site and remain outside the safety zone, which on average will be 9.5 miles from the detonation point. The actual size is determined by weapon NEW and method of delivery. The survey team will continue to monitor for protected species while leaving the area. As the survey vessels leave the area, marine species monitoring of the immediate target areas will continue at CCF through the live video feed received from the high definition cameras on the GRATV. Once the survey vessels have arrived at the perimeter of the safety zone (approximately 30 minutes after being instructed to leave, depending on actual travel time) the range will be declared "green" and mission will be allowed to proceed, assuming all non-participating vessels have left the safety zone as well.

(d) Execution of Mission

Immediately prior to live weapon drop, the Test Director and Safety Officer will communicate to confirm the results of marine mammal surveys and the appropriateness of proceeding with the mission. The Safety Officer will have final authority to proceed with, postpone, or cancel the mission. The mission would be postponed if:

1. Any marine mammal is visually detected within the ZOI. Postponement would continue until the animal(s) that caused the postponement is
    a. Confirmed to be outside of the ZOI on a heading away from the targets or
    b. Not seen again for 30 minutes and presumed to be outside the ZOI due to the animal swimming out of the range
        i. Average swim speed of dolphins assumed to be 5.6 km/hour

ii. Distance traveled in 30 minutes would be approximately 2,800 meters

2. Large schools of fish or large flocks of birds feeding at the surface are observed within the ZOI. Postponement would continue until these potential indicators are confirmed to be outside the ZOI.
3. Any technical or mechanical issues related to the aircraft or target boats.
4. Non-participating vessels enter the human safety zone prior to weapon release.

In the event of a postponement, protected species monitoring would continue from CCF through the live video feed.

Post-mission monitoring: Post-mission monitoring is designed to determine the effectiveness of pre-mission mitigation by reporting sightings of any dead or injured marine mammals. Post-detonation monitoring surveys will commence once the mission has ended or, if required, as soon as EOD personnel declare the mission area safe. Vessels will move into the survey area from outside the safety zone and monitor for at least 30 minutes, concentrating on the area down-current of the test site. This area is easily identifiable because of the floating debris in the water from impacted targets. Up to 10 AF support vessels will be cleaning debris and collecting damaged targets from this area thus spending many hours in the area once the mission is completed. All vessels will be instructed to report any dead or injured marine mammals to the Lead Biologist. The protected species survey vessels will document any marine mammals that were killed or injured as a result of the mission and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed will be documented and reported to Eglin Natural Resources.

The NMFS maintains stranding networks along U.S. coasts to collect and circulate information about marine mammal standings. Local coordinators may report stranding data to state and regional coordinators. Any observed dead or injured marine mammal would be reported to the appropriate coordinator.

11.7 MITIGATION EFFECTIVENESS

The effectiveness of the mitigation measures described above depends largely on the ability to visually locate marine mammals at or near the water surface, as visual observation is the primary measure used. Aerial surveys are not feasible for Maritime WSEP missions due to airspace and mission complexity; therefore observation will occur primarily from vessels and video cameras. The NMFS has evaluated the effectiveness of visual observation for a similar previous AF action in the same area of the Gulf (Maritime Strike Incidental Harassment Authorization issued 13 August 2013). This qualitative analysis for mitigation effectiveness is largely based on the successes during Maritime Strike missions conducted in 2013.

In summary, 34 total sightings were reported during pre-mission surveys of between 179 and 189 individuals, including bottlenose dolphins, Atlantic spotted dolphins, and sea turtles. One mission day was cancelled due to sea state conditions that prevented a proper pre-mission survey and high numbers of marine mammals observed in the area. Two other mission days were delayed due to extended surveys to ensure marine mammals were clear of the area. Two sightings of dolphin pods were reported during post-mission surveys up to 4.5 hours after the last detonation; however all animals were swimming normally, displaying normal behaviors, and not showing any signs of distress or injury (Department of the Air Force, 2014). Although there was an average time lapse of 2 hours and 45 minutes between completion of pre-mission surveys and when the first munition is dropped that was not originally anticipated, monitoring the video camera feed from CCF provided real time surveillance up to the point of detonation while survey vessels transited to the safety zone perimeter.

The overall effectiveness of these measures in reducing take levels has not been quantified; however the high numbers of documented sightings during the pre-mission surveys indicate a significant level of success in executing the survey plans and identifying protected species in the area. Furthermore, there were no observed impacts to any protected species during post-mission surveys and none were identified in the days immediately following the end of all Maritime Strike missions. Therefore, Eglin believes the proposed mitigations will provide a large measure of protection to marine mammals from potential acoustic impacts while enabling the military mission.

12. MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USE

Based on the discussion in Section 8, there are no impacts on the availability of species or stocks for subsistence use.

13. MONITORING AND REPORTING MEASURES

For Maritime WSEP missions, prospective mission sites will be monitored for marine mammal presence prior to commencement of activities. Vessel-based pre-mission monitoring will be conducted for at least one hour. Furthermore, after the survey vessels have exited the safety footprint, a trained marine species observer located in the CCF will continue monitoring the immediate target area through live video feed for the duration of the mission. Post-mission surveys will be carried out in all cases. If any marine mammals are detected during pre-mission surveys or the live video feed received from cameras on the GRATV, activities will be immediately halted until the area is clear of all marine mammals. Refer to Chapter 11 for a more detailed explanation of monitoring requirements.

In addition to monitoring for marine species before and after missions, the following monitoring and reporting measures will be required.

- All protected species observers will receive the Marine Species Observer Training Course developed by Eglin in cooperation with NMFS within a year of the planned missions.
- The Eglin Natural Resources Office will track use of the EGTTR and protected species observation results through the use of protected species observer report forms.
- A summary annual report of marine mammal observations and mission activities will be submitted to the NMFS Southeast Regional Office and the NMFS Office of Protected Resources either at the time of a request for renewal of the IHA, or 90 days after the

expiration of the current permit if a new permit is not requested. This annual report must include the following information:

- Date and time of each exercise;
- A complete description of the pre-exercise and post-exercise activities related to mitigating and monitoring the effects of mission activities on marine mammal populations;
- Results of the monitoring program, including numbers by species/stock of any marine mammals noted injured or killed as a result of the missions, and number of marine mammals (by species if possible) that may have been harassed due to presence within the activity zone; and

- If any dead or injured marine mammals are observed or detected prior to mission activities, or injured or killed during mission activities, a report must be made to NMFS by the following business day.
- Any unauthorized takes of marine mammals (i.e., mortality) must be immediately reported to NMFS and to the respective stranding network representative.

14. RESEARCH

Although Eglin AFB does not currently conduct independent research efforts, Eglin's Natural Resources Section participates in marine animal tagging and monitoring programs lead by other agencies. Additionally, the Natural Resources Section has also supported participation in annual surveys of marine mammals in the GOM with NMFS. From 1999 to 2002, Eglin, through a contract representative, participated in summer cetacean monitoring and research efforts. The contractor participated in visual surveys in 1999 for cetaceans in the GOM, photographic identification of sperm whales in the northeastern Gulf in 2001, and as a visual observer during the 2000 Sperm Whale Pilot Study and the 2002 sperm whale Satellite-tag (S-tag) cruise. In addition, Eglin's Natural Resources Section has obtained Department of Defense funding for two marine mammal habitat modeling projects. The latest such project (Garrison, 2008) included funding for and extensive involvement of NMFS personnel so that the most recent aerial survey data could be utilized for habitat modeling and protected species density estimates in the northeastern GOM.

Eglin conducts other research efforts which utilize marine mammal stranding information as a potential means of ascertaining the effectiveness of mitigation techniques. Stranding data is collected and maintained for the Florida panhandle area as well as Gulf-wide. This task is undertaken through the establishment and maintenance of contacts with local, state, and regional stranding networks. Eglin AFB assists with stranding data collection by maintaining its own team of permitted stranding personnel. In addition to simply collecting stranding data, various analyses are performed. Stranding events are tracked by year, season, and NMFS statistical zone, both Gulf-wide and on the coastline in proximity to Eglin AFB. Stranding data may be analyzed in relation to records of EGTTR mission activity in each water range, and possible correlations examined. In addition to being used as a possible measure of the effectiveness of mitigations, stranding data can yield insight into the species composition of cetaceans in the region.

15. LIST OF PREPARERS

Amanda Robydek, Environmental Scientist
Leidos / Eglin AFB Natural Resources
107 Highway 85 North
Niceville, FL 32578
(850) 882-8395
amanda.robydek.ctr@us.af.mil

Mike Nunley, Marine Scientist
Leidos / Eglin AFB Natural Resources
107 Highway 85 North
Niceville, FL 32578
(850) 882-8397
jerry.nunley.ctr@us.af.mil

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APPENDIX A: ACOUSTIC MODELING METHODOLOGY

Eglin Air Force Base Maritime WSEP MMPA Acoustic Impact Modeling

Submitted by:
Leidos

To:
Eglin Natural Resources
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Eglin Air Force Base, FL

In response to tasking associated with:
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Leidos Program Manager & Technical POC:
Dr. Robert Bieri
Marine Sciences R&D Division
4001 N. Fairfax Dr.
Arlington, VA 22203
Office: 703-907-2596
Fax: 703-276-3121
Email:
Robert.L.Bieri@leidos.com

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APPENDIX A
MMPA ACOUSTIC IMPACT MODELING

A.1 BACKGROUND AND OVERVIEW

A.1.1 Federal Regulations Affecting Marine Animals

All marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

Actions involving sound in the water include the potential to harass marine animals in the surrounding waters. Demonstration of compliance with MMPA, using best available science, has been assessed using criteria and thresholds accepted or negotiated, and described here.

Sections of the MMPA (16 U.S.C. 1361 et seq.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity, other than commercial fishing, within a specified geographical region. Through a specific process, if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization for incidental takings may be granted if National Marine Fisheries Service (NMFS) finds that the taking will have no more than a negligible impact on the species or stock(s), will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking, and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth.

NMFS has defined negligible impact in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to adversely affect the species or stock through effects on annual rates of recruitment or survival.

Subsection 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The National Defense Authorization Act of 2004 (NDAA) (Public Law 108-136) removed the small numbers limitation and amended the definition of "harassment" as it applies to a military readiness activity to read as follows:

> (i) *any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or*
> (ii) *any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding,*

> *or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].*

The primary potential impact to marine mammals from underwater acoustics is Level B harassment from noise.

A.1.2 Development of Animal Impact Criteria

For explosions of ordnance planned for use in the Eglin Air Force Base (AFB) Maritime WSEP Exercise Area, in the absence of any mitigation or monitoring measures, there is a very small chance that a marine mammal could be injured or killed when exposed to the energy generated from an explosive force. Analysis of noise impacts is based on criteria and thresholds initially presented in U.S. Navy Environmental Impact Statements for ship shock trials of the Seawolf submarine and the Winston Churchill (DDG 81), and subsequently adopted by NMFS.

Non-lethal injurious impacts (Level A Harassment) are defined in those documents as permanent (auditory) threshold shift (PTS), gastro-intestinal (GI) tract damage, and the onset of slight lung injury. Two thresholds are used for PTS: a weighted sound energy level (SEL) and an un-weighted peak sound pressure level (SPL). Thresholds follow the approach of Southall et al. (2007). The threshold producing the largest Zone of Influence (ZOI) is then used as the more protective of the dual thresholds. In most cases, the weighted total SEL is more conservative than the largest energy flux density (EFD) in any single 1/3-octave band that was used in earlier models. Type II weighting functions are for each functional hearing group. The threshold for the Type II weighted SEL is 187 dB re 1 $\mu Pa^2 \cdot s$; the threshold for peak pressure is 46 psi or 230 dB re 1 μPa peak SPL.

The criterion for slight injury to the GI tract was found to be a limit on peak pressure and independent of the animal's size (Goertner, 1982). A threshold of 103 psi (237 dB re 1 μPa peak SPL) is used for all marine mammals. This is the level at which slight contusions to the GI tract were reported from small charge tests (Richmond *et al.*, 1973).

The criteria for onset of slight lung injury were established using partial impulse because the impulse of an underwater blast wave was the parameter that governed damage during a study using mammals, not peak pressure or energy (Yelverton, 1981). Goertner (1982) determined a way to calculate impulse values for injury at greater depths, known as the Goertner "modified" impulse pressure. Those values are valid only near the surface because as hydrostatic pressure increases with depth, organs like the lung, filled with air, compress. Therefore the "modified" impulse pressure thresholds vary from the shallow depth starting point as a function of depth.

The shallow depth starting points for calculation of the "modified" impulse pressures are mass-dependent values derived from empirical data for underwater blast injury (Yelverton, 1981). During the calculations, the lowest impulse and body mass for which slight, and then extensive, lung injury found during a previous study (Yelverton et al, 1973) were used to determine the positive impulse that may cause lung injury. The Goertner model is sensitive to mammal weight such that smaller masses have lower thresholds for positive impulse so injury and harassment will be predicted at greater distances from the source for them. Species-specific masses are therefore used for determining mortality thresholds because they closely represent effects to individual species. Nominal body masses for each species are based on newborn individuals as a protective approach since the impulse threshold is lower for smaller masses and only a small percentage of a marine mammal population would consist of newborns. Where body masses are not available, surrogate species of comparable mass were utilized.

Level B (non-injurious) Harassment includes temporary (auditory) threshold shift (TTS), a slight, recoverable loss of hearing sensitivity. One criterion used for TTS, the total Type II weighted SEL is a threshold of 172 dB re 1 $\mu Pa^2 \cdot s$ for toothed whales (e.g., dolphins). A second criterion, a maximum allowable peak pressure of 23 psi (224 dB re 1 µPa peak SPL), has recently been established by NMFS to provide a more conservative range for TTS when the explosive or animal approaches the sea surface, in which case explosive energy is reduced, but the peak pressure is not. NMFS applies the more conservative of these two.

For multiple successive explosions, the acoustic criterion for non-TTS behavioral disturbance is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower sound energy levels than those that may cause TTS. The threshold for behavioral disturbance is set 5 dB below the Type II weighted total SEL-based TTS threshold, or 167 dB re 1 $\mu Pa^2 \cdot s$. This is based on observations of behavioral reactions in captive dolphins and belugas occurring at exposure levels ~ 5 dB below those causing TTS after exposure to pure tones (Finneran and Schlundt, 2004; Schlundt *et al.*, 2000).

Table A-2 summarizes the current threshold levels for analysis of explosives identified for use in the Eglin AFB Maritime WSEP exercise area.

Table A-2. Explosives Threshold Levels

Mortality*	Level A Harassment			Level B Harassment	
	Slight Lung Injury*	GI Tract Injury	PTS	TTS	Behavioral
$91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	$39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$	Unweighted SPL: 237 dB re 1 µPa	Weighted SEL: 187 dB re 1 $\mu Pa^2 \cdot s$ Unweighted SPL: 230 dB re 1 µPa	Weighted SEL: 172 dB re 1 $\mu Pa^2 \cdot s$ Unweighted SPL: 224 dB re 1 µPa (23 psi peak pressure)	Weighted SEL: 167 dB re 1 $\mu Pa^2 \cdot s$

*Expressed in terms of acoustic impulse (Pacsal – seconds [Pa·s]); *M* = Animal mass based on species (kilograms); *D* = Water depth (meters); PTS = permanent threshold shift; TTS = temporary threshold shift; SPL = sound pressure level; SEL = sound exposure level; dB re 1 µPa = decibels referenced to 1 microPascal; dB re 1 $\mu Pa^2 \cdot s$ = decibels reference to 1 microPascal-squared – seconds.

Work is ongoing in the community to refine the threshold criteria in response to new information about marine animal biology. The new modeling described here uses more conservative thresholds than were used in previous studies. Models were implemented in a way that allows the threshold criteria to be varied (over a realistic range of values). New results can be generated if the current criteria change.

A.2 EXPLOSIVE ACOUSTIC SOURCES

A.2.1 Acoustic Characteristics of Explosive Sources

The acoustic sources employed at the Eglin AFB Maritime WSEP exercise area are categorized as broadband explosives. Broadband explosives produce significant acoustic energy across several frequency decades of bandwidth. Propagation loss is sufficiently sensitive to frequency as to require model estimates at several frequencies over such a wide band.

Explosives are impulsive sources that produce a shock wave that dictates additional pressure-related metrics (peak pressure and positive impulse). Detailed descriptions of the sources in the Eglin AFB Maritime WSEP exercise area are provided in this subsection.

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: the weight of the explosive material, the type of explosive material, and the detonation depth. The net explosive weight (or NEW) accounts for the first two parameters. The NEW of an explosive is the weight of TNT required to produce an equivalent explosive power.

The detonation depth of an explosive is particularly important due to a propagation effect known as surface-image interference. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface-reflection scattering loss).

A.2.2 Animal Harassment Effects of Explosive Sources

The harassments expected to result from these sources are computed on a per in-water explosive basis; to estimate the number of harassments for multiple explosives, consider the following. Let A represent the impact area (that is, the area in which the chosen metric exceeds the threshold) for a single explosive. The cumulative effect of a series of explosives is then dictated by the spacing of the explosives relative to the movement of the marine wildlife. If the detonations are spaced widely in time or space, allowing for sufficient animal movements as to ensure a different population of animals is considered for each detonation, the cumulative impact area of N explosives is merely NA regardless of the metric. This leads to a worst case estimate of harassments and is the method used in this analysis.

At the other extreme is the case where the detonations occur at essentially the same time and location (but not close enough to require the source emissions to be coherently summed). In this case, the pressure metrics (peak pressure and positive impulse) are constant regardless of the number of detonations spaced closely in time, while the energy metrics increase at a rate of $N^{1/2}$ (under spherical spreading loss only) or less.

The firing sequence for some of the munitions consists of a number of rapid bursts, often lasting a second or less. Due to the tight spacing in time, each burst can be treated as a single detonation. For the energy metrics the impact area of a burst is computed using a source energy spectrum that is the source spectrum for a single detonation scaled by the number of rounds in a burst. For the pressure metrics, the impact area for a burst is the same as the impact area of a single round. As with detonations, if bursts are spaced widely in time or space, allowing for sufficient animal movements as to ensure a different population of animals is considered for each detonation, the cumulative impact area of N bursts is merely NA, where A is the impact area of a single burst, regardless of the metric. This leads to a worst case estimate of harassments and is the method used in this analysis.

Explosives are modeled as detonating at depths ranging from the water surface to 10 feet below the surface, as provided by Government-Furnished Information. Impacts from above surface detonations were considered negligible and not modeled.

For sources that are detonated at shallow depths, it is frequently the case that the explosion may breach the surface with some of the acoustic energy escaping the water column. We model surface detonations as occurring one foot below the water surface. The source levels have not been adjusted for possible venting nor does the subsequent analysis attempt to take this into account.

A.3 ENVIRONMENTAL CHARACTERIZATION

A.3.1 Important Environmental Parameters for Estimating Animal Harassment

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. In turn, propagation loss as a function of range depends on a number of environmental parameters including:

- water depth
- sound speed variability throughout the water column
- bottom geo-acoustic properties, and
- surface roughness, as determined by wind speed

Due to the importance that propagation loss plays in Anti-Submarine Warfare, the Navy has, over the last four to five decades, invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases containing these environmental parameters, which are accepted as standards for Navy modeling efforts. **Table A-3** contains the version of the databases used in the modeling for this report.

Table A-3. Navy Standard Databases Used in Modeling

Parameter	Database	Version
Water Depth	Digital Bathymetry Data Base Variable Resolution	DBDBV 6.0
Ocean Sediment	Re-packed Bottom Sediment Type	BST 2.0
Wind Speed	Surface Marine Gridded Climatology Database	SMGC 2.0
Temperature/Salinity Profiles	Generalized Digital Environment Model	GDEM 3.0

The sound speed profile directs the sound propagation in the water column. The spatial variability of the sound speed field is generally small over operating areas of typical size. The presence of a strong oceanographic front is a noteworthy exception to this rule. To a lesser extent, variability in the depth and strength of a surface duct can be of some importance. If the sound speed minimum occurs within the water column, more sound energy can travel further without suffering as much loss (ducted propagation). But if the sound speed minimum occurs at the surface or bottom, the propagating sound interacts more with these boundaries and may become attenuated more quickly. In the mid-latitudes, seasonal variation often provides the most significant variation in the sound speed field. For this reason, both summer and winter profiles are modeled to demonstrate the extent of the difference.

Losses of propagating sound energy occur at the boundaries. The water-sediment boundary defined by the bathymetry can vary by a large amount. In a deep water environment, the interaction with the bottom may matter very little. In a shallow water environment the opposite is true and the properties of the sediment become very important. The sound propagates through the sediment, as well as being reflected by the interface. Soft (low density) sediment behaves more like water for lower frequencies and the sound has relatively more transmission and relatively less reflection than a hard (high density) bottom or thin sediment.

The roughness of the boundary at the water surface depends on the wind speed. Average wind speed can vary seasonally, but could also be the result of local weather. A rough surface scatters the sound energy and increases the transmission loss. Boundary losses affect higher frequency sound energy much more than lower frequencies.

A.3.2 Characterizing the Acoustic Marine Environment

The environment for modeling impact value is characterized by a frequency-dependent bottom definition, range-dependent bathymetry and sound velocity profiles (SVP), and seasonally varying wind speeds and SVPs. The bathymetry database is on a grid of variable resolution.

The sound velocity profile database has a fixed spatial resolution storing temperature and salinity as a function of time and location. The low frequency bottom loss is characterized by standard definition of geo-acoustic parameters for then given sediment type of sand. The high frequency bottom loss class is fixed to match expected loss for the sediment type. The area of interest can be characterized by the appropriate sound speed profiles, set of low frequency bottom loss parameters, high frequency bottom loss class, and HFEVA very-high frequency sediment type for modeled frequencies in excess of 10 kHz.

Generally seasonal variation is sampled by looking at summer and winter cases. However, for Maritime WSEP ordnance usage is planned only for winter environments.

Impact volumes in the operating area are then computed using propagation loss estimates and the explosives model derived for the representative environment.

A.3.3 Description of the Eglin AFB Maritime WSEP Exercise Area Environment

The Eglin AFB Maritime WSEP Exercise Area is located off the coast of Florida in the Gulf of Mexico. It is an area that slopes from shallow waters near the coast to deeper waters offshore. The bottom is characterized as sandy sediment according to the Bottom Sediments Type Database. Environmental values were extracted from unclassified Navy standard databases in a radius of 50 km around the center point at

N 30° 08.5' W 86° 28'

The Navy standard database for bathymetry has a resolution of 0.05 minutes in the Gulf of Mexico; see **Figure A-1**. Mean and median depths from DBDBV in the extracted area are 47 and 112 meters, respectively.

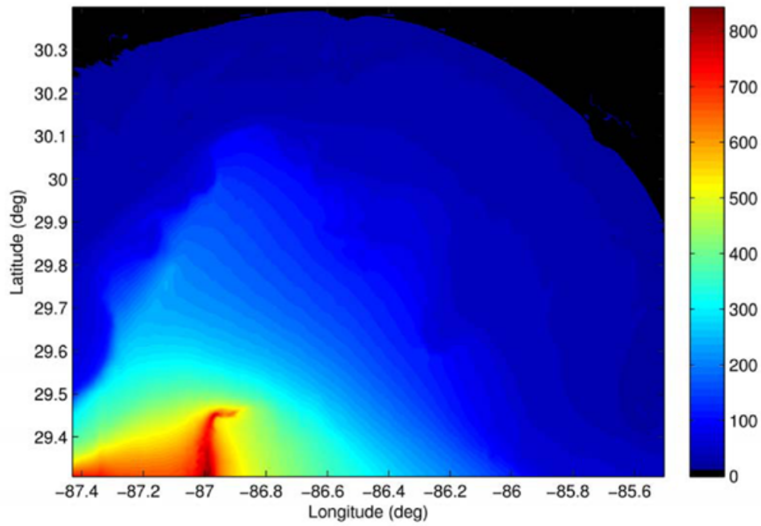

Figure A-1. Bathymetry (in meters) for Eglin AFB Maritime WSEP Exercise Area Representative Environment

The seasonal variability in wind speed was modeled as 8.6 knots in the summer and 13.02 knots in the winter.

Example input of range-dependent bathymetry is depicted in **Figure A-2** for the due-north bearing.

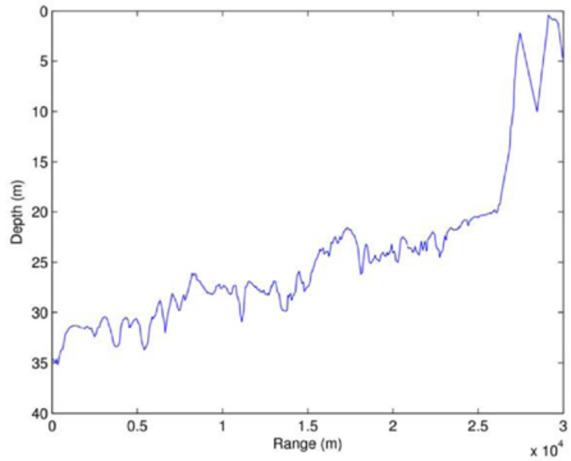

Figure A-2. Bathymetry due-North of Eglin AFB Maritime WSEP Exercise Area Center Point

A.4 MODELING IMPACT ON MARINE ANIMALS

Many underwater actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. The number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

Estimating the number of animals that may be injured or otherwise harassed in a particular environment entails the following steps.

- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL calculations are also made over disjoint one-third octave bands for a wide range of frequencies with dependence in range, depth, and azimuth for bathymetry and sound speed. TL computations were sampled with 40 degree spacing in azimuth.
- The Type II weighted total accumulated energy within the waters where the source detonates is sampled over a volumetric grid. At each grid point, the received energy from each source emission is modeled as the effective energy source level reduced by the appropriate propagation loss from the location of the source at the time of the emission to that grid point and summed. For the peak pressure or positive impulse, the appropriate metric is similarly modeled for each emission. The maximum value of that metric over all frequencies and emissions, is stored at each grid point.
- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point sampled in range and depth for which the appropriate metric exceeds that threshold, and accumulated over all modeled bearings.

Histograms representing impact volumes as a function of (possibly depth-dependent) thresholds, are stored in a spreadsheet for dynamic changes of thresholds.

- Finally, the number of harassments is estimated as the inner-product of the animal density depth profile and the impact volume and scaled by user-specifiable surface animal densities.

This section describes in detail the process of computing impact volumes.

A.4.1 Calculating Transmission Loss

Transmission loss (TL) was pre-computed for both seasons for thirty non-overlapping frequency bands. Only the winter season was used for Maritime WSEP analysis. The 30 bands had one-third octave spacing around center frequencies from 50 Hz to approximately 40.637 kHz. In the previous report for Maritime Strike analysis in 2012, TL was computed at only seven frequencies. The broadband nature of the sources has been well covered in this report. The TL was modeled using the Navy Standard GRAB V3 propagation loss model (Keenan, 2000) with CASS v4.3

The transmission loss results were interpolated onto a variable range grid with logarithmic spacing. The increased spatial resolution near the source provided greater fidelity for estimates.

The transmission loss was calculated from the source depth to an array of output depths. The output depths were the mid-points of depth intervals matching GDEM's depth sampling. For water depths from surface to 10 m depth, the depth interval was 2 m. Between 10 m and 100 m water depth, the depth interval was 5 m. For waters greater than 100 m, the depth interval was 10 m. For the Eglin AFB Maritime WSEP exercise area environment, there were thirty depths (1, 3, 5, 7, 9, 12.5, 17.5, 22.5, 27.5, 32.5, 37.5, 42.5, 47.5, 52.5, 57.5, 62.5, 67.5, 72.5, 77.5, 82.5, 87.5, 92.5, 97.5, 105, 115, 125, 135, 145, 155, 160, all in meters) representing depth-interval midpoints. The output depths represent possible locations of the animals and are used with the animal depth distribution to better estimate animal impact. The depth grid is used to make the surface image interference correction and to capture the depth-dependence of the positive impulse threshold.

An important propagation consideration at low frequencies is the effect of surface-image interference. As either source or target approach the surface, pairs of paths that differ by a single surface reflection set up an interference pattern that ultimately causes the two paths to cancel each other when the source or target is at the surface. A fully coherent summation of the eigenrays produces such a result but also introduces extreme fluctuations that would have to be highly sampled in range and depth, and then smoothed to give meaningful results, and would be inappropriate in representing a broad one-third octave band of the spectrum. An alternative approach is to implement what is sometimes called a semi-coherent summation. A semi-coherent sum attempts to capture significant effects of surface-image interference (namely the reduction of the field due to destructive interference of reflected paths as the source or target approach the surface) without having to deal with the more rapid fluctuations associated with a fully coherent sum. The semi-coherent sum is formed by a random phase addition of paths that have already been multiplied by the expression:

$$\sin^2\left(\frac{4\pi f z_s z_a}{c^2 t}\right)$$

where f is the frequency, z_s is the source depth, z_a is the animal depth, c is the sound speed and t is the travel time from source to animal along the propagation path. For small arguments of the sine function this expression varies directly as the frequency and the two depths. It is this relationship that causes the propagation field to go to zero as the depths approach the surface or the frequency approaches zero.

A.4.2 Computing Impact Volumes

This section and the next provide a detailed description of the approach taken to compute impact volumes for explosives. The impact volume associated with a particular activity is defined as the volume of water in which some acoustic metric exceeds a specified threshold. The product of this impact volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. The acoustic metric can either be an energy term (weighted or un-weighted energy flux density, either in a limited frequency band or across the full band) or a pressure term (such as peak pressure or positive impulse). The thresholds associated with each of these metrics define the levels at which half of the animals exposed will experience some degree of harassment (ranging from behavioral change to mortality).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range, which is defined as the maximum range at which a particular threshold is exceeded for a single source emission, defines the range to which marine mammal activity is monitored in order to meet mitigation requirements.

The effective energy source level is modeled directly for the sources to be used at the target area. The energy source level is comparable to the model used for other explosives (Arons (1954), Weston (1960), McGrath (1971), Urick (1983), Christian and Gaspin (1974)). The energy source level over a one-third octave band with a center frequency of f for a source with a net explosive weight of w pounds is given by:

$$\text{ESL} = 10\,\log_{10}(0.26f) + 10\,\log_{10}\left(2\,p_{max}^{\;2} / [1/\theta^2 + 4\,\pi^2 f^2]\right) + 197\ \text{dB}$$

where the peak pressure for the shock wave at one meter is defined as

$$p_{max} = 21600\,(w^{1/3} / 3.28)^{1.13}\ \text{psi} \qquad \text{(B-1)}$$

and the time constant is defined as:

$$\theta = [(0.058)\,(w^{1/3})\,(3.28 / w^{1/3})^{0.22}] / 1000\ \text{sec} \qquad \text{(B-2)}$$

For each season and explosive source, the amount of energy in the water column is calculated. The propagation loss for each frequency, expressed as a pressure term, modulates the sound energy found at each point on the grid of depth (uniform spacing) and range (logarithmic spacing). If a threshold is exceeded at a point, the impact volume at an annular sector is added to the total impact volume. The impact volume at a point is calculated exactly using the depth interval, the range interval of the point, and the slice of a sphere centered where the range is zero.

A.4.3 Effects of Metrics on Impact Volumes

The impact of explosive sources on marine wildlife is measured by three different metrics, each with its own thresholds. The energy (SEL) metric, the peak pressure (SPL) metric, and the "modified" positive impulse metric are discussed in this section. The energy metric, using the Type II weighted total energy, is accumulated after the explosive detonation. The other two metrics, peak pressure and positive impulse, are not accumulated but rather the maximum levels are taken.

Energy Metric

The energy flux density is sampled at several frequencies in one-third-octave bands. The total weighted energy flux at each range/depth combination is obtained by summing the product of the Type II frequency weighting function, $W_{II}(f)$, and the energy flux density at each frequency. The Type II weighting function in dB is given by:

$$W_{II}(f) = maximum\big(G_1(f), G_{12}(f)\big), \text{ where}$$

$$G_1(f) = K_1 + 20log_{10}\left[\frac{b_1^2 f^2}{(a_1^2+f^2)(b_1^2+f^2)}\right], \text{ and}$$

$$G_2(f) = K_2 + 20log_{10}\left[\frac{b_2^2 f^2}{(a_2^2+f^2)(b_2^2+f^2)}\right].$$

The component lower cutoff frequencies, a_1, upper cutoff frequencies, b, and gain, K, are a function of the functional hearing group. Parameters used for cetaceans are given in **Table A-4**.

Table A-4. Parameters used for Cetaceans

Functional Hearing Group	K_1(dB)	a_1(Hz)	b_1(Hz)	K_2(dB)	a_2(Hz)	b_2(Hz)
LF cetaceans	-16.5	7	22,000	0.9	674	12,130
MF cetaceans	-16.5	150	160,000	1.4	7,829	95,520
HF cetaceans	-19.4	200	180,000	1.4	9,480	108,820

Note that because the weightings are in dB, we will actually weight each frequency's EFD by $10^{(W_{II}(f)/10)}$, sum the EFDs over frequency and then convert the weighted total energy to back to dB, with level = 10 $\log_{10}$(total weighted EFD).

Peak Pressure Metric

The peak pressure metric is a simple, straightforward calculation at each range/animal depth combination. First, the transmission pressure ratio, modified by the source level in a one-third-octave band, is summed across frequency. This averaged transmission ratio is normalized by the total broadband source level. Peak pressure at that range/animal depth combination is then simply the product of:

- the square root of the normalized transmission ratio of the peak arrival,
- the peak pressure at a range of one meter (given by equation B-1), and
- the similitude correction (given by $r^{\ \ 0.13}$, where r is the slant range).

If the peak pressure for a given grid point is greater than the specified threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

"Modified" Positive Impulse Metric

The modeling of positive impulse follows the work of Goertner (Goertner, 1982). The Goertner model defines a "partial" impulse as

$$\int_0^{T_{min}} p(t)\,\mathrm{d}t$$

where $p(t)$ is the pressure wave from the explosive as a function of time t, defined so that $p(t) = 0$ for $t < 0$. This similitude pressure wave is modeled as

$$p(t) = p_{max}\, e^{\ \ t/\theta}$$

where p_{max} is the peak pressure at one meter (see, equation B-1), and θ is the time constant defined in equation A-2.

The upper limit of the "partial" impulse integral is

$$T_{min} = \min\ \{T_{cut}, T_{osc}\}$$

where T_{cut} is the time to cutoff and T_{osc} is a function of the animal lung oscillation period. When the upper limit is T_{cut}, the integral is the definition of positive impulse. When the upper limit is defined by T_{osc}, the integral is smaller than the positive impulse and thus is just a "partial" impulse. Switching the integral limit from T_{cut} to T_{osc} accounts for the diminished impact of the positive impulse upon the animals lungs that compress with increasing depth and leads to what is sometimes call a "modified" positive impulse metric.

The time to cutoff is modeled as the difference in travel time between the direct path and the surface-reflected path in an isovelocity environment. At a range of r, the time to cutoff for a source depth z_s and an animal depth z_a is

$$T_{cut} = 1/c\ \{\ [r^2 + (z_a + z_s)^2]^{1/2} - [r^2 + (z_a - z_s)^2]^{1/2}\ \}$$

where c is the speed of sound.

The animal lung oscillation period is a function of animal mass M and depth z_a and is modeled as

$$T_{osc} = 1.17\, M^{1/3}\, (1 + z_a/33)^{5/6}$$

where M is the animal mass (in kg) and z_a is the animal depth (in feet).

The modified positive impulse threshold is unique among the various injury and harassment metrics in that it is a function of depth and the animal weight. So instead of the user specifying the threshold, it is computed as $K\,(M)^{1/3}\,(1 + z_a/33)^{1/2}$. The coefficient K depends upon the level of exposure. For the onset of slight lung injury, K is 39.1; for the onset of extensive lung hemorrhaging (1% mortality), K is 91.4.

Although the thresholds are a function of depth and animal weight, sometimes they are summarized as their value at the sea surface for a typical dolphin calf (with an average mass of 12.2 kg). For the onset of slight lung injury, the threshold at the surface is approximately 13 psi-msec; for the onset of extensive lung hemorrhaging (1% mortality), the threshold at the surface is approximately 31 psi-msec.

As with peak pressure, the "modified" positive impulse at each grid point is compared to the derived threshold. If the impulse is greater than that threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

A.5 ESTIMATING ANIMAL HARASSMENT

A.5.1 Distribution of Animals in the Environment

Species densities are usually reported by marine biologists as animals per square kilometer. This gives an estimate of the number of animals below the surface in a certain area, but does not provide any information about their distribution in depth. The impact volume vector specifies the volume of water ensonified above the specified threshold in each depth interval. A corresponding animal density for each of those depth intervals is required to compute the expected value of the number of exposures. The two-dimensional area densities do not contain this information, so three-dimensional densities must be constructed by using animal depth distributions to extrapolate the density at each depth.

The following bottle nose dolphin (summer profile) example demonstrates the method used to account for three-dimensional analysis by merging the depth distributions with user-specifiable surface densities. Bottle nose dolphins are distributed with:

- 19.2% in 0-10 m,
- 76.8% in 10-50 m,
- 1.7% in 50-100 m, and
- 2.3% in 100-165 m.

The impact volume vector is sampled at 30 depths over the maximally 165 meter water column. Since this is a finer resolution than the depth distribution, densities are apportioned uniformly over depth intervals. For example, 19.2% of bottlenose dolphins are in the 0-10 meter interval, so approximately

- 3.84% are in 0-2 meters,
- 3.84% are in 2-4 meters,
- 3.84% are in 4-6 meters,
- 3.84% are in 6-8 meters, and
- 3.84% are in 8-10 meters.

Similarly, 76.8% are in the 10-50 m interval, so approximately

- 9.60% are in 10 - 15 meters,
- 9.60% are in 15 - 20 meters,
- 9.60% are in 20 - 25 meters,
- etc.

A.5.2 Harassment Estimates

Impact volumes for all depth intervals are scaled by their respective depth densities, divided by their depth interval widths, summed over the entire water column and finally converted to square kilometers to create impact areas. The spreadsheet allows a user-specifiable surface density in animals per square kilometer, so the product of these quantities yields expected number of animals in ensonified water where they could experience harassment.

Since the impact volume vector is the volume of water at or above a given threshold per unit operation (e.g. per detonation, or clusters of munitions explosions), the final harassment count for each animal is the unit operation harassment count multiplied by the number of units deployed.

The detonations of explosive sources are generally widely spaced in time and/or space. This implies that the impact volume for multiple firings can be easily derived by scaling the impact volume for a single detonation. Thus the typical impact volume vector for an explosive source is presented on a per-detonation basis.

Table A-4 shows the model outputs (i.e., take estimates) for each species. For thresholds that contain more than one criterion, the one that yields the highest level of take is used for Eglin's request and is highlighted in yellow.

Table A-4. Number of Bottlenose Dolphins and Atlantic Spotted Dolphin Potentially Affected

Munition	NEW (lbs)	Total #	Detonation Scenario	Mortality	Level A Harassment				Level B Harassment		
				Modified Goertner Model 1	Slight Lung Injury	GI Track Injury	PTS		TTS		Behavioral
					Modified Goertner Model 2	237 dB SPL	187 dB SEL	230 dB Peak SPL	172 dB SEL	23 psi	167 dB SEL
Bottlenose Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2	Surface	0.03	0.05	0.24	2.54	0.86	10.54	2.73	16.28
GBU-12 or GBU-54	192	6	Surface	0.05	0.10	0.33	4.23	1.17	19.55	3.37	31.44
AGM-65 (Maverick)	86	6	Surface	0.04	0.07	0.23	2.99	0.82	15.43	2.28	24.97
GBU-39 (LSDB)	37	4	Surface	0.01	0.03	0.10	1.24	0.38	7.82	1.05	12.75
AGM-114 (Hellfire)	20	15	10	0.20	0.64	0.38	4.57	1.64	100.21	5.52	196.34
AGM-175 (Griffin)	13	10	Surface	0.01	0.05	0.14	1.55	0.58	13.85	1.69	22.97
2.75 Rockets	12	100	Surface	0.13	0.46	1.33	14.34	5.55	135.21	16.34	223.15
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.01	0.20	0.66	1.64	102.71	8.56	334.63
Atlantic Spotted Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.01	0.02	0.39	0.05	1.78	0.12	2.79
GBU-12 or GBU-54	192	6	Surface	0.01	0.01	0.03	0.64	0.09	3.18	0.22	5.30
AGM-65 (Maverick)	86	6	Surface	0.00	0.01	0.02	0.45	0.07	2.50	0.18	4.13
GBU-39 (LSDB)	37	4	Surface	0.00	0.01	0.01	0.20	0.04	1.24	0.09	2.08
AGM-114 (Hellfire)	20	15	10	0.06	0.17	0.10	1.29	0.41	21.45	1.30	38.87
AGM-175 (Griffin)	13	10	Surface	0.00	0.01	0.02	0.28	0.07	2.14	0.17	3.70
2.75 Rockets	12	100	Surface	0.04	0.09	0.21	2.62	0.65	20.77	1.66	35.90
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.02	0.15	0.38	0.71	21.09	2.27	53.64
Unidentified[1] Dolphin Exposure Estimates											
GBU-10 or GBU-24	945	2.00	Surface	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.09
GBU-12 or GBU-54	192	6	Surface	0.00	0.00	0.00	0.02	0.00	0.11	0.01	0.18
AGM-65 (Maverick)	86	6	Surface	0.00	0.00	0.00	0.02	0.00	0.08	0.01	0.14
GBU-39 (LSDB)	37	4	Surface	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.07
AGM-114 (Hellfire)	20	15	10	0.00	0.01	0.00	0.04	0.01	0.73	0.04	1.32
AGM-175 (Griffin)	13	10	Surface	0.00	0.00	0.00	0.01	0.00	0.07	0.01	0.13
2.75 Rockets	12	100	Surface	0.00	0.00	0.01	0.09	0.02	0.71	0.06	1.22
PGU-13 HEI 30 mm	0.1	1000	Surface	0.00	0.00	0.00	0.01	0.02	0.72	0.08	1.82

[1]Unidentified dolphins can be either bottlenose or Atlantic spotted dolphin. Mortality and injury estimates in this table are conservatively based on the mass of a newborn Atlantic spotted dolphin.

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APPENDIX C

BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT ASSESSMENT

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

Mr. Bruce W. Hagedorn
Chief, Eglin Natural Resources
501 De Leon Street, Suite 101
Eglin AFB FL 32542-5133

Mr. David Bernhart
Protected Resources Division
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

This letter is being submitted to NOAA Fisheries Service to amend the formal consultation under Section 7 of the Endangered Species Act (ESA) for activities under the Maritime Weapon Systems Evaluation Program (WSEP) Operational Testing. The Biological Assessment (BA) which analyzes potential impacts to loggerhead sea turtles, Kemp's ridley sea turtles, leatherback sea turtles, and green sea turtles, as well as essential fish habitat, was submitted electronically on August 5, 2014. An email confirmation of receipt was received by Eglin Natural Resources (NR) staff on August 6, 2014 (Tracking number: SER-2014-14835). Since then, the proponent has requested to update the proposed action, specifically to increase the number of select munitions and modify the detonation scenario of one of the munitions, based on updated Department of Defense (DoD) testing requirements and weapons manufacturing availability. This letter describes the new Proposed Action and addresses the increased level of take associated with the changes. All other components of the proposed action including time, location, targets, and proposed mitigations and monitoring procedures will remain the same.

The proposed action involves the use of multiple types of live munitions against small boat targets in the Eglin Gulf Test and Training Range (Gulf of Mexico). A variety of live bombs/missiles, rockets and gunnery rounds (7.62 millimeter [mm] and 30 mm) will be deployed from several aircraft platforms including fighter jets, bombers, and gunships over a timeframe of a few weeks in February and March 2015, with multiple munitions being released per day. Net explosive weight of all weapons ranges from 0.1 to 945 pounds. Testing will be conducted in the Eglin Gulf Test and Training Range, approximately 17 miles offshore from Santa Rosa Island, as shown in Figures 1-1 and 1-2 in the BA. Table 1 shows the level of testing that was included in the original Proposed Action and what is being changed as part of this amendment. Changes are indicted in red text.

Table 1. Updated Maritime WSEP Munitions

Type of Munition	NEW	Original Proposed Action		New Proposed Action	
		Total #	Detonation Type	Total #	Detonation Type
GBU-10 or GBU-24	945 lbs	2	Surface	2	Surface
GBU-12 or GBU-54	192 lbs	6	Surface	6	Surface
AGM-65 (Maverick)	86 lbs	6	Surface	6	Surface
CBU-105 (WCMD)	83 lbs	2	Airburst	**4**	Airburst
GBU-38 (Laser SDB)	37 lbs	4	Surface	4	Surface
AGM-114 (Hellfire)	20 lbs	6	Surface	**15**	**Subsurface (10 msec delay)**
AGM-175 (Griffin)	13 lbs	6	Surface	**10**	Surface
2.75 Rockets	12 lbs	100	Surface	100	Surface
PGU-12 HEI 30 mm	0.1 lbs	1,000	Surface	1,000	Surface
7.62 mm/.50 cal	N/A	5,000	Surface	5,000	Surface

AGM = air-to-ground missile; cal = caliber; CBU = Cluster Bomb Unit; GBU = Guided Bomb Unit; HEI = high explosive incendiary; lbs = pounds; mm = millimeters; msec = millisecond; N/A = not applicable; NEW = net explosive weight; PGU = Projectile Gun Unit; SDB = small diameter bomb; WCMD = wind corrected munition dispenser

As indicated above, the total number of live munitions being released has increased including two more CBU-105s, nine more AGM-114s, and four more AGM-175s. In addition, all the AGM-114 missiles will include a delayed fuze such that each missile will detonate approximately 10 milliseconds (msec) after hitting the target, or at an approximate water depth of 10 feet (ft). This amendment letter addresses the increased level of takes associated with higher numbers of munitions as well as the resulting change in the zone of influence (ZOI) associated with the AGM-114 subsurface detonations.

All criteria, thresholds, and metrics used to determine mortality, physiological, and behavioral impacts to sea turtles are the same as what was detailed in the BA. Furthermore, all sea turtle density estimates used in the BA are still applicable to this amendment since neither time of year nor location has changed. Aside from updating numbers of specific munitions, the only major change in estimating takes is to incorporate the appropriate ZOI radii for mortality, physiological, and behavioral thresholds resulting from an AGM-114 missile detonating 10 ft below the water surface. The acoustic model used to calculate takes for the Proposed Action does not contain this specific munition/detonation scenario, therefore the winter radii associated with a munition with a larger NEW (GBU-38) detonating 10 ft underwater is used instead. This approach is considered highly conservative, given the differences in NEW between the two munitions, however Eglin NR feels this is in the best interest of the Air Force. This mission is considered high priority with a firm deadline. To avoid time delays associated with modifying the acoustic model, Eglin NR wishes to proceed with this approach to meet the mission's tight timeline. Table 2 shows the differences between the winter threshold radii for an AGM-114 surface detonation compared to a GBU-38 subsurface (10-ft depth) detonation. Since the Behavioral threshold contains dual criteria, the metric that yields the larger radius is used to determine takes and is **bolded** in the table.

Table 2. Winter Threshold Radii (in meters) for Surface Detonation vs. Subsurface (10-ft depth) Detonation

Munition	NEW (lbs)	Detonation Scenario	Mortality	Physiological	Behavioral	
			30.5 psi-msec	13 psi-msec	182 dB EFD*	23 psi
AGM-114 (Hellfire)	20	Surface	46	105	**413**	353
GBU-38 (JDAM)	189	Subsurface (10 msec delay)	278	529	**1,126**	749

*In greatest 1/3-octave band above 10 Hz or 100 Hz
AGM = air-to-ground missile; dB = decibels; EFD = energy flux density; GBU = guided bomb unit; JDAM = joint direct attack munition; lbs = pounds; msec = millisecond; psi = pounds per square inch

Table 3 compares take estimates for each species between those included in the original BA with what is being requested with this amendment. The new take estimates are indicated in red text. The numbers represent total impacts for all detonations combined and do not take into account the implementation of the monitoring and mitigation measures outlined in Chapter 5 of the BA.

Table 3. Number of Sea Turtles Potentially Affected by Maritime WSEP Test Missions

Sea Turtle Species	Number of Impacts, Mortality		Number of Impacts, Physiological		Number of Impacts, Behavioral	
	Original BA	Amended BA	Original BA	Amended BA	Original BA	Amended BA
Loggerhead	0.371	1.426	1.023	3.421	39.811	92.100
Kemp's ridley	0.299	1.150	0.826	2.760	32.119	74.305
Leatherback	0.128	0.512	0.327	1.184	12.890	28.510
Green	0.027	0.103	0.074	0.246	2.868	6.634
TOTAL	**0.825**	**3.191**	**2.25**	**7.611**	**87.688**	**201.549**

As shown in Table 3, take estimates have increased significantly with the new proposed action. This is mostly due to the conservative approach in modeling the 15 AGM-114 subsurface detonations with a larger munition. These numbers assume the maximum level of impacts without any of the mitigation measures or monitoring procedures detailed in Chapter 5 of the BA being employed; none of which are proposed to change as part of this amendment.

Although the number of sea turtles potentially impacted has increased under the new proposed action, Eglin NR believes it has not increased to the level that would jeopardize the population of any of the sea turtle species. Therefore Eglin NR has determined that the new proposed action **may affect, and is likely to adversely affect** loggerhead, Kemp's ridley, leatherback, and green sea turtles. Adherence to the mitigation measures and monitoring procedures outlined in Chapter 5 of the BA is expected to significantly reduce the potential for adverse impacts to sea turtle populations.

If you have any questions regarding this amendment letter or any of the proposed activities, please do not hesitate to contact either Mr. Jeremy Preston (850) 883-1153 or myself at (850) 882-8421.

Sincerely,

BRUCE W. HAGEDORN, GS-13

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

Mr. Bruce W. Hagedorn
Acting Chief, Eglin Natural Resources
501 De Leon Street, Suite 101
Eglin AFB FL 32542-5133

Mr. David Bernhart
Protected Resources Division
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

AUG -5 2014

Dear Mr. Bernhart:

This letter is being submitted to NOAA Fisheries Service to initiate a formal consultation under Section 7 of the Endangered Species Act (ESA) for activities under the Maritime Weapon Systems Evaluation Program (WSEP) Operational Testing. The Biological Assessment analyzes potential impacts to loggerhead sea turtles, Kemp's ridley sea turtles, leatherback sea turtles, and green sea turtles, as well as essential fish habitat.

The Proposed Action involves the use of multiple types of live munitions against small boat targets in the Eglin Gulf Test and Training Range (Gulf of Mexico). Net explosive weight of the weapons ranges from 0.1 to 945 pounds, and detonations will occur at least 20 feet above the water surface or at the water surface. The proposed action includes deployment of 36 live bombs/missiles, 100 rockets and 6,000 live gunnery rounds (7.62 millimeter [mm] and 30 mm) over a timeframe of a few weeks in February and March 2015, with multiple munitions being released per day. Missions are firmly scheduled to begin on February 6, 2015. The ordnance may be delivered by multiple types of aircraft including fighter jets, bombers, and gunships.

Eglin Natural Resources has determined that the Proposed Action **may affect, and is likely to adversely affect** loggerhead, Kemp's ridley, leatherback, and green sea turtles and **will not adversely affect** essential fish habitat. Adherence to the mitigation measures outlined in Chapter 5 of the BA is expected to significatnly reduce the potential for adverse impacts to sea turtle populations.

If you have any questions regarding this Biological Assessment or any of the proposed activities, please do not hesitate to contact either Mr. Jeremy Preston (850) 883-1153 or myself at (850) 882-8421.

Sincerely,

Bruce Hagedorn

BRUCE W. HAGEDORN, GS-12

ATTACHMENT: Maritime Weapon Systems Evaluation Program Operational Testing Biological Assessment and Essential Fish Habitat Assessment

MARITIME WEAPON SYSTEMS EVALUATION PROGRAM OPERATIONAL TESTING

FINAL BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT ASSESSMENT

EGLIN AIR FORCE BASE, FLORIDA

Submitted To:

Protected Resources Division &
Habitat Conservation Division
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg FL 33701

Submitted By:

Department of the Air Force
96 CEG/CEIEA
Natural Resources Office
501 DeLeon Street, Suite 101
Eglin AFB, FL 32542-5133

JULY 2014

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

96 TW	96th Test Wing
AFB	Air Force Base
AGL	Above Ground Level
AGM	Air-To-Ground Missile
BA	Biological Assessment
CBU	Cluster Bomb Unit
CV	Coefficient of Variation
dB re 1 μPs^2-s	Decibel referenced to one squared microPascal-second
E	Endangered
EA	Environmental Assessment
EFD	Energy Flux Density
EFH	Essential Fish Habitat
EGTTR	Eglin Gulf Test and Training Range
EO	Executive Order
ESA	Endangered Species Act
FMC	Fishery Management Council
FMP	Fishery Management Plan
ft	Feet
GBU	Guided Bomb Unit
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GSMFC	Gulf States Marine Fisheries Commission
HAPC	Habitat Area of Particular Concern
HEI	High Explosive Incendiary
in	Inch
in-lb/in^2	Inch-pound per square inch
J/in^2	Joules per square inch
kg	Kilogram
KIAS	Knots Indicated Air Speed
km	Kilometer
km^2	Square Kilometer
lbs	Pounds
m	Meters
mi	Mile
min	Minute
mm	Millimeter
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEW	Net Explosive Weight
NM	Nautical Mile
NM^2	Square Nautical Mile
NMFS	National Marine Fisheries Service
Pa-s	Pascal-second
PGU	Projectile Gun Unit
Psi-msec	Pounds per square inch-millisecond
SEFSC	Southeast Fisheries Science Center
SST	Sea Surface Temperature
T	Threatened
TA	Test Area
TTP	Tactics, Techniques, and Procedures
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
WSEP	Weapon Systems Evaluation Program
ZOI	Zone of Impact

EXECUTIVE SUMMARY

The purpose of this document is to support the consultation process for the Endangered Species Act (ESA) for the preferred alternative of the Maritime Weapon Systems Evaluation Program (WSEP) Operational Testing Environmental Assessment. Compliance with respect to the Marine Mammal Protection Act will be accomplished by submitting an incidental take permit request (Incidental Harassment Authorization).

Maritime WSEP test missions involve the use of multiple types of live munitions against small boat targets in the Eglin Gulf Test and Training Range (Gulf of Mexico). Net explosive weight of the weapons ranges from 0.1 to 945 pounds and detonations will occur at least 20 feet above the water surface or at the water surface. There are no sub-surface detonations planned. Maritime WSEP Operational Testing includes deployment of 36 live bombs/missiles, 100 rockets, and 6,000 live gunnery rounds (30 millimeter [mm] and 7.62 mm) over a timeframe of a few weeks in February and March 2015, with multiple munitions being released per day. The ordnance may be delivered by multiple types of aircraft including fighter jets, bombers, and gunships. The targets would consist of stationary, towed, and remotely controlled boats. Some boats would contain simulated crews made of plywood. The test location is approximately 17 miles offshore of Santa Rosa Island, in a water depth of 35 meters (115 feet).

The potential takes outlined in Section 4 represent the maximum expected number of animals that could be affected. Mitigation measures will be employed in an effort to decrease the number of animals affected. Maritime WSEP Operational Testing is anticipated to affect sea turtle species. Acoustic modeling of detonations indicates the potential for lethality, injury, and non-injurious harassment to sea turtles in the absence of mitigation measures. Mortality is considered unlikely for green turtles. Mortality is calculated as less than 0.4 animals each for loggerhead, Kemp's ridley, and leatherback turtles. It is expected that, with implementation of the management practices outlined in Chapter 5, potential impacts would be mitigated to the point that there would be no mortality takes. A total of about 2.3 turtles could be exposed to physiological impacts, and about 88 turtles could experience behavioral effects.

Maritime WSEP tests are not likely to adversely affect the Gulf sturgeon or smalltooth sawfish since these species predominantly occur outside the project area. Critical habitat for the Gulf sturgeon is located within 1 nautical mile of the shore, and does not fall within the footprint of the test area. Similarly, newly designated critical habitat for loggerhead sea turtles has been established, however none of the marine components coincide with the location of the proposed action. Maritime WSEP testing is not likely to adversely modify Gulf sturgeon critical habitat or loggerhead sea turtle critical habitat. Items and materials expended into the test area would not result in any adverse impacts to the chemical or biological environments that would reduce the quality and/or quantity of EFH. Hardbottom habitats and artificial reefs would be avoided to alleviate any potential impacts to protected habitat.

Marine mammal species protected under the ESA (sperm whale and Florida manatee) are not expected to occur in the test area. Three protected bird species (piping plover, wood stork, and bald eagle) occur in the Florida Panhandle region at certain times of the year. Direct impacts to bird species would be limited to encounters of birds flying through the test area at the same time a detonation occurred, and to direct strikes by weapons in flight. The likelihood of such scenarios is considered low. In addition, these bird species are primarily seen near land and are unlikely to occur 17 miles from shore in the test area. Piping plover critical habitat, which is designated on Santa Rosa Island, would not be affected by test activities.

The NMFS would be notified immediately if any of the actions considered in this biological assessment were modified or if additional information on listed species became available, as a re-initiation of consultation may be required. If impacts to listed species occurred beyond what has been considered in this assessment, all operations would cease and the NMFS would be notified. Any modifications or conditions resulting from consultation with the NMFS would be implemented prior to commencement of activities.

1. INTRODUCTION

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

This Biological Assessment (BA) and Essential Fish Habitat (EFH) Assessment is being submitted to fulfill requirements under Section 7 of the Endangered Species Act (ESA) and the Magnuson-Stevens Fishery Conservation and Management Act (MSA). This report addresses Air Force Maritime Weapon System Evaluation Program (WSEP) Operational Testing activities conducted in the Eglin Gulf Test and Training Range (EGTTR). The actions include air-to-surface test missions involving detonations of live munitions above the water and at the water surface with the potential to affect species listed under the ESA. This BA and EFH Assessment document is meant to initiate the formal consultation process with the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the ESA and the requirements of the MSA. The objectives of this BA and EFH Assessment are to:

- Document all federally listed T&E species and EFH that occur within the test area.
- Identify the actions, as described in the associated Environmental Assessment (EA), which have the potential to impact, either beneficially or adversely, those documented species and EFH.
- Determine and quantify to the extent possible what effects these activities would likely have on federally listed species and EFH.

The purpose of the Proposed Action is to continue the development of tactics, techniques and procedures (TTP) for U.S. Air Force (USAF) strike aircraft to counter small maneuvering maritime targets in order to better protect U.S. and other vessels or assets from small boat threats. The Proposed Action is needed because current weaponeering systems do not accurately model air-launched weapon detonations on or above water. Damage effects under these conditions must be known to generate TTPs to engage small moving boats. The need to conduct this type of testing has arisen in response to increasing threats at sea posed by operations conducted from small boats.

There has been limited Air Force (AF) aircraft and munitions testing on engaging and defeating small boat threats. Small boats can carry a variety of weapons, can be employed in large or small numbers by many nations and groups, and may be difficult to locate, track, and engage in the marine environment. Therefore, the AF proposes to employ live munitions against boat targets in the GOM in order to continue development of TTPs to train USAF strike aircraft to counter small maneuvering surface vessels. More detailed information regarding the Proposed Action is provided in Chapter 2.

1.2 SCOPE OF THE PROPOSED ACTION

Maritime WSEP missions are scheduled to occur over a period of a few weeks in February/March 2015 with missions firmly scheduled to begin on February 6, 2015. Missions would occur on weekdays during daytime hours only, with multiple live munitions being released each day. All activities would take place within the EGTTR, which is defined as the airspace over the Gulf of Mexico (GOM) controlled by Eglin Air Force Base (AFB), beginning at a point three nautical miles (NM) from shore. The EGTTR is subdivided into blocks consisting of Warning Areas W-155, W-151, W-470, W-168, and W-174, as well as Eglin Water Test Areas 1 through 6 (Figure 1-1). Warning Area W-155, which is controlled by the Navy, is used occasionally to support Eglin missions. Over 102,000 square nautical miles (NM^2) of GOM surface waters exist under the EGTTR air space. However, activities described in this document will occur only in W-151, and specifically in sub-area W-151A (Figure 1-2). Descriptive information for all of W-151 and for W-151A is provided below.

The specific planned mission location is approximately 17 miles offshore from Santa Rosa Island, in nearshore waters of the continental shelf. Water depth is about 35 meters (115 feet). Test events would be conducted in various sea states and weather conditions, up to a wave height of four feet.

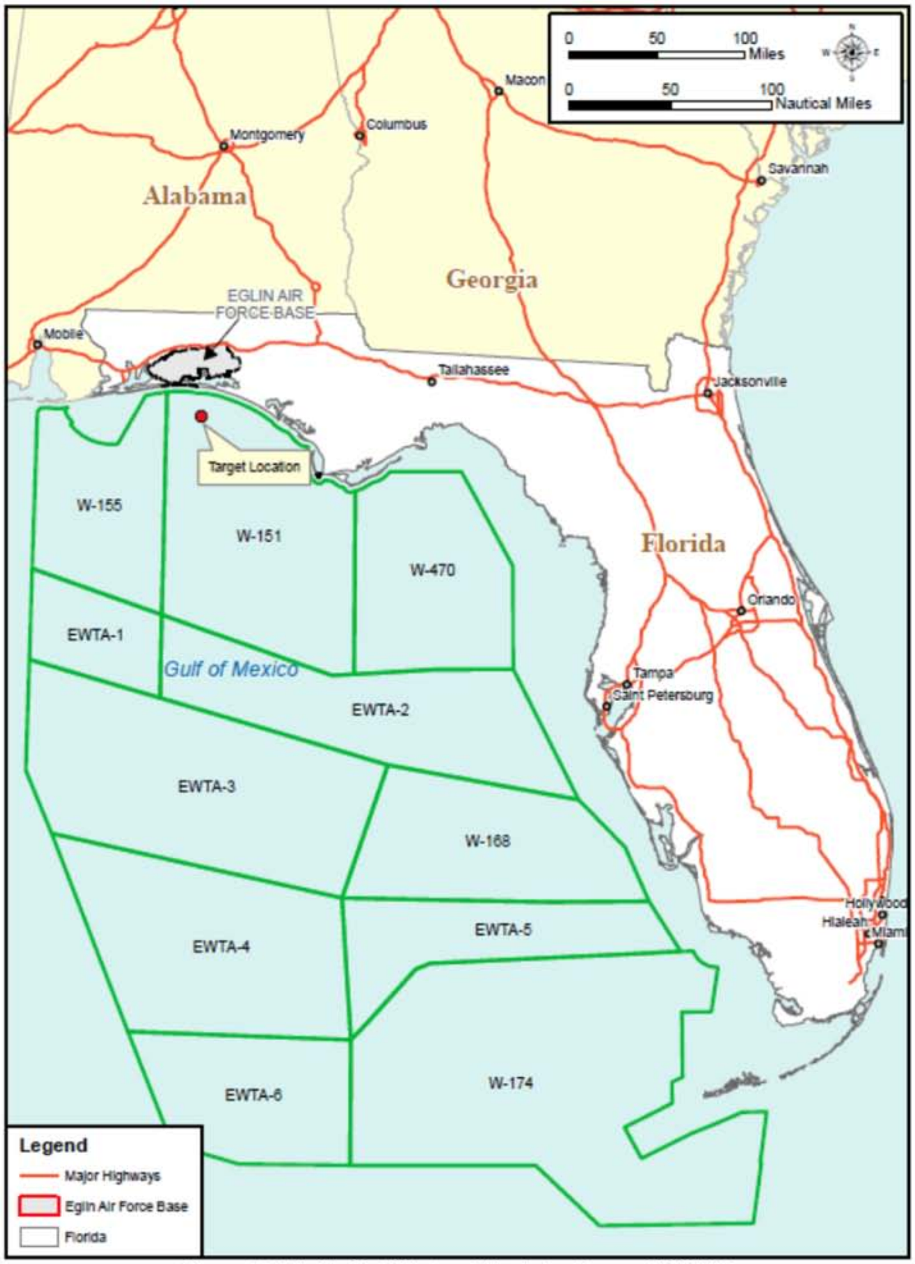

Figure 1-1. Eglin Gulf Test and Training Range (EGTTR)

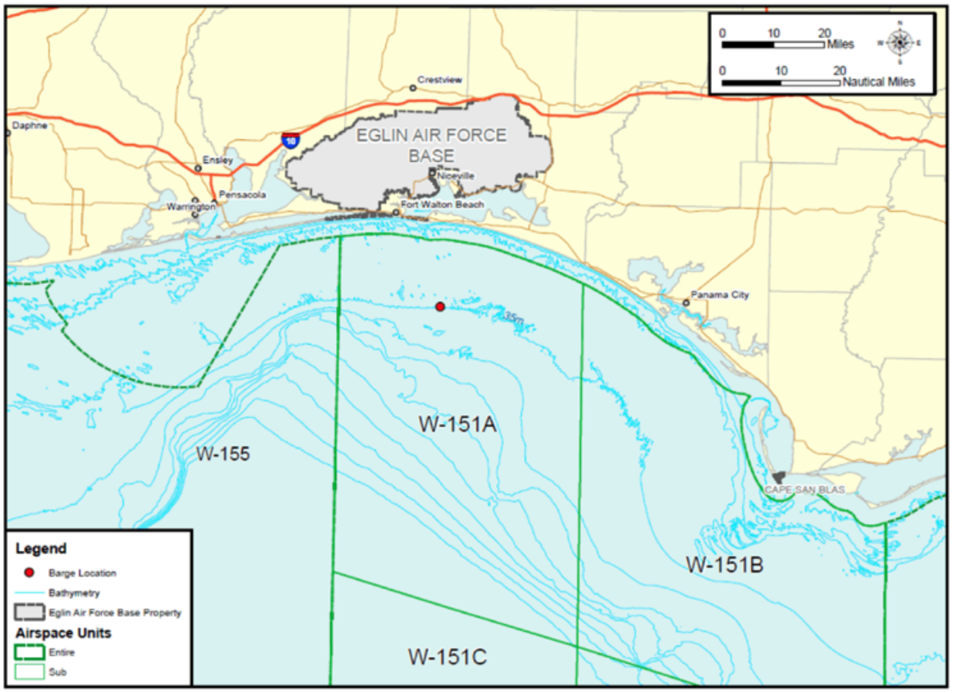

Figure 1-2. Maritime WSEP Operational Testing Location in W-151A

W-151

The inshore and offshore boundaries of W-151 are roughly parallel to the shoreline contour. The shoreward boundary is 3 NM from shore, while the seaward boundary extends approximately 85 to 100 NM offshore, depending on the specific location. W-151 covers a surface area of approximately 10,247 NM^2 (35,145 square kilometers [km^2]), and includes water depths ranging from about 20 to 700 meters (66 to 2,297 feet). This range of depth includes continental shelf and slope waters. Approximately half of W-151 lies over the shelf.

W-151A

W-151A extends approximately 60 NM offshore and has a surface area of 2,565 NM^2 (8,797 km^2). Water depths range from about 30 to 350 meters (98 to 1,148 feet) and include continental shelf and slope zones. However, most of W-151A occurs over the continental shelf, in water depths less than 250 meters (820 feet). Maritime WSEP operations will occur in the shallower, northern inshore portion of the sub-area, in a water depth of about 35 meters (115 feet).

1.3 FEDERAL SPECIES CONSIDERED

Several species of sea turtles and marine mammals occur in the northeastern GOM and were considered for potential impacts in this BA. Two federally listed fish, the Gulf sturgeon and the smalltooth sawfish, also occur in the Gulf. In addition, three protected bird species may occur near the test area (the bald eagle has been removed from the endangered species list but remains protected under the Bald and Golden Eagle Protection Act). All marine mammals receive federal protection under the Marine Mammal Protection Act of 1972 (MMPA). Impacts to marine mammals have been addressed in an Incidental Harassment Authorization request submitted to the Office of Protected Resources of NMFS. No ESA-listed marine mammals would be affected given the location of the Proposed Action on the northeastern continental shelf, approximately 17 miles from shore in a water depth of 35 meters. The federally listed threatened (T) and endangered (E) species considered for potential impact are:

Sea Turtles

- Atlantic loggerhead sea turtle (*Caretta caretta*), T
- Atlantic green sea turtle (*Chelonia mydas*), E
- Kemp's ridley sea turtle (*Lepidochelys kempii*), E
- Leatherback sea turtle (*Dermochelys coriacea*), E

Fish

- Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), T
- Smalltooth sawfish (*Pristis pectinata*), E

Birds

- Piping plover (*Charadrius melodus*)
- Wood stork (*Mycteria Americana*)
- Bald eagle (*Haliaeetus leucocephalus*)

Additional discussion of these species, as well as an explanation for excluding some species, is provided in Chapter 3.

1.4 APPLICABLE REGULATORY REQUIREMENTS AND COORDINATION

In addition to Executive Order (EO) 12114 (1979), "Environmental Effects Abroad of Major Federal Actions," and the National Environmental Policy Act of 1969 (Section 1.1), the following applicable acts and regulations were also considered.

- Endangered Species Act (ESA): The purpose of the ESA of 1973, as amended, is to protect fish, wildlife, and plant species currently in danger of extinction and those species that may become so in the foreseeable future. The ESA states that "…it is unlawful for any person subject to the jurisdiction of the United States to…*take* any such species within the United States or the territorial sea of the United States" or *take* any such species upon the high seas." The term *take* is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Each federal agency is required to review its actions at the earliest possible time to determine whether any action it authorizes, funds, or carries out may affect listed species or critical habitat. If such a determination is made, consultation with the appropriate agency is required.

The U.S Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share the responsibilities for administering the Act, with NMFS generally coordinating ESA activities for marine and anadromous species (e.g., sturgeon, sawfish) and the USFWS coordinating ESA activities for terrestrial and freshwater species. ESA responsibilities regarding sea turtles are further split between the two agencies; NMFS coordinates activities that could impact turtles in the marine environment, while the USFWS is responsible for nesting turtles and turtle nest sites on beaches. Activities associated with Maritime WSEP Operational Testing would only occur in the marine environment; thus, consultation with the NMFS is applicable in this situation.

- Magnuson-Stevens Fishery Conservation and Management Act (MSA), including Essential Fish Habitat: The Magnuson-Stevens Act requires that federal agencies consult with NMFS for any actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect EFH, which may include any substrate or waters necessary for fish to feed, breed, spawn, or grow to maturity. Migratory routes such as rivers or passes to and from spawning grounds must also be considered. "Substrate" includes sediment, hardbottom, underwater structures, and associated biological communities, including jetties, artificial reefs, and shipwrecks. Biological communities are broadly defined as well, including mangroves, tidal marshes, oyster beds, mud and clay burrows, coral reefs, and submerged aquatic vegetation. "Waters" are defined as aquatic areas and their chemical and biological properties (i.e., water quality) and may include open waters, wetlands, estuaries, and rivers. Thus, analyses of effects should consider physical, chemical, and biological properties of water such as nutrients, turbidity, and oxygen concentrations. Impacts that result in a reduction of quality or quantity of EFH are defined as adverse. Adverse effects may be direct, such as physical disruption or contamination, or indirect, such as loss of prey or reduction in fecundity. They may be narrow in scope, affecting only a particular site, or wide-ranging, affecting an entire habitat.

  If consultation is required for potential adverse effects to EFH, NMFS would provide recommendations to the federal agency for avoiding or mitigating potential impacts of the activity to EFH. The federal agency may then respond to NMFS, describing which procedures it would propose to reduce EFH impacts and, if different from NMFS' procedures, an explanation for the differences.

2. DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action is for Eglin AFB (86th Fighter Weapons Squadron [86 FWS]) to conduct live ordnance testing in the GOM as part of the Maritime WSEP Operational Testing. The proposed missions are very similar to the recently conducted Maritime Strike Operations (Maritime Strike Biological Opinion [SER-2012-9587] dated 6 May 2013). The Maritime WSEP test objectives are to evaluate maritime deployment data, evaluate TTPs, and to determine the impact of TTPs on Combat AF training.

Multiple live munitions and aircraft types will be used to meet the objectives of the Maritime WSEP Operational Tests (Table 2-1). Munition types include bombs, missiles, and gunnery rounds. Because the tests will focus on weapon/target interaction, no particular aircraft will be specified for a given test as long as it meets the delivery parameters. The munitions will be deployed against static, towed, and remotely controlled boat targets. Static and controlled targets consist of stripped boat hulls with plywood simulated crews and systems. Damaged boats will be recovered for data collection. Test data collection and operation of remotely controlled boats will be conducted from an instrumentation barge known as the Gulf Range Armament Test Vessel (GRATV) anchored on-site, which will also provide a platform for cameras and weapon-tracking equipment. Target boats will be positioned approximately 600 feet from the GRATV, depending on the munition.

Table 2-1. Live Munitions and Aircraft

Munitions	Aircraft (not associated with specific munitions)
GBU-10 laser-guided Mk-84 bomb	F-16C fighter aircraft
GBU-24 laser-guided Mk-84 bomb	F-16C+ fighter aircraft
GBU-12 laser-guided Mk-82 bomb	F-15E fighter aircraft
GBU-54 Laser Joint Direct Attack Munition, laser-guided Mk-82 bomb	A-10 fighter aircraft
CBU-105 (WCMD)	B-1B bomber aircraft
AGM-65 Maverick air-to- surface missile	B-52H bomber aircraft
GBU-38 Small Diameter Bomb II (Laser SDB)	MQ-1/9 unmanned aerial vehicle
AGM-114 Hellfire air-to-surface missile	AC-130 gunship
AGM-175 Griffin air-to-surface missile	
2.75 Rockets	
PGU-13/B high explosive incendiary 30 mm rounds	
7.62 mm/.50 Cal	

AGM = air-to-ground missile; Cal = caliber; CBU = Cluster Bomb Unit; GBU = Guided Bomb Unit; Mk = Mark; mm = millimeters; PGU = Projectile Gun Unit

Live testing will include two fuzing options: detonation above the water surface and at the water surface. No subsurface detonations are planned. The number of each type of munition, height of detonation, explosive material, and net explosive weight (NEW) of each munition associated with Maritime WSEP Operational Testing is provided in Table 2-2. The quantity of live munitions tested is considered necessary to provide the intended level of tactics and weapons evaluation, including a number of replicate tests sufficient for an acceptable statistical confidence level regarding munitions capabilities.

Table 2-2. Maritime WSEP Munitions

Type of Munition	Total # of Live Munitions	Detonation Type	Warhead – explosive material	Net Explosive Weight per Munition
GBU-10 or GBU-24	2	Surface	MK-84 - Tritonal	945 lbs
GBU-12 or GBU-54	6	Surface	MK-82 - Tritonal	192 lbs
AGM-65 (Maverick)	6	Surface	WDU-24/B penetrating blast-fragmentation warhead	86 lbs
CBU-105 (WCMD)	2	Airburst	10 BLU-108 sub-munitions each containing 4 projectiles, parachute, rocket motor and altimeter	83 lbs
GBU-38 (Laser Small Diameter Bomb)	4	Surface	AFX-757 (Insensitive munition)	37 lbs
AGM-114 (Hellfire)	6	Surface	High Explosive Anti-Tank (HEAT) tandem anti-armor metal augmented charge	20 lbs
AGM-175 (Griffin)	6	Surface	Blast fragmentation	13 lbs
2.75 Rockets	100	Surface	Comp B-4 HEI	Up to 12 lbs
PGU-12 HEI 30 mm	1,000	Surface	30 x 173 mm caliber with aluminized RDX explosive. Designed for GAU-8/A Gun System	0.1 lbs
7.62 mm/.50 Cal	5,000	Surface	N/A	N/A

AGL = above ground level; AGM = air-to-ground missile; CBU = Cluster Bomb Unit; GBU = Guided Bomb Unit; JDAM = Joint Direct Attack Munition; LJDAM = Laser Joint Direct Attack Munition; mm = millimeters; lbs = pounds; PGU = Projectile Gun Unit; HEI = high explosive incendiary

A human safety zone will be established around the area prior to each live mission, and will be enforced by a large number of safety boats (approximately 20 to 25). The size of this zone will vary, depending upon the particular munition used in a given test event. A composite safety footprint was developed, which incorporates all munitions being deployed and averages them out. The composite safety footprint consisted of approximately a 19 mile-wide diameter circle (9.5 mile-wide radius from the detonation point). Non-participating vessels (such as recreational and commercial fishing vessels) will be excluded from entering the safety footprint while it is active, which is expected to be up to four hours per mission on test days. The Eglin Safety Office will position the safety support vessels around the safety footprint to ensure commercial and recreational boats do not accidentally enter the area. Before delivering the ordnance, mission aircraft may make a dry run over the target area to ensure that it is clear of non-participating vessels, although this action would not necessarily be performed before all releases.

In addition, measures designed to avoid or minimize impacts to marine species have been developed in cooperation with the NMFS. A separate zone around the target will be established for marine species protection, based on the distance to which energy- and pressure-related impact zones could extend for the various types of ordnance listed in Tables 2-2 and 2-3. This zone will not be the same size as the human safety zone. Trained marine species observers will survey the species protection zone and a buffer zone before each mission. In addition, mission-related personnel will be in the area performing various tasks and will observe for protected marine species as feasible during preparation activities.

Description of the Proposed Action

At least two ordnance delivery aircraft will participate in each live weapon release mission. Prior to the test, AF pilots aboard mission aircraft may make a dry run over the target area to ensure it is clear of non-participating vessels before ordnance is deployed. Due to the limited flyover duration and potentially high speed and altitude of the aircraft, pilots will not survey for marine species.

In addition to surveys conducted from boats, one to three video cameras will be positioned on the GRATV anchored on-site. The camera(s) will be used to document the weapons' performance against the targets and to monitor for the presence of protected species. An Eglin Natural Resources representative will be located in Eglin's Central Control Facility (CCF), along with mission personnel, to view the video feed before and during test activities. Missions would not proceed until the target area is clear of protected marine species. A detailed description of mitigation measures is provided in Chapter 5.

After each mission, a team of AF personnel aboard surface vessels would collect debris and retrieve damaged targets from the mission site. These vessels would be separate from dedicated protected species observer vessels that would conduct the post-mission surveys to assess potential impacts from the mission. On test days involving the release of CBU-105s, the Eglin AF Explosive Ordnance Disposal (EOD) team would be on hand to inspect floating targets and identify and render safe any unexploded ordnance (UXO), including fuzes, classified components, and intact munitions. UXO that cannot be removed would be detonated in place using between one and four 1.25-lb blocks of C-4 explosives. Once the area has been cleared by the Eglin EOD team (typically one hour after the release of CBU-105s), the range will be reopened for the debris clean-up team and the protected species survey vessels.

3. SPECIES AND ESSENTIAL FISH HABITAT DESCRIPTIONS

Species protected under the ESA and potentially occurring in the northern GOM include four sea turtle species, one cetacean, one sirenian, two fish, and three bird species. The hawksbill sea turtle (*Eretmochelys imbricata*) inhabits the GOM, but is considered to have limited occurrence near the mission area. For example, there were only five reported hawksbill strandings in the action area during the ten-year period from 2003-2012 (NMFS, 2013). Therefore, the hawksbill is not included in this document. All other sea turtle species have potential occurrence within the Maritime WSEP mission area. The ESA-listed sperm whale (*Physeter macrocephalus*) has consistent occurrence in portions of the northern Gulf. However, sperm whales are found further out on the continental slope in waters deeper than 600 meters (1,969 feet). All cetaceans are protected under the Marine Mammal Protection Act of 1972; potential impacts to these species have been addressed in an Incidental Harassment Authorization request to the NMFS Office of Protected Resources.

The sirenian is the federally endangered Florida manatee (*Trichechus manatus latirostrus*). Manatees primarily inhabit coastal and inshore waters, and are rarely sighted offshore. Maritime WSEP missions will be conducted approximately 17 miles off the coast. Therefore, manatee occurrence is considered unlikely and this species is not discussed further.

The smalltooth sawfish (*Pristis pectinata*) is a federally endangered fish species. Once common throughout the GOM from Texas to Florida, the current distribution is generally restricted to the southern half of peninsular Florida. The species is only commonly found in the Everglades and in shallow areas with mangrove forests in Florida Bay and the Florida Keys, as well as off southern Florida. Sawfish reside typically within 1.9 km (1 NM) of the shore in estuaries, shallow banks, sheltered bays, and river mouths with sandy and muddy bottoms. Occasionally, they are found offshore on reefs or wrecks and over hard or mud bottoms. Only a remote chance exists for this species to be in the mission area, and it is therefore excluded from further analysis.

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), listed as federally threatened, is an anadromous fish that spends part of its life cycle in the marine environment and part in riverine environments. Adult Gulf sturgeon occur in fresh water during the warm months, when spawning occurs, and migrate into estuarine and marine environments in the fall to forage and overwinter. The results of research conducted by Eglin AFB show that the fish generally begin outmigration in October, and movement back toward the river systems begins in March. The Gulf sturgeon is generally considered to occur near the shoreline, although factors such as water depth or prey distribution may be more important factors than distance from land. Gulf sturgeon have been observed off the Suwannee River area as far as 16.7 kilometers (10 miles) from shore (USFWS and NMFS, 2003). The USFWS has designated critical habitat for the Gulf sturgeon in the GOM (in addition to several rivers and bays). This protected habitat encompasses coastal waters from the mean high water line and out to 1.9 km (1 NM) offshore.

Eglin AFB has studied sturgeon occurrence and distribution in areas potentially affected by military activities through funding provided by the Department of Defense Legacy Resource Management Program. Results show that the fish generally begin outmigration in October and have departed the river systems by November. After moving into the Gulf of Mexico, sturgeon may move east or west. The majority of sturgeon tagged for this study migrated to the west, congregating in the nearshore waters of the Alabama and Mississippi Gulf Coasts, which is well-outside the footprint of Eglin-scheduled activities. A small number of those moving east appeared to remain in the vicinity of Eglin property but a few were detected as far as St. Joseph Peninsula, Florida. Movement back toward the river systems generally begins in March. The amount of sturgeon activity detected near Eglin's Santa Rosa Island property appears to be predominantly from sturgeon tagged in the Choctawhatchee River. Initial results indicated that sturgeon remain very close to shore off Santa Rosa Island (within 1,000 meters). However, a more offshore distribution was noted during the last year of study, when over 80 percent of sturgeon detections were recorded at a receiver 1,250 meters from shore. Given the commonly cited detection range of 500 meters, it is assumed that some number of sturgeon were at least 1,750 meters (approximately 1 mile) from shore. The extent of the offshore distribution could not be discerned because receivers were not placed farther out in the Gulf. However, the 1,750 meter distance does not approach the mission area location 17 miles offshore. Given the distance of the test site from land, impacts to this species are considered unlikely.

Unit 11 of Gulf sturgeon critical habitat is located in the vicinity of the test area but would not be affected by munitions deployment. Vessels associated with AF activities will pass through critical habitat while transiting to the test site. However, the vessels will not adversely affect essential features of the habitat (prey items, water and sediment quality, migratory pathways). Vessels will operate in marked channels or in water sufficiently deep enough to avoid bottom contact. Pollutants from outboard motors could be introduced into the water, but water quality would not be affected due to the volume of pollutants in relation to the volume of water in the GOM. Therefore, Gulf sturgeon critical habitat would not be adversely affected and is not discussed further in this BA.

The three protected bird species include the piping plover, wood stork, and bald eagle. Although the bald eagle has been removed from the federal list of endangered species, it remains protected under the Bald and Golden Eagle Protection Act. Critical habitat has been designated for the piping plover on Santa Rosa Island, the land mass nearest the test location. None of these species would typically be found on the marine water surface or in association with the target boats. Direct impacts would be limited to possible encounters of birds flying through the mission area at the same time a detonation occurred (at a height above the water that placed them in the blast radius), and to direct strikes by weapons in flight. The possibility of such scenarios is considered remote. In addition, the species are not typically found 17 miles off shore. Piping plover critical habitat would not be affected by test activities. Therefore, protected bird species are not considered further in this document.

3.1 SEA TURTLES

Four sea turtle species may occur in the northeastern Gulf, including the Atlantic loggerhead (*Caretta caretta*), Atlantic green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and Kemp's ridley (*Lepidochelys kempii*) (Table 3-1). All species but the loggerhead are classified under the ESA as endangered. The loggerhead is classified as threatened. Sea turtles spend their lives at sea and rarely come ashore except to nest. It is theorized that young turtles, between the time they enter the sea as hatchlings and their appearance as subadults, spend their time drifting in ocean currents among seaweed and marine debris (Carr, 1986a, 1986b, 1987). The number of sea turtles decreased significantly during the twentieth century. Factors contributing to this decline include habitat destruction from beach lighting, erosion control practices, off-road vehicle use, predator activities, and illegal egg harvesting.

Table 3-1. Sea Turtle Species in the Maritime WSEP Test Area

Species	Status
Atlantic green sea turtle *(Chelonia mydas)*	ESA: FE
Kemp's ridley sea turtle *(Lepidochelys kempii)*	ESA: FE
Leatherback sea turtle *(Dermochelys coriacea)*	ESA: FE
Atlantic loggerhead sea turtle *(Caretta caretta)*	ESA: FT

ESA = Endangered Species Act; FE = Federally Endangered; FT = Federally Threatened

Nesting activity in Florida is documented by the Florida Fish and Wildlife Conservation Commission for the loggerhead, green, and leatherback sea turtle. Of these species, the loggerhead is the most prolific, with Florida accounting for over 90 percent of nesting in the U.S. (FWRI, 2012). The majority of sea turtle nesting occurs along the southeastern Florida peninsula. For example, in 2013 there were 24,630 loggerhead nests in Brevard County, compared to 144 nests for Santa Rosa, Okaloosa, and Walton Counties combined (the three counties in which Eglin AFB lies). Sea turtle nesting data for these three counties are provided in Table 3-2. Although the State website does not list nesting activity for leatherback or Kemp's ridley sea turtles in the northern Gulf, Eglin AFB reports that these two species occasionally nest on military-controlled beaches of Santa Rosa Island.

Table 3-2. Sea Turtle Nesting Data, 2013

County	Survey Length in km (mi)	Loggerhead Sea Turtle Nests	Loggerhead Sea Turtle Non-Nesting Emergences	Green Sea Turtle Nests	Green Sea Turtle Non-Nesting Emergences	Leatherback Sea Turtle Nests	Leatherback Sea Turtle Non-Nesting Emergences
Santa Rosa	11.2 (7.00)	67	41	0	0	0	0
Okaloosa	38.0 (23.6)	56	40	11	5	0	0
Walton	48.7 (30.3)	44	29	1	0	0	0

Source: FWRI, 2014
km – kilometers; mi = miles

3.1.1 Loggerhead Sea Turtle – Northwest Atlantic Ocean Distinct Population Segment

The loggerhead sea turtle was listed as a threatened species throughout its range on July 28, 1978. NMFS and the USFWS have published a final rule designating nine Distinct Population Segments (DPS) for loggerhead sea turtles (76 FR 58868, September 22, 2011; effective October 24, 2011). The Northwest Atlantic DPS (NWA DPS) is the only one that coincides with the Maritime WSEP action area and therefore is the only one considered in this BA.

3.1.1.1 *Description, Distribution, and Population Structure*

The loggerhead turtle is a large, hard-shelled sea turtle. The mean straight carapace length of adults is approximately 92 cm (36 in), and the average weight is 116 kg (256 lbs) (NMFS and USFWS, 1991a). This species inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd, 1988). The majority of nesting occurs along the western boundaries of the Atlantic and Indian Oceans (NRC, 1990). Loggerhead turtles are not as dependent upon nearshore waters as some other species (greens and hawksbills), and the expected distribution therefore extends from the shoreline past the continental shelf break into waters of the continental slope. On average, loggerhead turtles spend over 90 percent of their time underwater (DON, 2007). Routine dive depths of 9 to 22 meters (29.5 to 72 feet) have been recorded, and dives of up to 233 meters (764 feet) have been recorded for a post-nesting female loggerhead. Routine dives typically last from 4 to 172 minutes.

In the western North Atlantic, loggerhead nesting occurs primarily along the U.S. coast from southern Virginia to Alabama. Additional nesting beaches are found along the northern and western GOM, eastern Yucatán Peninsula, and in areas of the Bahamas, Cuba, Central and South America, and the eastern Caribbean Islands. Non-nesting adult females occur throughout the species' U.S. coastal range and the Caribbean Sea. Little is known about the distribution of adult males. Aerial surveys suggest that about 12 percent of loggerheads in U.S. waters occur in the eastern GOM; the majority (54 percent) occurs along the southeast U.S. Atlantic coast (TEWG, 1998, as cited in NMFS, 2013). Shallow water habitats with large expanses of open ocean access provide foraging habitat for adult loggerheads, while juveniles are found in enclosed, shallow water estuarine environments not frequented by adults (Epperly et al. 1995c, as cited in NMFS, 2013). Benthic, immature loggerheads are known to migrate between northern and southern areas off the U.S. coast as water temperatures seasonally rise and fall (Morreale and Standora 1998; Shoop and Kenney 1992) (Keinath 1993; Epperly et al. 1995c; as cited in NMFS, 2013).

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to southern peninsular Florida, and along the Florida Gulf coast. Previously, NMFS recognized at least five Western Atlantic loggerhead subpopulations. The Florida Panhandle nesting subpopulation was considered to consist of individuals occurring at Eglin AFB and beaches near Panama City, Florida. However, the recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula (and presumably other areas of Florida as well) and that subpopulation boundaries could not be designated based on genetic differences. Therefore, the recovery plan uses a combination of nesting densities, geographic separation, geopolitical boundaries, and genetic differences to identify recovery units. The Northern Gulf of Mexico Recovery Unit (Franklin County, Florida through Texas) is the unit associated with the Maritime WSEP test area. The plan concluded that all recovery units are essential to the recovery of the species.

3.1.1.2 *Life History*

Loggerhead sea turtles reach sexual maturity between 20 and 38 years of age, although the age appears to vary widely among populations (NMFS-SEFSC, 2001) (Frazer and Ehrhart, 1985, as cited in NMFS, 2013). The mating season occurs from late March to early June, and eggs are laid throughout the summer months. Female loggerheads deposit an average of 4.1 nests per nesting season (Murphy and Hopkins, 1984) and have an average remigration interval of 3.7 years (Tucker, 2010, as cited in NMFS, 2013). Mean clutch size along the southeastern U.S. coast varies from 100 to 126 eggs (Dodd, 1988).

Loggerhead sea turtles are generally thought to circumnavigate the North Atlantic Gyre as pelagic post-hatchlings and early juveniles (often occurring in *Sargassum* drift lines or other convergence zones), and may lead a pelagic existence for as long as 7 to 12 years (Bolten et al., 1998). At some point, individuals apparently shift to a different midwater feeding habitat; in the eastern North Atlantic Ocean, it is believed to be the waters surrounding the Azore and Madeira Islands. Other oceanic waters include the Grand Banks (Newfoundland, Canada) and the Mediterranean Sea. As later juveniles and adults, loggerheads most often occur on the continental shelf and shelf edge of the U.S. Atlantic and Gulf coasts; they are also known to inhabit coastal estuaries and bays along both coasts (CETAP, 1982; Shoop and Kenney, 1992). However, the results of recent studies suggest that not all loggerhead turtles follow the model described above (Laurent et al. 1998; Bolten and Witherington 2003; as cited in NMFS, 2013). These studies suggest some turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized, or move back and forth between pelagic and coastal habitats (Witzell, 2002). Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd, 1988). Sub-adult and adult loggerheads, primarily found in coastal waters, prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

3.1.1.3 *Abundance and Trends*

Although the loggerhead is the most commonly sighted sea turtle in the southeastern United States, there currently is not a reliable estimate of population size in the western North Atlantic Ocean. The NMFS Southeast Fisheries Science Center has developed a preliminary demographic model to predict population trajectories (NMFS, 2013). One of the most robust results estimated an adult female population size for the western North Atlantic of between 20,000 and 40,000 individuals, with a low likelihood of being up to 70,000. Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can under some circumstances provide a reasonable estimate of trends in the adult female population (assuming strong nest site fidelity). Loggerhead nesting at all combined Florida index beaches declined significantly for the NWA DPS between 1989 and 2008. However, nesting has increased substantially since that time, such that the overall nesting trend from 1989 to 2012 is approximately zero (no gain or loss) (NMFS, 2013). There was a near record level of nests in 2012. Nesting for the Northern Gulf of Mexico Recovery Unit showed a significant declining trend of 4.7 percent from 1997 to 2008. Nesting on Florida Panhandle index beaches specifically, which represents the majority of nesting for this recovery unit, generally declined between 1997 and 2011 (with a notable exception in 2008). However, nesting in 2012 and 2013 increased to levels comparable to the late 1990s, with a record level in 2012.

A recent study conducted between 2010 and 2012 used satellite telemetry to tag and track the movements of 39 adult female loggerheads from nesting beaches at three sites in Florida and Alabama (Hart et al, 2013). The results of this study have indicated that female loggerheads from this subpopulation make longer movements during the inter-nesting period than previously thought and may regularly utilize nesting beaches from different geographic areas within the same reproductive season, which demonstrates a significantly less nest-site fidelity level than previously reported (Hart et al., 2013). This study also spatially defined and identified characteristics of in-water inter-nesting areas and assessed overlap between these areas with shrimp trawling and active oil and gas extraction activities.

3.1.1.4 *Threats*

Loggerhead sea turtles are exposed to a variety of threats, as described by NMFS (2013). Cold stunning is a natural event that may result in mortality. The greatest anthropogenic threat to the NWA DPS is fishery bycatch in neritic and oceanic habitats. Domestic (U.S.) fishery operations that result in capture, injury, and mortality to sea turtles of various life stages include pelagic longline, shrimp, trawl, gill net, purse seine, hook-and-line, pound net, and trap fisheries. In addition, loggerheads are exposed to direct and incidental impacts due to foreign fishing operations including longline, trawl, and gill net fisheries. Specifically, the in-water inter-nesting habitat areas of the Northern Gulf of Mexico subpopulation of loggerhead sea turtles identified by Hart et al. directly overlapped with areas reporting a moderate level of shrimp trawling activities and the locations of active oil and gas platforms (2013).

Loggerhead sea turtles are also affected by non-fishery impacts in marine and terrestrial environments. Construction and maintenance of Federal navigation channels in nearshore U.S. waters can result in turtle mortality due to entrainment in dredges. Turtles may also be entrained in the cooling systems of electrical plants. Other nearshore threats include vessel operations, military exercises (including detonations), and scientific research activities.

Coastal development may affect sea turtles through habitat alteration and nesting interference. The placement of buildings, pilings, and beach armoring materials, as well as sand removal or beach renourishment, may remove nesting beach habitat, change thermal profiles, and increase erosion. Artificial lighting associated with coastal development may also interfere with nesting behavior and may result in hatchling disorientation. Additional terrestrial threats include predation by land animals, direct egg and adult harvest (mostly in foreign countries), and introduction of pollutants such as pesticides, hydrocarbons, and organochlorides into marine waters.

There have been actions implemented to reduce anthropogenic impacts to sea turtles, particularly since the early 1990s. These actions include lighting ordinances, predation control, nest relocations, and measures to reduce mortality resulting from various fisheries and other marine activities. Use of Turtle Excluder Devices has significantly decreased impacts due to shrimp trawling in the U.S, although trawling is still one of the largest sources of anthropogenic loggerhead mortality.

3.1.1.5 *Critical Habitat Designation*

On July 10, 2014 the USFWS and NMFS issued Final Rules to designate critical habitat for the NWA DPS of the loggerhead sea turtle (79 FR 39755 and 79 FR 39855, effective August 11, 2014). Under the USFWS rule, approximately 1,102 km (685 miles) of loggerhead sea turtle nesting beaches in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi are included in the terrestrial component of critical habitat. The nesting beaches on Eglin AFB (including Cape San Blas) are exempt because Eglin's Integrated Natural Resources Management Plan (INRMP) already incorporates measures that provide a benefit for the species.

Under the NMFS rule, 38 occupied marine areas within the range of the NWA DPS are included in the marine component of critical habitat and contain at least one, or a combination of the following habitat types: nearshore reproductive habitat, winter area, breeding area, constricted migratory corridor, and *Sargassum* habitat. Of those, only nearshore reproductive habitat and *Sargassum* habitat areas were designated in the northern Gulf of Mexico (Figure 3-1).

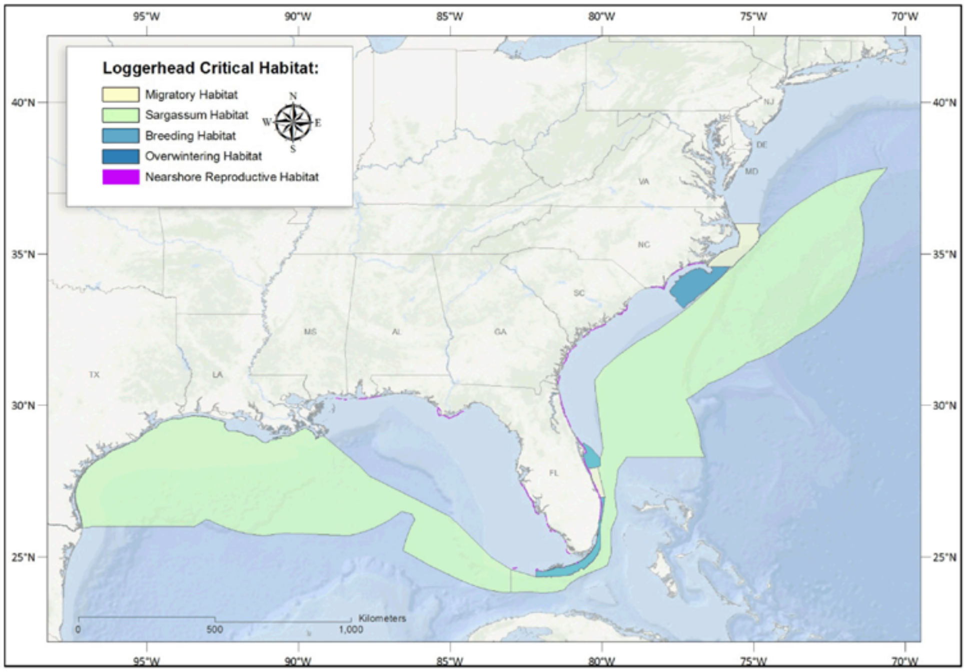

Figure 3-1. Marine Component of Loggerhead Critical Habitat Designation
(Source: NOAA Fisheries, 2014)

Nearshore reproductive habitat describes nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water. This includes nearshore waters out to 1.6 km (1 mile) offshore. The identification of nearshore reproductive habitat was based primarily on location of beaches identified as high density nesting beaches by the USFWS and beaches adjacent to the high density nesting beaches that serve as expansion areas. As a result, 36 units of nearshore reproductive critical habitat have been identified. This includes waters off three high density/expansion nesting beaches not designated as terrestrial critical habitat by the USFWS because they occur on military lands with an associated INRMP in place. Since Eglin's INRMP does not address waters off the nesting beaches on SRI and Cape San Blas, nearshore reproductive habitat has been designated from the shoreline of these beaches out to 1.6 km (1 mile) in the Gulf.

The *Sargassum* habitat portion of the marine designation consists of the western Gulf of Mexico from the 10-meter bathymetry line starting at the mouth of the Mississippi River and proceeding west and south to the outer boundary of the U.S. Economic Exclusion Zone (EEZ). The southern boundary is the U.S. EEZ from the 10-meter bathymetry line off of Texas to the Gulf of Mexico-Atlantic Ocean border. The eastern edge follows the 10-meter bathymetry line from the mouth of the Mississippi River then goes in a straight line to the northernmost boundary of the Loop Current and follows along its eastern edge to the Gulf of Mexico-Atlantic Ocean border.

Since neither the nearshore reproductive habitat nor the *Sargassum* habitat units occur within the Maritime WSEP mission area, loggerhead sea turtle critical habitat would not be adversely affected and is not discussed further in this BA.

3.1.2 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered throughout its entire range on December 2, 1970 under the Endangered Species Conservation Act of 1969 (a precursor to the ESA). The Kemp's ridley is considered the most imperiled of the world's sea turtles (USFWS and NMFS, 1992).

3.1.2.1 *Description, Distribution, and Population Structure*

The Kemp's ridley sea turtle is the smallest living sea turtle. The straight carapace length is approximately 65 cm (26 in) and adults weigh less than 45 kg (99 lb) (USFWS and NMFS, 1992). Adults Kemp's ridley shells are almost circular. Few data are available on the maximum dive duration. Satellite-tagged juveniles showed different mean surface intervals and dive depths depending on whether they are located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals) (DON, 2007). Dive times range from a few seconds to a maximum of 167 min; routine dives last between 16.7 and 33.7 min. Kemp's ridleys spend between 89 and 96 percent of their time submerged.

Adults have a very restricted distribution relative to other sea turtles, occurring mostly in shallow nearshore waters of the GOM (although adults are sometimes sighted along the eastern U.S. coast). Post-pelagic turtles can be found over crab-rich sandy or muddy bottoms. Nesting is generally limited to beaches of the western GOM, primarily in the Mexican state of Tamaulipas, although a few nests have also been recorded in Florida and the Carolinas (Meylan et al., 1995). Kemp's ridleys nest in daytime aggregations known as "arribadas," primarily at Rancho Nuevo, Mexico; most nesting occurs in this single locality (Pritchard, 1969, as cited in NMFS, 2013). The Kemp's ridley is a rare nester on Eglin beaches and was documented for the first time in 2008 when three nests were deposited on Santa Rosa Island. Since the confirmed nesting in 2008, Kemp's have returned in 2010, 2011, 2012, and 2013.

3.1.2.2 *Life History*

Kemp's ridley sea turtles reach sexual maturity at 7 to 15 years of age. Although some turtles nest annually, the remigration rate is approximately two years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing about 100 eggs (Márquez, 1994). The species remains in the post-hatchling pelagic stage from one to four years, and in the benthic immature stage for approximately seven to nine years (Schmid and

Witzell, 1997). Little is known of the movements of the post-hatching, planktonic stage within the GOM, although the turtles are assumed to associate with *Sargassum* seaweed. Post-hatchlings and small juveniles may be retained in the northern Gulf until migrating inshore to demersal habitats, or may be carried south in the Loop Current where they may become entrained in the Florida Current and Gulf Stream (Musick and Limpus, 1997). Once they reach a size of approximately 20 to 30 cm (8 to 12 in), or about 2 years of age, the turtles migrate to neritic developmental habitats along the U.S. Atlantic and Gulf coasts, where they spend the majority of their lives as large juveniles and adults. Atlantic juveniles/subadults travel northward with seasonal warming to feed in coastal waters from Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989).

Adult Kemp's ridleys primarily occupy neritic habitats that typically contain muddy or sandy bottoms where prey can be found. The diet of post-pelagic turtles consists primarily of crabs, with a preference for portunid crabs (Bjorndal, 1997, as cited in NMFS, 2013). Stomach contents of Kemp's ridleys along the lower Texas coast consisted mostly of nearshore crabs and mollusks, in addition to fish, shrimp, and other foods likely scavenged from shrimping operations (Shaver, 1991, as cited in NMFS, 2013). Highly suitable habitats identified in the GOM include the western coast of Florida (particularly the Cedar Keys area), the eastern coast of Alabama (including Mobile Bay), the mouth of the Mississippi River, and coastal waters off western Louisiana and eastern Texas.

3.1.2.3 *Abundance and Trends*

Of the seven existing sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. The adult female population was estimated to be in excess of 40,000 individuals in 1947 (Hildebrand, 1963, as cited in NMFS, 2013), but nesting numbers were below 1,000 by the mid-1980s. However, increased nesting in the 1990s suggested that the decline had stopped, and the population is currently increasing (USFWS, 2000, as cited in NMFS, 2013). The number of nests observed at Rancho Nuevo and nearby beaches increased between 1985 and 1999 (TEWG, 2000), and data from all Mexican beaches show that the number of nests increased from 7,147 to 21,797 between 2004 and 2012 (a substantial decline occurred in 2010) (Gladys Porter Zoo nesting database 2013, as cited in NMFS, 2013). A small nesting population is apparently emerging in the United States (primarily in Texas), with the number of nests increasing from 6 in 1996 to 209 in 2012 (National Park Service data, as cited in NMFS, 2013).

Recent modeling suggests that Kemp's ridley populations may increase substantially in the future. Heppell et al. (2005) suggest that the population is expected to increase at least 12 to 16 percent per year, and that the population could reach at least 10,000 females nesting on Mexico beaches by 2015. Modeling reported by NMFS et al. (2011) predicts that the population is expected to increase 19 percent per year. Approximately 25,000 nests would be needed to reach an estimated 10,000 nesting females (based on an average 2.5 nests per nesting female). Despite the nesting decline in 2010, the nearly 22,000 nests recorded in 2012 suggest that the models may reasonably forecast actual population increases. However, as with any model, future data will be needed to confirm the projected population trajectory.

3.1.2.4 *Threats*

Threats to the Kemp's ridley sea turtle are generally the same as those described for the loggerhead sea turtle.

3.1.3 Green Sea Turtle

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations which were listed as endangered. Due to the inability to distinguish between these populations away from nesting beaches, green turtles are considered endangered wherever they occur in U.S. waters.

3.1.3.1 *Description, Distribution, and Population Structure*

The green sea turtle is the largest hard-shelled sea turtle. Adults commonly reach 100 cm (39.4 in) in carapace length and 150 kg (331 lbs) in weight (NMFS and USFWS, 1991b). The species is considered a tropical herbivore. Green turtles typically make dives shallower than 30 m (98 ft); however, a maximum dive depth of 110 m (361 ft) has been recorded in the Pacific Ocean. The maximum dive time recorded for a subadult green turtle is 66 minutes (min), with routine dives ranging from 9 to 23 min.

Green turtles are distributed circumglobally in tropical and subtropical waters (NMFS and USFWS, 1991b). Green turtles have been seen in the open ocean and can likely traverse an entire ocean basin during their life cycle. Nesting occurs in more than 80 countries worldwide (Hirth and USFWS, 1997). The two largest nesting populations are found at Tortuguero (Caribbean coast of Costa Rica) and Raine Island (Great Barrier Reef in Australia). In the U.S., nesting occurs from Texas to North Carolina, as well as the U.S. Virgin Islands and Puerto Rico (NMFS and USFWS, 1991b; Dow et al., 2007). However, the great majority of nesting in the U.S. occurs in southeastern Florida, particularly Brevard to Broward Counties (Meylan et al. 1995) (Johnson and Ehrhart 1994, as cited in NMFS, 2013). The green turtle nesting aggregation in Florida is recognized as a regionally significant colony (USFWS NFFO, 2009a).

In U.S. Atlantic and GOM waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern U.S. include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty, 1984) (Hildebrand, 1982; Shaver, 1994; as cited in NMFS, 2013); the GOM off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr, 1957; Carr, 1984; as cited in NMFS, 2013); Florida Bay and the Florida Keys (Schroeder and Foley, 1995); the Indian River Lagoon system in Florida (Ehrhart, 1983, as cited in NMFS, 2013); and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart, 1992; Wershoven and Wershoven 1992). The summer developmental habitat also encompasses estuarine and coastal waters from North Carolina to Long Island Sound (Musick and Limpus, 1997). Additional important foraging areas in the western Atlantic include coastal areas of Puerto Rico, Cuba, Nicaragua, Panama, Colombia, and Brazil (Hirth, 1971), and the northwestern coast of the Yucatán Peninsula.

Adults are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs (Hays et al. 2001), and are known to migrate seasonally between northern and southern areas. The existence of regional subpopulations is supported by genetic data (Bowen et al. 1992; Fitzsimmons et al. 2006). However, turtles from different nesting origins are commonly found mixed together on foraging grounds throughout the species' range.

3.1.3.2 *Life History*

Green sea turtles have slow growth rates (Green 1993; McDonald-Dutton and Dutton 1998) and do not reach maturity until 20 to 50 years of age (Hirth and USFWS 1997; Chaloupka and Musick 1997, as cited in NMFS, 2013). The slow growth rate is believed to be a consequence of the largely herbivorous, low energy diet (Bjorndal, 1982, as cited in NMFS, 2013). Upon reaching maturity, females return to natal beaches to lay eggs (Balazs, 1982; Frazer and Ehrhart, 1985; as cited in NMFS, 2013) and can migrate hundreds to thousands of kilometers between foraging and nesting areas.

In the southeastern U.S., nesting occurs between June and September, with peak activity in June and July (Witherington and Ehrhart, 1989). Females nest every two to four years (Balazs, 1983), laying three to four clutches per nesting year (Johnson and Ehrhart, 1996). Mean clutch size is about 110 to 115 eggs (136 eggs in Florida). After emerging, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to reside for three to seven years, feeding close to the surface on a variety of marine algae and prey items associated with drift lines and other debris. At approximately 20 to 25 cm caprapace length, juveniles leave pelagic habitats and enter benthic foraging habitats (protected lagoons and open coastal areas rich in sea grass and marine algae). Adult green turtles feed almost exclusively on sea grasses and algae in shallow bays, lagoons, and reefs (Rebel and Ingle, 1974, as cited in NMFS, 2013), although some populations also feed heavily on invertebrates (Carballo et al., 2002, as cited in NMFS, 2013). While in coastal habitats, green turtles exhibit foraging and nesting ground site fidelity and are able to return to these sites if displaced (McMichael et al., 2003, as cited in NMFS, 2013). Generally, adults are only occasionally found in the northern GOM. Most adult females off Florida appear to reside in nearshore foraging areas throughout the Florida Keys and in waters southwest of Cape Sable, with some post-nesting turtles also residing in Bahamian waters (NMFS and USFWS, 2007a).

3.1.3.3 *Abundance and Trends*

A summary of worldwide nesting data (NMFS and USFWS, 2007a) suggests that, of the 23 nesting sites where trends were discernible, 10 were increasing, 9 were stable, and 4 were decreasing. Generally, the Pacific, Western Atlantic, and Central Atlantic regions appeared to show more positive trends, while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends. The Atlantic Ocean regions had the most positive changes in abundance.

The green turtle 5-year status review identified eight geographic areas considered to be primary sites for nesting in the Atlantic/Caribbean, and reviewed the nest count trend for each (NMFS and USFWS, 2007a). The sites include 1) Yucatán Peninsula, Mexico; 2) Tortuguero, Costa Rica; 3) Aves Island, Venezuela; 4) Galibi Reserve, Suriname; 5) Isla Trindade, Brazil; 6)

Ascension Island, United Kingdom; 7) Bioko Island, Equatorial Guinea; and 8) Bijagos Achipelago, Guinea-Bissau. Nesting at all sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago, where insufficient data were available to assess trends. Seminoff (2004) (as cited in NMFS, 2013) found similar results for nesting sites in the Atlantic, including sites on Florida beaches. The largest known nesting assemblage in the Atlantic Ocean occurs at Tortuguero, Costa Rica. There appears to be an increasing trend at this site since monitoring began in the early 1970s. Emergences increased from about 41,250 annually (1971 to 1975), to an average of 72,200 (1992 to 1996) (Bjorndal et al., 1999, as cited in NMFS, 2013). Similarly, Troëng and Rankin (2005) (as cited in NMFS, 2013) reported increasing trends between 1999 and 2003.

In the continental U.S., green turtle nesting occurs along the Atlantic coast, primarily along central and southeast Florida (Meylan et al., 1994; Weishampel et al., 2003; as cited in NMFS, 2013). Nesting has increased along the Atlantic coast of Florida, occurring on beaches where only loggerhead nesting was observed in the past (Pritchard, 1997, as cited in NMFS, 2013). Nesting also occurs occasionally along the Gulf coast of Florida, including the Florida Panhandle (Meylan et al., 1995). Eglin AFB property supports the highest number of green sea turtle nests in northwest Florida. More recently, nesting has been documented on beaches of North Carolina, South Carolina, and Georgia.

Index beaches have been established in Florida in order to standardize data collection methods and effort on key nesting beaches. Since establishment of these beaches in 1989, the green turtle nesting pattern has consisted of biennial peaks with a generally positive trend. Between 1989 and 2012, nest counts across Florida have increased approximately substantially, from a low of 267 in the early 1990s to a high of 10,701 in 2011. Modeling by Chaloupka et al. (2008) suggests that the Florida nesting stock at the Archie Carr National Wildlife Refuge is growing at an annual rate of 13.9 percent.

There are no reliable abundance estimates for immature green sea turtles in the coastal areas of the southeastern U.S., where they come to forage. Ehrhart et al. (2007) (as cited in NMFS, 2013) have documented a significant increase in abundance in the Indian River Lagoon area. It is likely that immature turtles foraging in the southeastern U.S. come from multiple genetic stocks. Therefore, the status in the southeastern U.S. may be surmised from trends of the main regional nesting beaches (Florida, Yucatán, and Tortuguero).

3.1.3.4 *Threats*

Threats to the green sea turtle are generally the same as those described for the loggerhead sea turtle. However, green turtles are apparently more affected by fibropapillomatosis disease than other sea turtle species.

3.1.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969 (precursor to the ESA).

3.1.4.1 *Description, Distribution, and Population Structure*

The leatherback sea turtle is the largest sea turtle in the world. Mature adults can reach lengths of over 2 meters and weigh close to 900 kg (2000 lbs), although adults typically weigh between 200 and 700 kg (441 and 1,543 lbs) (NMFS and USFWS, 1992). The leatherback is the only sea turtle that lacks a hard, bony shell. The carapace is approximately 4 cm thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged carapace and large flippers make the leatherback well equipped for long distance foraging migrations. Unlike other sea turtles which feed on hard-bodied prey, leatherbacks have pointed tooth-like cusps and sharp edged jaws that are used to consume soft-bodied pelagic prey such as jellyfish and salps (Pritchard, 1971, as cited in NMFS, 2013). The mouth and throat also have backward-pointing spines that help retain gelatinous prey.

The leatherback sea turtle is a far-ranging species with a broad thermal tolerance (NMFS and USFWS, 1995), foraging in temperate and subpolar regions worldwide and undergoing extensive migrations to and from tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS-SEFSC, 2001). Leatherbacks nest in the western Atlantic from the southeastern U.S. to southern Brazil, and in the eastern Atlantic from Mauritania to Angola. The most significant nesting beaches in the Atlantic, and perhaps in the world, are located in French Guiana and Suriname (NMFS-SEFSC, 2001).

Previous genetic analyses suggested that there were at least three genetically distinct nesting populations within the Atlantic basin. More recent genetic analyses, along with tagging data, have resulted in the identification of seven breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG, 2007). General differences in migration patterns and foraging grounds may occur between the groups, although data supporting this hypothesis are limited.

The leatherback is the deepest diving sea turtle, but the species may also enter shallow waters to locate prey items. The average dive depths from tagging studies off the continental shelf of St. Croix are 35 to 122 m (115 to 400 ft), with estimated maximum depths of over 1,000 m (3,281 ft) (DON, 2007). Typical dive durations average 6.9 to 14.5 min per dive, with a maximum of 42 min. Routine dive lengths around St. Croix can range from 4 to 14.5 min. The maximum known dive length for a subadult is 7.7 min.

3.1.4.2 *Life History*

Leatherbacks are long-lived, with some individuals reaching 30 years of age or more. The age at which leatherbacks reach sexual maturity is unclear, with estimates ranging widely from 3 to 29 years of age (Rhodin, 1985; Zug and Parham, 1996; Avens and Goshe, 2007; as cited in NMFS, 2013). Females lay up to 10 nests during the nesting season (March through July in the U.S.) at 2 to 3 year intervals, with 100 or more eggs in each clutch (Schultz, 1975, as cited in NMFS, 2013). However, up to about 30 percent of the eggs can be infertile. Hatching occurs after 60 to 65 days. Leatherbacks forage in coastal waters but appear to remain primarily pelagic through all life stages (Heppell et al., 2003, as cited in NMFS, 2013).

There is limited information about the oceanic distribution of post-hatchling and early juvenile leatherbacks. These life stages are generally restricted to waters with temperatures greater than 26°C (79°F) and, in contrast to the other four sea turtle species found in U.S. waters, they are likely not associated with *Sargassum* (NMFS and USFWS, 1992; Eckert, 2002). Late juvenile and adult leatherback turtles are known to range from mid-ocean to the continental shelf and nearshore waters (Schroeder and Thompson, 1987; Shoop and Kenney, 1992). Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters. The distribution and movement of adult leatherbacks appear to be linked to seasonal availability of prey and to requirements of the reproductive cycle (Collard, 1990; Davenport and Balazs, 1991). The location and abundance of prey, including medusae, siphonophores, and salpae, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (NMFS and USFWS, 1995).

3.1.4.3 *Abundance and Trends*

The status of the Atlantic leatherback population is generally less clear than that of the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000; Sarti Martínez et al., 2007; as cited in NMFS, 2013). However, data collection and analyses by the Leatherback Turtle Expert Working Group has provided some information (TEWG, 2007). The Southern Caribbean/Guianas stock, which includes the Guianas, Trinidad, Dominica, and Venezuela, is the largest known Atlantic leatherback nesting aggregation (TEWG, 2007). Past analyses showed that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS-SEFSC, 2001). However, from 1979 to 1986, the number of nests was increasing at about 15 percent annually, which could indicate that the decline was part of a natural nesting cycle that coincides with the erosion cycle of Guiana beaches described by Schultz (1975) (as cited in NMFS, 2013). The cycle of beach erosion and reformation may result in shifting nesting beach locations throughout the region. It is possible that the Guianas and possibly Trinidad should be viewed as one population (Reichart et al., 2001, as cited in NMFS, 2013). Genetics studies support this hypothesis and have resulted in designation of the Southern Caribbean/Guianas stock. The TEWG has determined that the stock had demonstrated a long-term, positive population growth rate.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia, with the most intense nesting occurring in Costa Rica, Panama, and Colombia (Duque et al., 2000, as cited in NMFS, 2013). Data from three index nesting beaches in the region suggest the nesting population likely did not grow between 1995 and 2005 (TEWG, 2007). Other modeling (of Tortuguero only) indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng and Chaloupka, 2007, as cited in NMFS, 2013).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG, 2007). Similarly, the average annual growth rate was approximately 1.1 and 1.2 percent at the primary nesting beach on St. Croix and on Tortola, respectively, during the timeframe of the 1980s through the mid-2000s (TEWG, 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800 and 900 per year in the 2000s following totals of fewer than 100 nests annually in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data, as cited in NMFS, 2013). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, followed by 265, 615, 552, and 625 nests over the next four years (FWC Index Nesting Beach Survey Database, as cited in NMFS, 2013). This pattern is thought to demonstrate a cyclical nesting pattern, similar to the biennial nesting cycle of green turtles. The overall trend shows rapid growth on Florida's east coast. Only infrequent nesting activity has been documented in northwest Florida. Until the spring of 2000, the only confirmed leatherback nesting in this region was in Franklin and Gulf Counties. In May and June 2000, nesting was documented for the first time in Okaloosa County on Eglin AFB's Santa Rosa Island property. Since then, one leatherback nest was found on Eglin's property in 2012.

The West African leatherback nesting stock is a large and important aggregation, but has not been well studied. Nesting occurs in various countries along Africa's Atlantic coast, but is generally undocumented. Gabon supports a large amount of nesting, with at least 30,000 nests in one season (Fretey et al., 2007). Due to the lack of survey effort and data collection, trend analyses are not available.

Two other small but growing nesting stocks utilize the beaches of Brazil and South Africa. The TEWG found a positive growth rate of about one percent for the Brazil and South Africa stocks between 1988 and 2003.

There is currently not a reliable estimate of total population size for Atlantic leatherback sea turtles due to inconsistent data. In 1996, the entire Western Atlantic population was characterized as stable at best (Spotila et al., 1996, as cited in NMFS, 2013), with a population of about 18,800 nesting females. Spotila et al. (1996) (as cited in NMFS, 2013) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 adult females. This is consistent with the estimate of 34,000 to 95,000 total adults determined by the TEWG (TEWG, 2007).

3.1.4.4 *Threats*

Threats to the leatherback sea turtle are generally the same as those described for the loggerhead sea turtle. However, leatherbacks seem to be more vulnerable to entanglement in fishing gear than other sea turtle species. This may be the result of body type, attraction to gelatinous organisms and algae that collect on buoys and buoy lines, method of locomotion, and possibly attraction to the lightsticks used in longline fisheries. In addition, leatherback turtles may be more prone to ingestion of marine debris due to their predominantly pelagic existence and tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migrating (Shoop and Kenney 1992) (Lutcavage et al. 1997, as cited in NMFS, 2013). Leatherbacks may not always distinguish between prey items and plastic debris (Mrosovsky et al., 2009).

3.1.5 Juveniles/Hatchlings

Sea turtle hatchlings are present at certain times of the year within the Maritime WSEP test area. Loggerhead turtles nest every year on Santa Rosa Island. Green turtles nest every other year. Leatherback and Kemp's ridley turtles nest on the island infrequently. Nesting generally occurs between May and August, and the incubation period is approximately 60 days overall. Once hatchlings reach the GOM, at least some will be associated with floating mats of *Sargassum*. The mats provide shelter and a wide variety of food.

3.2 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act) (16 U.S.C. 1801 *et seq.*) established jurisdiction over marine fishery resources within the U.S. Exclusive Economic Zone. The Magnuson-Stevens Act mandated the formation of eight fishery management councils (FMC), which function to conserve and manage certain fisheries within their geographic jurisdiction. The Councils are required to prepare and maintain a Fishery Management Plan (FMP) for each fishery that requires management. The Gulf of Mexico Fishery Management Council (GMFMC) manages fisheries in the Maritime WSEP test area. Amendments contained in the Sustainable Fisheries Act of 1996 (Public Law 104-267) require the councils to identify Essential Fish Habitat (EFH) for each fishery covered under a FMP. EFH is defined as the waters and substrate necessary for spawning, breeding, or growth to maturity (16 U.S.C. 1802[10]). The term "fish" is defined as "finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds."

In addition to the GMFMC, the Gulf States Marine Fisheries Commission (GSMFC) and NMFS also have management responsibilities for certain fisheries. The GSMFC is an organization of five states from the Gulf coast of Florida to Texas that manages fishery resources in state waters. The GSMFC provides coordination and administration for a number of cooperative state/federal marine fishery resources. NMFS has jurisdiction over highly migratory species in federal waters of the GOM.

The GMFMC manages seven fishery resources in federal waters off the coasts of Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida to Key West. The coral and coral reef FMP includes over 300 coral species. The reef fish FMP includes 31 species of snappers, groupers, tilefishes, jacks, triggerfishes, and wrasses. Fish in this FMP are generally demersal subtropical species that utilize similar habitats and are harvested by similar methods, both recreationally and commercially. Shrimp species include brown, white, pink, and royal red. The spiny lobster fishery is managed jointly by the GMFMC and the South Atlantic Fishery Management Council, with the GMFMC acting as the lead council. The Coastal Migratory Pelagics management unit consists of king mackerel, Spanish mackerel, cobia, dolphin, little tunny, cero mackerel, and bluefish. Managed species and associated EFH are shown in Table 3-3.

Species and EFH Descriptions

Table 3-3. Fish Species and Management Units for which Essential Fish Habitat has been Identified

Species or Management Unit	Essential Fish Habitat
Coastal Migratory Pelagics (7 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.
Coral and Coral Reefs (over 300 species)	The total distribution of coral species and life stages throughout the Gulf of Mexico including the East and West Flower Garden Banks, Florida Middle Grounds, southwest tip of the Florida reef tract, and predominant patchy hard bottom offshore of Florida from approximately Crystal River south to the Keys, and scattered along the pinnacles and banks from Texas to Mississippi, at the shelf edge.
Red Drum	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to depths of 25 fathoms; waters and substrates extending from Crystal River, Florida to Naples, Florida between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms.
Reef Fish (31 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.
Shrimp (4 species)	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the US/Mexico border to Fort Walton Beach, Florida from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana to Pensacola Bay, Florida between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida to Naples, Florida between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.
Spiny Lobster	Gulf of Mexico waters and substrates extending from Tarpon Springs, Florida to Naples, Florida between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida to the boundary between the areas Page 2-88 Final EIS for EFH for the Gulf of Mexico FMPs March 2004 covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 15 fathoms.
Stone Crab	All Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the US/Mexico border to Sanibel, Florida from estuarine waters out to depths of 10 fathoms; waters and substrates extending from Sanibel, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 15 fathoms.

Source: GMFMC, 2004

In addition to establishing EFH, the Magnuson-Stevens Act also directs NMFS and the FMCs to characterize Habitat Areas of Particular Concern (HAPCs). HAPCs are subsets of EFH that are rare, especially ecologically important, particularly susceptible to human-induced degradation, or located in environmentally stressed areas. HAPCs typically include high-value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish. HAPCs in the GOM include the Flower

Species and EFH Descriptions

Garden Banks, Florida Middle Grounds, Tortugas North and South Ecological Reserves, Madison-Swanson Marine Reserve, Pulley Ridge, and the following reefs and banks: Stetson, McNeil, Bright Rezak, Geyer, McGrail Bouma, Sonnier, Alderice, and Jakkula (GMFMC, 2004). None of these areas are near the Maritime WSEP test area, and would therefore not be affected by mission activities.

4. DETERMINATION OF EFFECTS

4.1 SEA TURTLES

Sea turtles could be impacted during Maritime WSEP test activities by direct strikes, debris, and potential effects from noise and overpressure produced by detonations. Due to sea turtles' generally dispersed distribution (low density) and relatively short surface intervals, the possibility of direct strikes by inert munitions is considered low and is not considered further.

4.1.1 Boat Strikes

In addition to target boats, a number of surface vessels will be at the test area to set-up the targets and secure the safety zone. Boat strikes could potentially affect sea turtles swimming or feeding at or just beneath the water surface. Propeller wounds have increasingly occurred among the loggerheads found dead or debilitated in Florida. In addition, noise from surface vessel traffic may cause behavioral responses in sea turtles. However, the number of boats associated with the test would not appreciably change the typical background level of boat traffic in the area, where a large number of recreational and commercial fishing boats regularly operate in the area. Missions will occur in a variety of sea states up to wave heights of four feet. However, vessel operators are expected to adjust their speed and vigilance based on conditions. Increased sea states will likely result in vessels being operated at lower speeds, thereby reducing the risk of an interaction. The likelihood of a boat strike is considered low. Therefore, potential boat strikes associated with Maritime WSEP test activities **may affect, but are not likely to adversely affect** sea turtles.

4.1.2 Debris

Test activities may result in fragments of bombs, missiles, gunnery rounds, and pieces of the targets being dispersed into the water. These fragments could remain on the water surface, enter the water column, or settle to the bottom. Surface debris will be collected by AF personnel to the extent practicable, but debris below the surface will not be collected. Debris can negatively impact sea turtles (as well as other marine species). Debris can be ingested and cause gastrointestinal blockages or damage to internal organs. Sea turtles, (especially leatherbacks) may be more susceptible to marine debris ingestion than other marine species due to the tendency of floating debris to concentrate in convergence zones which adults and juveniles use for feeding and migrating routes. Floating plastics such as plastic bags are known to be ingested by turtles, causing injury or death (Mrosovsky et al., 2009). Debris can also result in entrapment or entanglement of sea turtles, although this is more commonly associated with derelict fishing gear. However, the amount of debris will be minimal compared to other sources of debris and to the volume of water in the northeast GOM. In addition, surface debris will be collected and removed from the water to the extent feasible. Therefore, the proposed action **may affect, but is not likely to adversely affect** sea turtles through the release of marine debris.

4.1.3 Noise and Pressure Effects due to Ordnance Detonations

Sea turtles spend nearly their entire lives at sea, coming ashore only to nest and, in rare circumstances and locations, to bask. When at the water surface, sea turtle bodies are almost entirely below the water's surface, typically with only the head above water. This makes sea turtles difficult to locate visually and also exposes them to effects of nearby underwater explosions. Detonation of live ordnance produces noise and pressure waves in the water column that could cause mortality, injury, or harassment (behavioral changes). The effects to a given individual turtle depend on the source of the sound/pressure wave, proximity of the turtle to the source, and the number of disturbances over time. Turtles near a detonation could be injured or killed as a result of tissue destruction caused by intense pressure waves. Tissue damage is most likely to occur where there is substantial impedance differences (e.g., across air/tissue interfaces in the ear canal, sinuses, lungs, and intestines).

Noise from mission activities may cause a startle reaction in sea turtles and produce temporary, sub-lethal stress. Startle reactions may include increased surfacing, rapid swimming, or diving (McCauley 2000, Lenhardt 1994, as cited in NMFS, 2013). Noise due to mission activities may affect habitat quality such that important biological behaviors may be disrupted (e.g., feeding, mating, and resting), and turtles may avoid the test area because of the noise. The magnitude of those effects may be affected by the frequency, periodicity, duration, and intensity of the sounds, as well as the behavior of the animals during the exposure.

Compared to marine mammals, little is known about the role of sound and hearing in sea turtle life history and behavior, and only rudimentary information is available about responses to anthropogenic noise. Lenhardt et al. (1983) (as cited in NMFS, 2013) suggested that sea turtles use acoustic signals as guideposts during migration and as a cue to identify natal beaches. Sea turtles appear to be most sensitive to low frequencies; greatest sensitivities were from 200 to 700 Hz for the green turtle (Ridgway et al., 1969) and around 250 Hz for juvenile loggerheads (Bartol et al., 1999, as cited in DON, 2008). The effective hearing range for marine turtles is generally considered to be between 100 and 1,000 Hz (Bartol et al., 1999, as cited in DON, 2008; Lenhardt, 1994; Moein, 1994, as cited in DON, 2008; Ridgway et al., 1969). Hearing thresholds below 100 Hz were found to increase rapidly (Lenhardt, 1994). Additionally, calculated in-water hearing thresholds at best frequencies (100 to 1,000 Hz) appear to be high, at 160 to 200 dB re 1μPa (Lenhardt, 1994; Moein et al., 1995, as cited in DON, 2008). A study on the effects of airguns on sea turtle behavior also suggests that they are most likely to respond to low-frequency sounds (McCauley et al., 2000). Green and loggerhead turtles noticeably increased their swimming speed, as well as swimming direction, when received levels reached 166 dB re 1 μPa, and their behavior became increasingly erratic at 175 dB re 1 μPa (McCauley et al., 2000). There is no information regarding the consequences that these disturbances may have on sea turtles in the long term, but short-term disruption to normal behaviors and temporary abandonment of habitat is likely in response to some noises produced by munitions testing.

The potential number of sea turtles affected by detonations is assessed in the following paragraphs. In summary, three key sources of information are necessary for estimating potential effects: 1) the zone of influence; 2) the density of animals potentially occurring within the zone of influence; and 3) the number of detonation events. These components are discussed in further detail below. Appendix A contains a description of the acoustic modeling methodology used to determine the number of sea turtles potentially impacted by Maritime WSEP activities.

4.1.3.1 *Zone of Influence*

The Zone of Influence (ZOI) is defined as the area of ocean in which sea turtles could potentially be exposed to various noise or pressure thresholds associated with exploding ordnance. Due to the general lack of information regarding sea turtle hearing thresholds, there are no acoustic energy or pressure impact threshold ranges that are currently endorsed by the NMFS. In the absence of such information, thresholds used for marine mammal analyses are typically used when evaluating potential effects to sea turtles (e.g., DON, 2008; DON, 2009). Specifically, thresholds are identified for mortality, injury, and harassment. The Level B behavioral harassment criterion is currently not used for turtle impacts analysis. The following paragraphs provide a general discussion of the various metrics, criteria, and thresholds used for impact assessment in this BA. A summary is provided in Table 4-1.

Metrics

Standard, currently accepted impulsive and acoustic metrics were used for the analysis of underwater energy and pressure waves in this document. Three metrics are particularly important for this assessment.

- *Peak Pressure*: This is the maximum positive pressure, or peak amplitude of impulsive sources, for an arrival. Units are in psi.
- *Positive Impulse*: This is the time integral of the pressure over the initial positive phase of an arrival. This metric represents a time-averaged pressure disturbance from an explosive source. Units are typically Pascal-second (Pa-s) or pounds per square inch per millisecond (psi-msec). The latter is used in this document. There is no decibel analog for impulse.
- *Energy flux density (EFD)*: For plane waves, which is assumed for acoustic energy produced by the actions described in this document, EFD is the time integral of the squared pressure divided by the impedance. EFD levels have units of Joules per square meter (J/m^2), inch-pounds per square inch ($in\text{-}lb/in^2$), or decibels referenced to one squared microPascal-second (dB re 1 μPa^2-s) (with the usual convention that the reference impedance is the same as the impedance at the field point). The latter unit is used in this document.

Criteria and Thresholds: Mortality

Lethal impacts are associated with exposure to a certain level of positive impulse pressure, expressed as psi-msec. The criterion for mortality typically used for marine mammal assessments, and therefore applied to sea turtles in this document, is onset of severe lung injury. The threshold is stated in terms of the Goertner (1982) modified positive impulse with value indexed to 30.5 psi-msec. The Goertner approach depends on propagation, source/animal depths, and animal mass in a complex way. Because animals of greater mass can withstand greater pressure shock waves, this threshold was conservatively based on the mass of a dolphin calf. This threshold is further conservative in that, although it corresponds to only a one percent chance of mortal injury, any animal experiencing onset of severe lung injury is considered to be lethally taken.

Criteria and Thresholds: Injury

Non-lethal injurious impacts are currently defined for marine mammals with dual criteria: eardrum rupture (associated with permanent hearing threshold shift), and onset of slight lung injury. However, in order to be consistent with previous Department of Defense analysis (DON, 2008), only the latter is used for sea turtle analysis. The criterion is associated with a positive impulse level which is given in terms of the Goertner (1982) modified positive impulse metric indexed to 13 psi-msec. The 13 psi-msec threshold was originally developed to correspond to slight lung injury in a dolphin calf. The impact range for similar injury in an adult dolphin or larger cetacean would be less. However, as a conservative measure, the 13 psi-msec threshold is typically used to estimate impacts to all age classes.

Criteria and Thresholds: Harassment

The physiological effect associated with non-injurious harassment is temporary (hearing) threshold shift (TTS), which is defined as a temporary, recoverable loss of hearing sensitivity at a particular frequency or frequency range. Similar to physiological impacts, TTS is currently defined with dual criteria. The first criterion is an EFD of 182 dB re 1 μPa^2-s in any 1/3-octave band at frequencies above 100 Hz for toothed whales and above 10 Hz for baleen whales. The second criterion is stated in terms of peak pressure at 23 psi. The more conservative (i.e., larger) range of the two criteria is used to estimate impacts in this document.

Table 4-1. Explosive Criteria Used for Estimating Sea Turtle Impacts

Effect	Criteria	Metric	Threshold
Mortality	Onset of extensive lung injury	Goertner modified positive impulse	30.5 psi-ms
Physiological	Onset slight lung injury	Goertner modified positive impulse	indexed to 13 psi-ms
Behavioral	TTS	Greatest energy flux density level in any 1/3-octave band above 100 Hz - for total energy over all exposures	182 dB re 1 μPa^2-s
Behavioral	TTS	Peak pressure over all exposures	23 psi

dB 1 μPa^2-s = decibel referenced to 1 micropascal squared second; Hz = hertz; psi-ms = pounds per square inch-millisecond; PTS = Permanent Threshold Shift; TTS= temporary threshold shift

4.1.4 Sea Turtle Density

Density estimates for three sea turtle species (loggerhead, Kemp's ridley, and leatherback) were obtained from a habitat modeling project conducted for portions of the EGTTR, including the Maritime WSEP test area (Garrison, 2008). NOAA Fisheries' Southeast Fisheries Science Center (SEFSC) personnel conducted line transect aerial surveys of the continental shelf and coastal waters of the eastern GOM during winter (February 2007; water temperatures of 12-15°Celsius) and summer (July/August 2007; water temperatures >26°Celsius). The surveys covered nearshore and continental shelf waters to a maximum depth of 200 meters, with the majority of effort concentrated in waters from the shoreline to 20 meters depth. Marine species encounter rates during the surveys were generally corrected for sighting probability and also for the probability that animals were available on the surface to be seen. The survey data were combined with remotely sensed environmental data/habitat parameters (water depth, sea surface temperature [SST], and chlorophyll-*a* concentration) to develop habitat models. The technical approach, described as Generalized Regression and Spatial Prediction, spatially projects the species-habitat relationship based on distribution of environmental factors, resulting in predicted densities for un-sampled locations and times. The spatial density model can therefore be used to predict relative density in unobserved areas and at different times of year based upon the monthly composite SST and chlorophyll datasets derived from satellite data. Similarly, the spatial density model can be used to predict relative density for any sub-region within the surveyed area.

Garrison (2008) produced sea turtle density estimates at various spatial scales within the EGTTR. At the largest scale, density data were aggregated into four principal strata categories: North-Inshore, North-Offshore, South-Inshore, and South-Offshore. These densities were provided in the published survey report. It should be noted that these aggregated densities were not corrected for the availability of turtles at the surface, and the resulting negative bias is likely large. Unpublished densities were also provided to Eglin AFB for smaller blocks (sub-areas) corresponding to airspace units, and a number of these sub-areas were combined to form larger zones. Densities in these smaller areas were provided in Excel© spreadsheets by the report author. Unlike the aggregated estimates, sub-area densities were corrected for animal surface availability.

For both large areas and sub-areas, regions occurring entirely within waters deeper than 200 meters were excluded from predictions, and those straddling the 200 meter isobath were clipped to remove deep water areas. In addition, because of limited survey effort, density estimates beyond 150 meters water depth are considered invalid. The environmental conditions encountered during the survey periods (February and July/August) do not necessarily reflect the range of conditions potentially encountered throughout the year. In particular, the transition seasons of spring (April-May) and fall (October-November) have a very different range of water temperatures. Accordingly, for predictions outside of the survey period or spatial range, it is necessary to evaluate the statistical variance in predicted values when attempting to apply the model. The coefficient of variation (CV) of the predicted quantity is used to measure the validity of model predictions. According to Garrison (2008), the best predictions have CV values of approximately 0.2. When CVs approach 0.7, and particularly when they exceed 1.0, the resulting model predictions are extremely uncertain and are considered invalid.

Due to difficulties in distinguishing green and hawksbill sea turtles from the air, these two species were combined into a Green/Hawksbill category. Habitat modeling resulted in prediction of relatively high densities of this species category in warm, offshore waters of the northern GOM. However, Garrison (2008) cautions that this prediction is highly suspect, and that these results should only be applied from southwestern Florida to the Dry Tortugas. Therefore, habitat modeling results for the green sea turtle are not used in this document. Model results for leatherback turtles are also less reliable due to overall low observation numbers, but Garrison (2008) does not suggest discounting leatherback density estimates in the northern Gulf.

Density estimates for green sea turtles are derived from Epperly et al. (2002). Although the publication focuses on sea turtle bycatch, aerial surveys were conducted in conjunction with the studies. The surveys were conducted by NMFS personnel each fall between 1992 and 1996. Results were stratified into inshore (0 to 10 fathoms) and offshore (10 to 40 fathoms) areas, as well as into western and eastern geographic zones. The eastern offshore stratum is most applicable to the Maritime WSEP mission location. Results were also presented for upper and lower 95 percent confidence intervals. The density corresponding to the upper confidence interval of the 10 to 40 fathom stratum is used in this document. Density estimates were not adjusted for sighting or availability bias, likely resulting in underestimation of true density; therefore, the authors presented the values as minimum density estimates. To account for the potential for negative bias associated with sighting and availability bias, Eglin AFB adjusted the minimum density estimate for green sea turtles based on a 90 percent dive profile (i.e., sea turtles are assumed to spend an average of 90 percent of their time underwater and 10 percent of their time at the surface).

Based upon the preceding discussion, density estimates shown in Table 4-2 for loggerhead, Kemp's ridley, and leatherback sea turtles correspond to the median density in sub-area 137, as presented by Garrison (2008) (Figure 4-1). Within this block, densities were provided based upon one year (2007) and five-year monthly averages for SST and chlorophyll. The five year average is considered preferable and is used in this document. For loggerhead, Kemp's ridley, and leatherback turtles, CVs were acceptable for February and March. Since Maritime WSEP test activities could occur any time during February or March, the density estimate associated with the highest monthly five-year average was used for this analysis,,which in this case was in February. CV for February in this particular block ranged from 0.33 to 0.41.

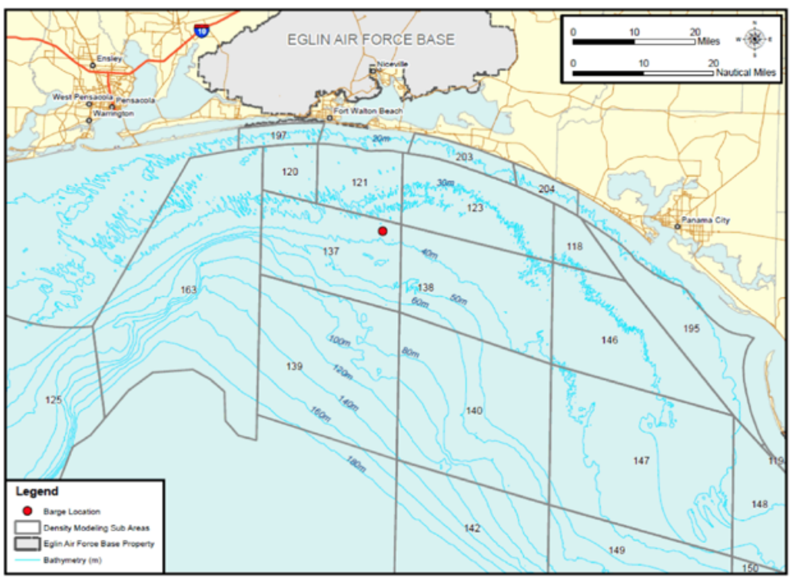

Figure 4-1. Sub-Areas Included in Garrison (2008)

Table 4-2. Sea Turtle Density Estimates

Species	Adjusted Density (animals/km^2)
Loggerhead sea turtle[1]	2.36
Kemp's ridley sea turtle[1]	1.904
Leatherback sea turtle[1]	0.601
Green sea turtle[2]	0.170

[1]Source: Garrison, 2008; adjusted for observer and availability bias by author
[2]Source: Epperly et al., 2002; not adjusted for sighting or availability bias by the authors, but adjusted by Eglin AFB for this take analysis

Density is nearly always reported for an area (e.g., animals per square kilometer). Analyses of survey results may include correction factors for negative bias. Garrison (2008) provided such a correction for loggerhead, Kemp's ridley, and leatherback sea turtles. Since Epperly et al. (2002) did not provide a correction factor for green sea turtles; Eglin AFB adjusted the densities to account for a 90 percent dive profile for this species only. Although the study area appears to represent only the surface of the water (two-dimensional), density actually implicitly includes animals anywhere within the water column under that surface area. Density estimates usually assume that animals are uniformly distributed within the prescribed area, even though this is likely rarely true. Sea turtles may be clumped in areas of greater importance, for example, in areas of greater food availability. Density can occasionally be calculated for smaller areas, but usually there are insufficient data. Therefore, assuming an even distribution within the prescribed area is the typical approach.

In addition, assuming that marine animals are distributed evenly within the water column does not accurately reflect behavior. Databases of behavioral and physiological parameters obtained through tagging and other technologies have demonstrated that marine animals use the water column in various ways. Some species conduct regular deep dives while others may engage in much shallower dives, regardless of bottom depth. The assumption that all species are evenly distributed from surface to bottom is almost never accurate and can present a distorted view of species distribution in any region. Therefore, a depth distribution adjustment is applied to sea turtle densities in this document (Table 4-3). By combining turtle density with depth distribution information, a three-dimensional density estimate is possible. These estimates allow more accurate modeling of potential sea turtle exposures from explosive sources. Refer to Appendix A for a more detailed description of the acoustic modeling methodology.

Table 4-3. Depth Distribution for Sea Turtles in the Maritime WSEP Test Area

Species	Depth Distribution	Reference
Leatherback sea turtle	28% at <6 m, 36% at 6-12 m, 24% at 13-51 m, 7% at 52-102 m, 3% at 103-150 m, and 2% at >150 m.	Eckert (2006)
Loggerhead sea turtle	33% at <1 m, 15% at 1-3 m, 12% at 4-6 m, 8% at 7-10 m, 25% at 11-25 m, and 7% at >25 m.	Dellinger and Freitas (2001)
Other hard-shelled sea turtles (Kemp's ridley and green)	33% at <1 m, 15% at 1-3 m, 12% at 4-6 m, 8% at 7-10 m, 25% at 11-25 m, and 7% at >25 m.	Dellinger and Freitas (2001)

m = meters

4.1.5 Number of Events

The number of events for Maritime WSEP activities generally corresponds to the number of live ordnance expenditures shown in Tables 2-2 and 2-3. However, it should be noted that the number of bursts for the CBU-105 cluster bomb is 10 submunitions containing 4 projectiles each. The 30 mm gunnery rounds were modeled as one burst each. The 7.62 mm/.50 cal rounds do not contain high explosives and therefore do not detonate and introduce acoustic energy or pressure into the water column.

4.1.6 Exposure Estimates

Tables 4-4 and 4-5 provide the maximum estimated winter and summer range, or radius, from the detonation point to which the various thresholds extend. This range is then used to calculate the total area of the ZOI. The calculated ZOIs are combined with the density estimates listed in Table 4-2 (adjusted for depth distribution) and the number of live munitions to provide an estimate of the number of sea turtles potentially affected (Tables 4-6 through 4-8). For metrics with two criteria (e.g., 182 dB EFD and 23 psi for harassment), the larger number of the two are presented and are bolded in Table 4-2. In some cases, munitions are analyzed according to weight class in order to facilitate use of previous acoustic modeling. In these cases, the resulting impact estimates are conservative in that the NEW used for modeling is greater than the actual NEW. Specifically, the GBU-38 SDB (37 lbs actual NEW) is modeled as AGM-65 (86 lbs modeled NEW), and the AGM-175 and 2.75 rockets (13 and 12 lbs actual NEW, respectively) are modeled as AGM-114 (20 lbs modeled NEW). Appendix A contains model results for all criteria. It should be noted that the impact estimates shown in the table do not account for required mitigation measures, which are expected to reduce the likelihood and extent of impacts. Mitigation measures are described in Chapter 5.

Table 4-4. Winter Threshold Radii (in meters) for Maritime WSEP Ordnance

Munition	Detonation Scenario	Mortality	Physiological	Behavioral	
		30.5 psi-msec	13 psi-msec	182 dB EFD*	23 psi
GBU-10 or GBU-24	Surface	202	362	932	**1280**
GBU-12 or GBU-54	Surface	114	243	687	**752**
AGM-65 (Maverick)	Surface	84	187	**605**	575
GBU-39 (LSDB)	Surface	84	187	**605**	575
CBU-105	Airburst	0	0	0	0
AGM-114 (Hellfire)	Surface	46	105	**413**	353
AGM-175 (Griffin)	Surface	46	105	**413**	353
2.75 Rockets	Surface	46	105	**413**	353
PGU-13 HEI 30 mm	Surface	0	7	31	**60**
7.62 mm/.50 cal	Surface	0	0	0	0

*In greatest 1/3-octave band above 10 Hz or 100 Hz

Table 4-5. Number of Sea Turtles Potentially Affected by Maritime WSEP Test Missions

Species	Number of Impacts, Mortality	Number of Impacts, Physiological	Number of Impacts, Behavioral
Loggerhead sea turtle	0.371	1.023	39.811
Kemp's ridley sea turtle	0.299	0.826	32.119
Leatherback sea turtle	0.128	0.327	12.890
Green sea turtle	0.027	0.074	2.868
TOTAL	**0.825**	**2.25**	**87.688**

The table indicates the potential for lethality, injury, and non-injurious harassment to sea turtles in the absence of mitigation measures. The numbers represent total impacts for all detonations combined. Mortality is considered unlikely for green turtles. For loggerhead, Kemp's ridley, and leatherback turtles, mortality was calculated as less than one animal combined. However, the potential for impacts from live munitions testing would be reduced with the implementation of the monitoring and mitigation measures outlined in Chapter 5. Noise and pressure effects due to detonations at the water surface **may affect, and are likely to adversely affect,** sea turtles.

4.2 ESSENTIAL FISH HABITAT

The MSA requires federal agencies to assess potential impacts to EFH for managed commercial fisheries. Adverse impacts to EFH are defined as those that reduce quality and/or quantity of EFH. The EFH constituents identified in Table 3-3 (Section 3.2) include estuaries, coral/hardbottom, other substrate, and the water column. Maritime WSEP test activities would not occur in estuaries. No reef or other hardbottom habitat occurs within about 10 miles of the site (Figure 4-2). Known artificial reefs occur within the composite safety footprint, with the nearest being between two and three miles from the approximate target site. However, it is considered unlikely that ordnance or debris would affect artificial reefs or other hard bottom areas.

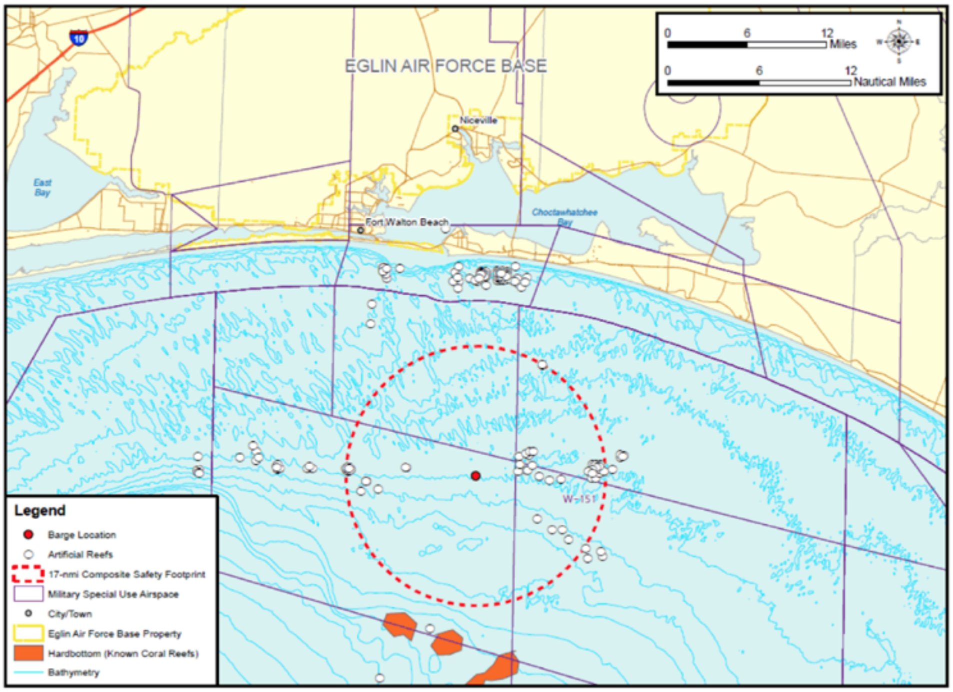

Figure 4-2. Hardbottom Habitat near the Maritime WSEP Test Area

Impacts to substrate and the water column could occur due to metals and chemical materials, debris (including sunken targets), and anchoring of the instrumentation barge. There will be no underwater detonations, and explosions at the water surface will not affect the seafloor. Therefore, there will be no affects to sediments or other substrates due to blast effects.

Metals typically used to construct bombs, missiles, and gunnery rounds include copper, aluminum, steel, and lead. Aluminum is also present in some explosive materials such as tritonal. Lead is present in batteries used in vessels such as the remotely controlled target boats. Metal debris would settle to the seafloor after munitions are detonated. Metal ions would slowly leach into the substrate and the water column, causing elevated concentrations in a small area around munitions fragments. Some of the metals, such as aluminum, occur naturally in the ocean at varying concentrations and would not necessarily degrade the substrate or water column. Other metals, such as lead, could cause toxicity in microbial communities in the substrate. However, such effects would be localized and would not significantly affect the overall habitat quality of sediments in the northeastern Gulf. In addition, metal fragments would corrode, degrade, and become encrusted over time.

Chemical materials include explosive byproducts and fuel, oil, and other fluids (including battery acid) associated with remotely controlled target boats. Explosive byproducts would be introduced into the water column through detonation of live munitions. Explosive materials associated with test ordnance include tritonal and research department explosive (RDX), among others. Tritonal is primarily composed of 2,4,6-trinitrotoluene (TNT). RDX is sometimes referred to as cyclotrimethylenetrinitramine. Various byproducts are produced during and immediately after detonation of TNT and RDX. During the very brief time that a detonation is in progress, intermediate products may include carbon ions, nitrogen ions, oxygen ions, water, hydrogen cyanide, carbon monoxide, nitrogen gas, nitrous oxide, cyanic acid, and carbon dioxide (Becker, 1995). However, reactions quickly occur between the intermediates, and the final products consist mainly of water, carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen gas, although small amounts of other compounds may persist or be produced as well.

Chemical materials introduced into the water column would be quickly dispersed by currents, tidal action, and waves, and would eventually become uniformly distributed throughout the northern GOM. A portion of the carbon compounds, such as CO and CO_2, would likely become integrated into the carbonate system (alkalinity and pH buffering capacity of seawater). Some of the nitrogen and carbon compounds, including petroleum products, would be metabolized or assimilated during protein synthesis by phytoplankton and bacteria. Most of the gas products that do not react with the water or become assimilated by organisms would be released to the atmosphere. Due to dilution, mixing, and transformation, none of the chemicals potentially released into the water column are expected to have significant impacts on the marine environment.

Explosive material that is not consumed in a detonation could sink to the substrate and bind to sediments. However, the quantity of such materials in expected to be inconsequential. Research has shown that if munitions function properly, nearly full combustion of the explosive materials will occur, and only extremely small amounts of raw materials will remain. In addition, TNT decomposes when exposed to sunlight/ultraviolet radiation and is also degraded by microbial activity (Becker, 1995). Several types of microorganisms have been shown to metabolize TNT. Similarly, RDX is decomposed by hydrolysis, ultraviolet radiation exposure, and biodegradation. There is potential for munitions to fail to detonate. In this case, intact explosive materials could eventually enter the water column. This process would probably happen slowly, as the munition casing degraded. In addition, it is expected that the dud rate will be low. The fate of chemical materials from UXO would be similar to that described above.

Direct physical impacts to the seafloor could occur due to debris and the barge anchoring system. Debris deposited on the seafloor would include spent munitions fragments, UXO (in the case of dud munitions), and possibly pieces of the target boats (fiberglass, plywood, etc.). Debris would not appreciably affect the sandy seafloor. Debris moved by water currents could scour the bottom, but sediments would quickly refill any affected areas, and overall effects to benthic communities would be minor. Large pieces of debris would not be as prone to movement on the seafloor and could result in beneficial effects by providing habitat for encrusting organisms, fish, and other marine fauna. Target boats have foam-filled hulls and most of the pieces are designed to float in order to facilitate collection for a damage assessment. Overall, the quantity of material deposited on the seafloor would be small compared to other sources of debris in the GOM. Although missions will be planned to avoid hardbottom habitats and artificial reefs, there is some potential for debris to be carried by currents and cause minimal alteration to such habitats before becoming embedded in the sediments. However, the potential for such a scenario to cause significant damage in considered low, and effects to natural or artificial reefs are not expected.

The GRATV would be anchored to the seafloor with four anchors, one on each corner of the barge. The anchors would cover a small area of sandy seafloor habitat immediately surrounding the GRATV. In addition water currents flowing around the anchors could cause some scouring of the substrate. These actions could result in mortality, injury, or displacement of benthic organisms. However, the area of affected seafloor would be insignificant compared to the amount of available similar habitat in the vicinity of the mission area, and in the nearshore waters of the northeastern GOM generally. In addition, the GRATV will leave the area after test missions are completed, and water currents would re-distribute sediments.

There will be no reduction in EFH quality and/or quantity due to Maritime WSEP Operational Testing. Mission activities **will not adversely affect EFH**.

5. MITIGATIONS

5.1 INTRODUCTION

Mitigations are measures taken to lessen or eliminate the impacts of an action. As defined in CEQ Regulations (40 CFR §1508.20), mitigation includes:

- Avoiding the impact altogether by not taking a certain action or part of an action
- Minimizing impacts by limiting the degree of magnitude of the action and its implementation
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time through preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments

Mitigations may include any supplemental activities that are designed, proposed, and exercised to help reduce or eliminate the potential impacts (i.e., incidental harassment takes) to the marine resources. The Air Force recognizes the importance of such "in-place" mitigations and is aware that NMFS recommends an approved mitigation plan that outlines the scope and effectiveness of the proposed activity's mitigations.

5.2 IMPACT MINIMIZATION

The potential takes discussed in Chapter 4 represent the maximum expected number of animals that could be affected. The impact estimates do not take into account measures that will be employed to minimize impacts to sea turtles and other marine species (some of these measures will help ensure human safety of mission participants and non-participants as well). Mitigation measures consist of visual monitoring to detect the presence of sea turtles and sea turtle indicators (e.g., large jellyfish aggregations and *Sargassum* mats). Monitoring procedures are described in the following subsections.

5.2.1 Visual Monitoring

Visual monitoring will be required during Maritime WSEP missions from surface vessels and high-definition video cameras. A large number of range clearing boats (approximately 20 to 25) will be stationed around the test site to prevent non-participating vessels from entering the human safety zone. Based on the composite footprint, range clearing boats will be located approximately 15,289 meters (9.5 miles) from the detonation point (Figure 5-1). Actual distance will vary based on the size of the munition being deployed, but as a means of comparison, this distance is used for the mitigation plan.

Summary of Conclusions

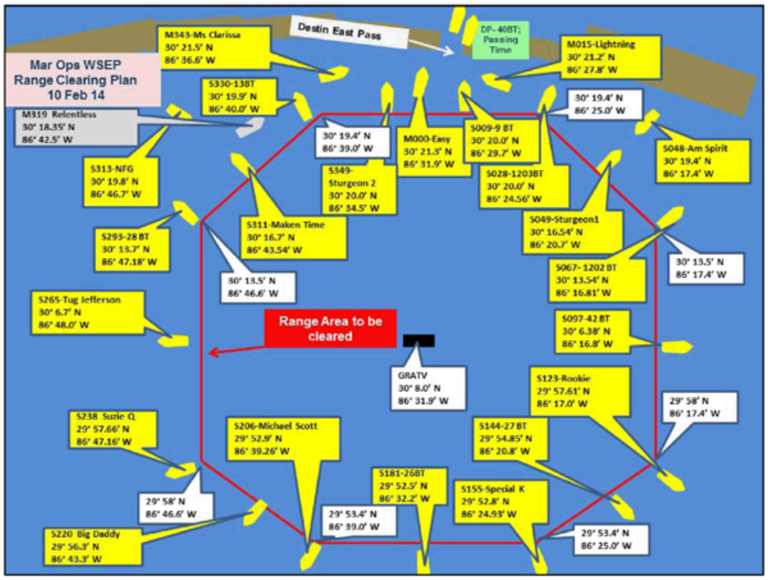

Figure 5-1. Range Area to be Cleared for Human Safety Zone

Trained marine species observers will be aboard two to six of the range clearing boats (depending on area required to be surveyed) and will conduct protected species surveys before and after each test. The protected species survey vessels will be dedicated solely to observing for marine species during pre-mission surveys while the remaining safety boats clear the area of non-authorized vessels. The protected species survey vessels will begin surveying the area at sunrise. The area to be surveyed will encompass the largest applicable ZOI based on the particular ordnance involved, which in almost all cases is the marine mammal Level B behavioral harassment range, plus a buffer zone. Although the behavioral harassment metric is not used for sea turtle impact estimates, it is used for marine mammals. Because sea turtles and mammals are both included in the same pre-mission surveys, this provides an additional benefit for turtles in that the survey area is larger than it would be based solely on turtle impact zones. The buffer zone is an additional area outside the ZOI that has the same radius of the ZOI, thereby doubling the survey area. This is an additional precautionary measure to ensure not only that the ZOI is clear of protected species, but also that the area around the ZOI is clear of animals that may enter the area after the pre-mission surveys have been completed. By doubling the acoustic modeling results for the winter season, the largest possible distance from the target to be surveyed is 2,292 meters (1.4 miles). This distance is double the range of the corresponding 177 dB EFD behavioral harassment threshold for 945 pound NEW munitions detonated at the water surface. The smallest distance to be surveyed is 100 meters (0.06 miles), which is double the 177 dB EFD behavioral harassment range for 30 mm gunnery rounds. The survey pattern will depend upon the size of the survey area and may include line transects or circular routes. Example survey routes for different munitions successfully used during Maritime Strike missions are shown in Figure 5-2. Because of human safety issues, observers will be required to leave the mission area at least 30 minutes in advance of live weapon deployment and move to a position on the safety zone periphery, approximately 9.5 miles from the detonation point. Observers will

Summary of Conclusions

continue to scan for protected marine species from the periphery, but effectiveness will be limited as the boat will remain at a designated station.

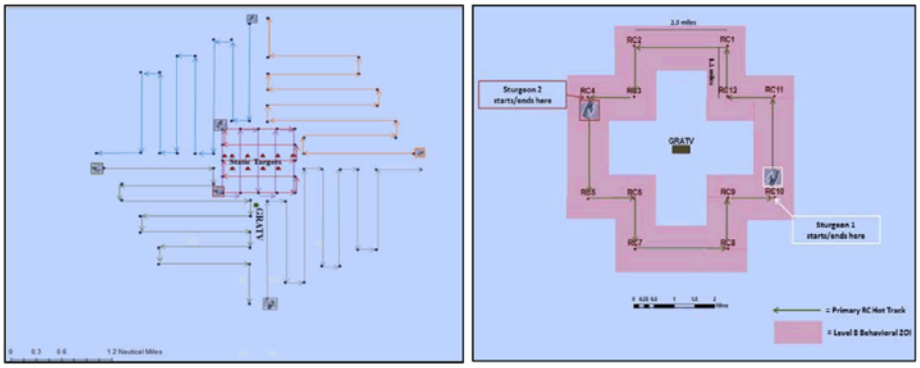

Figure 5-2. Example Routes Used During Maritime Strike Missions in 2013 and 2014

AF personnel will be within the mission area (on boats and the GRATV) on each day of testing well in advance of weapon deployment, typically near sunrise. They will perform a variety of tasks including target preparation, equipment checks, etc., and will opportunistically observe for sea turtles and indicators as feasible throughout test preparation. However, such observations are considered incidental and would only occur as time and schedule permits. Any sightings would be relayed to the Lead Biologist, as described in the detailed mitigation procedures below.

In addition to vessel-based monitoring, one to three video cameras will be positioned on the GRATV anchored on-site to allow for real-time monitoring for the duration of the mission. The camera configuration and actual number of cameras used would depend on the specific mission requirements. In addition to monitoring the area for mission objective issues, the camera(s) will also be used to monitor for the presence of protected species. A trained marine species observer from Eglin Natural Resources would be located in Eglin's CCF, along with mission personnel, to view the live video feed before and during test activities. The distance to which objects can be detected at the water surface by use of the cameras is considered generally comparable to that of the human eye. The GRATV will be located about 600 feet (183 meters) from the target area. The sea turtle mortality threshold distance extends from 0 to 202 meters (depending on ordnance), and the physiological threshold distance extends from 0 to 362 meters. Given these distances, observers could reasonably be expected to view a substantial portion of the mortality zone in front of the camera, although a small portion would be behind or to the side of the camera view. Some portion of the physiological zone could also be viewed, although it would be less than that of the mortality zone (a large percentage would be behind or to the side of the camera view). Representative screen shots from three different cameras are shown in Figures 5-3 through 5-5.

Figure 5-3. Representative Screen Shot, Camera 1

Figure 5-4. Representative Screen Shot, Camera 2

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Figure 5-5. Representative Screen Shot, Camera 3

At least two ordnance delivery aircraft will participate in each live weapon release. Prior to the mission, AF pilots aboard mission aircraft may make a dry run over the target area to ensure it is clear of non-participating vessels before ordnance is deployed. Observation effectiveness may vary among aircraft types. Jets will fly at a minimum speed of 300 knots indicated air speed (approximately 345 miles per hour, depending on atmospheric conditions) and at a minimum altitude of 1,000 feet (305 meters). Due to the limited flyover duration and potentially high speed and altitude, observation for marine species would probably be only marginally effective at best, and pilots would, therefore, not participate in protected species surveys.

5.2.2 Environmental Considerations

Weather conducive for sea turtle monitoring is required to effectively implement the surveys. Wind speed and the resulting surface conditions of the GOM are critical factors affecting observation effectiveness. Higher winds typically increase wave height and create "white cap" conditions, both of which limit an observer's ability to locate marine species at or near the surface. Maritime WSEP missions will be delayed or rescheduled if the sea state is greater than number 4 of Table 5-1 at the time of the mission. The Lead Biologist aboard one of the survey vessels will make the final determination on whether conditions are conducive for sighting protected species or not. In previous Maritime Strike missions conducted in 2013, a mission was canceled due to sea state conditions that prevented a proper pre-mission survey and high numbers of marine mammals observed in the area. Other missions in 2013 were delayed due to extended surveys to ensure protected species were clear of the area (Department of the Air Force, 2014). In addition, the missions will occur no earlier than two hours after sunrise and no later than two hours prior to sunset to ensure adequate daylight for pre- and post-mission monitoring.

Table 5-1. Sea State Scale for Maritime WSEP Mission Surveys

Sea State Number	Sea Conditions
0	Flat calm, no waves or ripples.
1	Light air, winds 1-2 knots; wave height to 1 foot; ripples without crests.
2	Light breeze, winds 3-6 knots; wave height 1-2 feet; small wavelets, crests not breaking.
3	Gentle breeze, winds 7-10 knots; wave height 2-3.5 feet; large wavelets, scattered whitecaps.
4	Moderate breeze, winds 11-16 knots; wave height 3.5-6 feet; breaking crests, numerous whitecaps.

5.2.3 AF Support Vessels

AF support vessels will consist of a combination of AF and civil service/civilian personnel. Vessel-based and video monitoring will be conducted for all missions. The Eglin Range Safety Officer, in cooperation with the Santa Rosa Island Tower Control at Test Site A-13B and CCF, will coordinate and manage all range clearing and protected species observation efforts. All support vessels will be in radio contact with one another and with Tower Control on the government VHF channel 81a or 82a. CCF will monitor all radio communications, but Tower will relay messages between the vessels and CCF. The Safety Officer and Tower Control will also be in continual contact with the Test Director throughout the mission and will coordinate information regarding range clearing. Final decisions regarding mission execution, including possible mission delay or cancellation based on protected species sightings, will be the responsibility of the Safety Officer, with concurrence from the Test Director. Lines of communication for protected species surveys are shown in Figure 5-6.

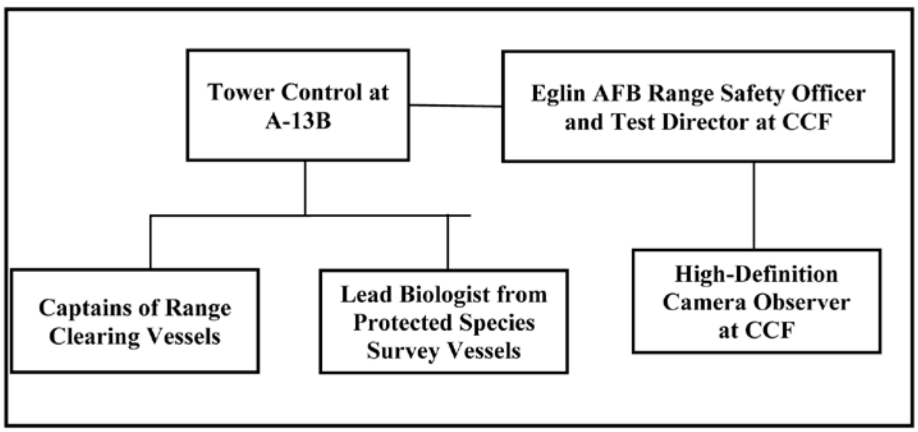

Figure 5-6. Marine Species Observer Lines of Communication

5.2.4 Roles and Responsibilities of Dedicated Observers

The following subsections describe the roles and responsibilities of each component of the entire monitoring team. The overall objective of these efforts is to provide sufficient and continual monitoring support before, during, and after each mission that will enable effective observations without putting undue burden on the mission.

5.2.4.1 *Protected Species Survey Vessels*

Protected species and species indicator monitoring will be conducted from between two and six surface vessels, depending on the size of the ZOI and buffer area being monitored. These survey vessels will run predetermined line transects, or survey routes, that will provide sufficient coverage of the survey area within a one hour timeframe. Monitoring activities will be conducted from the highest point feasible on the vessels (Figure 5-7). Each vessel will have at least two dedicated observers who are trained in identifying protected marine species and indicators of protected species occurrence, such as large *Sargassum* mats and jellyfish aggregations. One vessel will contain the Lead Biologist, who will be the point of contact between all survey vessels and Tower Control.

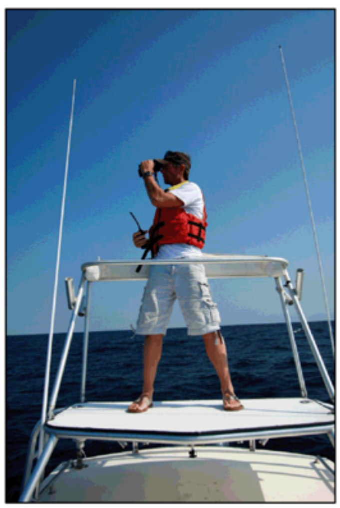

Figure 5-7. Marine Species Observer Example

5.2.4.2 *High-Definition Video Camera Observer*

Maritime WSEP missions will be monitored from the GRATV via live high-definition video feed. Video monitoring would, in addition to facilitating assessment of the mission, make possible remote viewing of the area for determination of environmental conditions and the presence of marine species right up to the release of live munitions. For the duration of the mission, a trained marine species observer from Eglin Natural Resources will be in CCF monitoring all live video feed. Although not part of the surface vessel survey team, the Eglin Natural Resources representative will report any protected species sightings to the Range Safety

Officer, who will also be sitting in CCF. The entire ZOI and buffer area will not be visible through the video feed for all missions; however, the targets and immediately surrounding areas will be in the field of view of the cameras and the representative will be able to identify any protected species that may enter the mission site right before the detonations and determine if any were injured immediately following the detonations. Should a protected marine species be detected on the live video, the weapon release can be stopped almost immediately because the video camera observer is in direct contact with Test Director and Safety Officer at CCF

5.2.5 Lines of Communication

The protected species survey vessels and the video camera observer will have open lines of communication to facilitate real-time reporting of protected species sightings and other relevant information, such as safety concerns and presence of non-participating vessels in the human safety zone. Direct radio communication between all surface vessels, GRATV personnel, and the Tower Control will be maintained throughout the mission. The Range Safety Officer will monitor all radio communications from CCF and information between the Safety Officer and the support vessels will relayed via Tower Control. All sighting information from pre-mission surveys will be communicated to the Lead Biologist on a separate radio channel than the range clearing vessels to reduce overall radio chatter and potential confusion. After compiling all the sighting information from the other survey vessels, the Lead Biologist will inform Tower Control on whether the area is clear of protected species or not. If the range is not clear, the Lead Biologist will provide recommendations on whether the mission should be delayed or cancelled. A mission delay recommendation would occur, for example, if a small number of protected species are in the ZOI or buffer area but appear to be on a heading away from the mission area. On the other hand, a mission cancellation recommendation could occur if there is a large number of protected species in the ZOI or buffer area and there is no indication that they would leave the area on their own volition within a reasonable timeframe. Tower Control will relay the Lead Biologist's recommendation to the Safety Officer in CCF. The Safety Officer and Test Director will collaborate regarding range conditions based on the information provided by the Lead Biologist and the status of range clearing vessels. Ultimately, the Safety Officer will have final authority on decisions regarding delays and cancellations of missions.

5.2.6 Detailed Mitigation Plan

The marine mammal Level B Behavioral ZOI (a conservative scenario for sea turtles) plus a buffer zone for the largest munition to be released on any mission day will be monitored for the presence of sea turtles and indicators. The entire survey area radius will be twice the distance of the Level B Behavioral ZOI radius from the planned detonation point. Maritime WSEP mitigations will be regulated by AF safety parameters. Any mission may be delayed or cancelled due to technical issues or range clearing issues. Should a delay occur during pre-mission surveys, all mitigation procedures would continue either for the duration of the delay or until the mission is canceled. To ensure the safety of survey personnel, the team will depart the mission area approximately 30 minutes to one hour before live ordnance delivery. Stepwise mitigation procedures for the Maritime WSEP missions are outlined below

Pre-mission Monitoring: The purposes of pre-mission monitoring are to 1) evaluate the mission site for environmental suitability of the mission, and 2) verify that the ZOI and buffer area are free of visually detectable sea turtles, as well as potential indictors of these species. On the morning of the mission, the Test Director and Safety Officer will confirm that there are no issues that would preclude mission execution and that weather is adequate to support mitigation measures.

(a) Sunrise or Two Hours Prior to Mission

AF range clearing vessels and protected species survey vessels will be on site at least two hours prior to the mission. The Lead Biologist on board one of the survey vessels will assess the overall suitability of the mission site based on environmental conditions (sea state) and presence/absence of sea turtle indicators. This information will be relayed to the Safety Officer in CCF.

(b) One and One-Half Hours Prior to Mission

Vessel-based surveys will begin approximately one and one-half hours prior to live weapon deployment. Surface vessel observers will survey the ZOI and buffer area and relay all marine species and indicator sightings, including the time of sighting, GPS location, and direction of travel, if known, to the Lead Biologist. The Lead Biologist will document all sighting information on report forms to be submitted to Eglin Natural Resources after each mission. Surveys will continue for approximately one hour. During this time, AF personnel in the mission area will also observe for marine species as feasible. If sea turtles or indicators are observed within the ZOI or buffer area, the range will be declared "fouled," a term that signifies to mission personnel that conditions are such that a live ordnance drop cannot occur (e.g., protected species or civilian vessels are in the mission area). If no sea turtles or indicators are observed, the range will be declared clear of protected species.

(c) One-Half Hour Prior to Mission

At approximately 30 minutes to one hour prior to live weapon deployment, marine species observers will be instructed to leave the mission site and remain outside the safety zone, which on average will be 9.5 miles from the detonation point. The actual size is determined by weapon NEW and method of delivery. The survey team will continue to monitor for protected species while leaving the area. As the survey vessels leave the area, marine species monitoring of the immediate target areas will continue at CCF through the live video feed received from the high definition cameras on the GRATV. Once the survey vessels have arrived at the perimeter of the safety zone (approximately 30 minutes after being instructed to leave, depending on actual travel time), the range will be declared "green" and the mission will be allowed to proceed, assuming all non-participating vessels have left the safety zone as well.

(d) Execution of Mission

Immediately prior to live weapon drop, the Test Director and Safety Officer will communicate to confirm the results of protected marine species surveys and the appropriateness of proceeding with the mission. The Safety Officer will have final authority to proceed with, postpone, or cancel the mission. The mission would be postponed if:

Summary of Conclusions

1. Any sea turtle is visually detected within the ZOI. Postponement would continue until the animal(s) that caused the postponement is
   a. Confirmed to be outside of the ZOI on a heading away from the targets or
   b. Not seen again for 30 minutes and presumed to be outside the ZOI due to the animal swimming out of the range.
      i. Average swim speed of sea turtle assumed to be 1.9 km/hour
      ii. Distance traveled in 30 minutes would be approximately 950 meters
2. Large jellyfish aggregations or *Sargassum* mats are observed within the ZOI. Postponement would continue until these potential indicators are confirmed to be outside the ZOI.
3. Technical or mechanical issues arise related to the aircraft or target boats.
4. Non-participating vessels enter the human safety zone prior to weapon release.

In the event of a postponement after survey vessels have left the safety zone, protected species monitoring would continue from CCF through the live video feed.

Post-mission monitoring: Post-mission monitoring is designed to determine the effectiveness of pre-mission mitigation by reporting sightings of any dead or injured sea turtles. Post-detonation monitoring surveys will commence once the mission has ended or, if required, as soon as EOD personnel declare the mission area safe. Vessels will move into the survey area from outside the safety zone and monitor for at least 30 minutes, concentrating on the area down-current of the mission site. This area is easily identifiable because of the floating debris in the water from impacted targets. Up to 10 AF support vessels will be clearing debris and collecting damaged targets from this area, thus spending many hours in the area once the mission is completed. All vessels will be instructed to report any dead or injured sea turtles to the Lead Biologist. The protected species survey vessels will document any sea turtles that were killed or injured as a result of the mission and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed will be documented and reported to Eglin Natural Resources.

The NMFS maintains stranding networks along U.S. coasts to collect and circulate information about sea turtle strandings. Local coordinators may report stranding data to state and regional coordinators. Any observed dead or injured sea turtle would be reported to the appropriate coordinator.

5.3 MITIGATION EFFECTIVENESS

The effectiveness of the mitigation measures described above depends largely on the ability to visually locate sea turtles at or near the water surface, as visual observation is the primary measure used. The NMFS has evaluated the effectiveness of visual observation for a similar previous AF action in the same area of the Gulf (Precision Strike Weapon [PSW] testing). Mitigation effectiveness estimates for PSW testing was primarily based on aerial surveys, with supplemental surveys conducted from boats and video cameras. Similar to Maritime WSEP activities, observers were required to leave the mission area one hour prior to detonation due to human safety concerns. Under such a scenario, NMFS estimated the mitigation effectiveness to be 30 percent. That is, the number of takes estimated for each criterion could reasonably be reduced by 30 percent. Aerial surveys are not feasible for Maritime WSEP missions, and observation will occur primarily from vessels and video cameras. Therefore, survey effectiveness is not quantified in this document but is likely less than the 30 percent estimated for PSW testing.

6. SUMMARY OF CONCLUSIONS

Based on the analysis in Section 4.1, sea turtles are likely to be adversely affected due to surface detonations during Maritime WSEP missions. Adherence to mitigation measures, as described in Chapter 5, may help to reduce the potential for adverse impacts to sea turtle populations. Chemical materials and debris expended into the mission area would not reduce the quality and/or quantity of EFH. Hardbottom habitats and artificial reefs would be avoided.

The Protected Resources Division and Habitat Conservation Division of NMFS would be notified immediately if any of the actions considered in this BA and EFH Assessment were modified or if additional information on ESA-listed species became available, as a re-initiation of consultation may be required. If impacts to listed species occurred beyond what has been considered in this assessment, all operations would cease and the NMFS Protected Resources Division would be notified. Any modifications or conditions resulting from consultation with the NMFS would be implemented prior to commencement of activities. Eglin Natural Resources believes this fulfills all requirements of the MSA and Section 7 of the ESA and no further action is necessary.

7. LIST OF PREPARERS

Amanda Robydek, Environmental Scientist
Leidos / Eglin AFB Natural Resources
107 Highway 85 North
Niceville, FL 32578
(850) 882-8395
amanda.robydek.ctr@us.af.mil

Rick Combs, Environmental Scientist
Leidos
1130 Eglin Parkway
Shalimar, FL 32579
(850) 609-3459
ronald.r.combs@leidos.com

J. Mike Nunley, Environmental Scientist
Leidos / Eglin AFB Natural Resources
107 Highway 85 North
Niceville, FL 32578
(850) 882-8397
jerry.nunley.ctr@us.af.mil

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9. APPENDIX A

ACOUSTIC MODELING METHODOLOGY

A.1 INTRODUCTION

Sea turtle exposure estimates are derived from the results of acoustic modeling performed by a contracted company with expertise in underwater acoustics. The modeling process and methodology are discussed in the following sections, which include a description of the acoustic sources being modeled, characterization and descriptions of important environmental components incorporated into the model, methodologies and calculations used to model impacts to marine animals, and a description of harassment estimate determination and model results. .

A.2 EXPLOSIVE ACOUSTIC SOURCES

A.2.1 Acoustic Characteristics of Explosive Sources

The acoustic sources employed for Maritime WSEP Operations are categorized as broadband explosives. Broadband explosives produce significant acoustic energy across several frequency decades of bandwidth. Propagation loss is sufficiently sensitive to frequency as to require model estimates at several frequencies over such a wide band.

Explosives are impulsive sources that produce a shock wave that dictates additional pressure-related metrics (peak pressure and positive impulse). A list of the proposed munitions to be used in Maritime WSEP Operations is provided in Section 2.

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: the weight of the explosive material, the type of explosive material, and the detonation depth. The net explosive weight (or NEW) accounts for the first two parameters. The NEW of an explosive is the weight of TNT required to produce an equivalent explosive power.

The detonation depth of an explosive is particularly important due to a propagation effect known as surface-image interference. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface-reflection scattering loss).

A.2.2 Animal Harassment Effects of Explosive Sources

The harassments expected to result from these sources are computed on a per in-water explosive basis; to estimate the number of harassments for multiple explosives, consider the following: Let A represent the impact area (that is, the area in which the chosen metric exceeds the threshold) for a single explosive. The cumulative effect of a series of explosives is then dictated by the spacing of the explosives relative to the movement of the marine wildlife. If the detonations are spaced widely in time or space, allowing for sufficient animal movements as to ensure a different population of animals is considered for each detonation and N corresponds to the number of explosives being detonated, calculating the cumulative impact area ($A_{Cumulative}$) of N explosives can be represented as $A_{Cumulative}$ = N x A, regardless of the metric. This leads to a worst case estimate of harassments and is the method used in this analysis.

At the other extreme is the case where the detonations occur at essentially the same time and location (but not close enough to require the source emissions to be coherently summed). In this case, the pressure metrics (peak pressure and positive impulse) are constant regardless of the number of detonations spaced closely in time, while the energy metrics increase at a rate of $N^{½}$ (under spherical spreading loss only) or less.

The firing sequence for some of the proposed munitions (CBU-103) consists of a number of rapid bursts, often lasting a second or less. Due to the tight spacing in time, each burst can be treated as a single detonation. For the energy metrics the impact area of a burst is computed using a source energy spectrum that is the source spectrum for a single detonation scaled by the number of rounds in a burst. For the pressure metrics, the impact area for a burst is the same as the impact area of a single round. For all metrics, the cumulative impact area of an event consisting of N bursts is merely the product of the impact area of a single burst and the number of bursts, as would be the case if the bursts are sufficiently spaced in time or location as to insure that each burst is affecting a different set of marine wildlife.

Explosives are modeled as detonating at depths ranging from the water surface to 10 feet below the surface, as provided by Government-Furnished Information. Impacts from above surface detonations were considered negligible and not modeled.

For sources that are detonated at shallow depths, it is frequently the case that the explosion may breach the surface with some of the acoustic energy escaping the water column. The source levels have not been adjusted for possible venting, nor does the subsequent analysis attempt to take this into account.

A.3 ENVIRONMENTAL CHARACTERIZATION

A.3.1 Important Environmental Parameters for Estimating Animal Harassment

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. In turn, propagation loss as a function of range depends on a number of environmental parameters including:

- water depth
- sound speed variability throughout the water column
- bottom geo-acoustic properties, and
- surface roughness, as determined by wind speed

Since the U.S. Navy has conducted extensive testing and training activities in the marine environment, such as Anti-Submarine Warfare, over the last four to five decades, they have invested heavily in measuring and modeling environmental parameters that contribute to propagation loss. The result of this effort is the following collection of global databases containing these environmental parameters, which are accepted as standards for Navy and other Department of Defense modeling efforts. **Table A-1** contains the version of the databases used in the modeling for this analysis.

Table A-1. Navy Standard Databases Used in Modeling

Parameter	Database	Version
Water Depth	Digital Bathymetry Data Base Variable Resolution	DBDBV 6.0
Ocean Sediment	Re-packed Bottom Sediment Type	BST 2.0
Wind Speed	Surface Marine Gridded Climatology Database	SMGC 2.0
Temperature/Salinity Profiles	Generalized Digital Environment Model	GDEM 3.0

The sound speed profile directs the sound propagation in the water column. The spatial variability of the sound speed field is generally small over operating areas of typical size. The presence of a strong oceanographic front is a noteworthy exception to this rule. To a lesser extent, variability in the depth and strength of a surface duct can be of some importance. If the sound speed minimum occurs within the water column, more sound energy can travel further without suffering as much loss (ducted propagation). But if the sound speed minimum occurs at the surface or bottom, the propagating sound interacts more with these boundaries and may become attenuated more quickly. In the mid-latitudes, seasonal variation often provides the most significant variation in the sound speed field. For this reason, both summer and winter profiles are modeled to demonstrate the extent of the difference.

Losses of propagating sound energy occur at the boundaries. The water-sediment boundary defined by the bathymetry can vary by a large amount. In a deep water environment, the interaction with the bottom may matter very little. In a shallow water environment the opposite is true and the properties of the sediment become very important. The sound propagates through the sediment, as well as being reflected by the interface. Soft (low density) sediment behaves more like water for lower frequencies and the sound has relatively more transmission and relatively less reflection than a hard (high density) bottom or thin sediment.

The roughness of the boundary at the water surface depends on the wind speed. Average wind speed can vary seasonally, but could also be the result of local weather. A rough surface scatters the sound energy and increases the transmission loss. Boundary losses affect higher frequency sound energy much more than lower frequencies.

A.3.2 Characterizing the Acoustic Marine Environment

The environment for modeling impact value is characterized by a frequency-dependent bottom definition, range-dependent bathymetry and sound velocity profiles (SVP), and seasonally varying wind speeds and SVPs. The bathymetry database is on a grid of variable resolution.

The sound velocity profile database has a fixed spatial resolution storing temperature and salinity as a function of time and location. The low frequency bottom loss is characterized by standard definition of geo-acoustic parameters for the given sediment type of sand. The high frequency bottom loss class is fixed to match expected loss for the sediment type. The area of interest can be characterized by the appropriate sound speed profiles, set of low frequency bottom loss parameters, high frequency bottom loss class, and High Frequency Environmental Acoustics (HFEVA) very-high frequency sediment type for modeled frequencies in excess of 10 kilohertz (kHz).

Generally seasonal variation is sampled by looking at summer and winter cases. However, given current plans to conduct Maritime WSEP activities in the June 2013 timeframe, ordnance usage was assigned to the summer season only rather than equally divided between summer and winter seasons.

Impact volumes in the operating area were then computed using propagation loss estimates and the explosives model derived for the representative environment.

A.3.3 Description of the Maritime WSEP Operations Study Area Environment

The Maritime WSEP Operations Study Area is located off the coast of Florida in the Gulf of Mexico. It is an area that slopes from shallow waters near the coast to deeper waters offshore. The bottom is characterized as sandy sediment according to the Bottom Sediments Type Database. Environmental values were extracted from unclassified Navy standard databases in a radius of 50 km around the center point at

N 30° 08.5' W 86° 28'

The Navy standard database for bathymetry has a resolution of 0.05 minutes in the Gulf of Mexico; see Figure A-1. Mean and median depths from DBDBV in the extracted area are 47 and 112 meters, respectively.

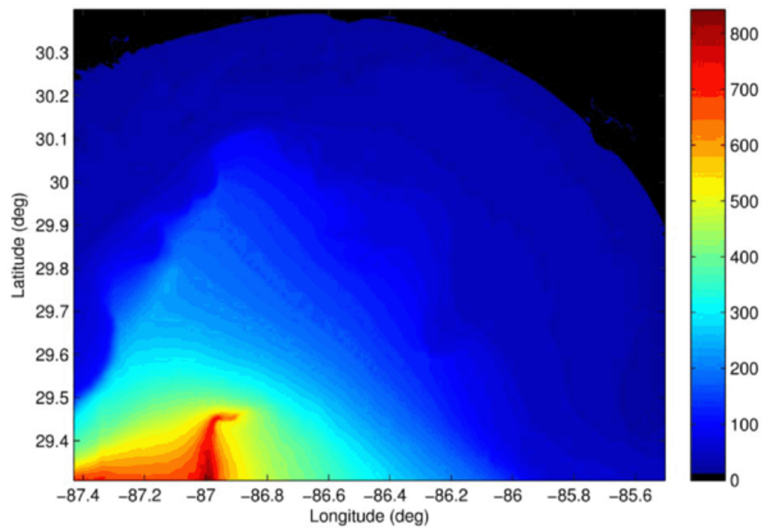

Figure A-1. Bathymetry (in meters) for the Maritime WSEP Operations Study Area Representative Environment

The seasonal variability in wind speed was modeled as 8.6 knots in the summer and 13.02 knots in the winter.

Example input of range-dependent bathymetry is depicted in Figure A-2 for the due-north bearing.

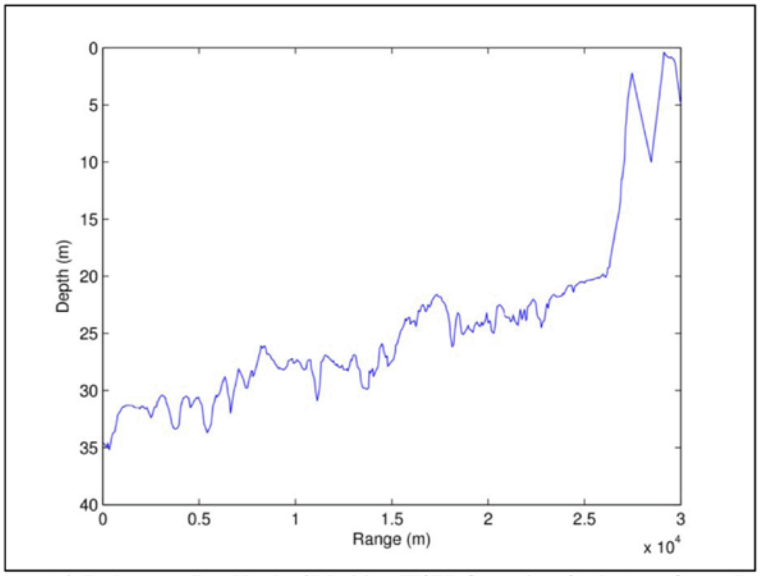

Figure A-2. Bathymetry Due North of Maritime WSEP Operations Study Area Center Point

A.4 MODELING IMPACT ON MARINE ANIMALS

Many underwater actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. The number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

Estimating the number of animals that may be injured or otherwise harassed in a particular environment entails the following steps.

- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL calculations are also made over disjoint one-third octave bands for a wide range of frequencies with dependence in range, depth, and azimuth for bathymetry and sound speed. TL computations were sampled with 20 degree spacing in azimuth.

- The accumulated energy within the waters where the source detonates is sampled over a volumetric grid. At each grid point, the received energy from each source emission is modeled as the effective energy source level reduced by the appropriate propagation loss from the location of the source at the time of the emission to that grid point and summed. For the peak pressure or positive impulse, the appropriate metric is similarly modeled for each emission. The maximum value of that metric over all frequencies and emissions is stored at each grid point.

- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point sampled in range and depth for which the appropriate metric exceeds that threshold, and accumulated over all modeled bearings. Histograms representing impact volumes as a function of (possibly depth-dependent) thresholds are stored in a spreadsheet for dynamic changes of thresholds.

- Finally, the number of harassments is estimated as the inner-product of the animal density depth profile and the impact volume and scaled by user-specifiable surface animal densities.

The following section describes in detail the process of computing impact volumes.

A.4.1 Calculating Transmission Loss

Transmission loss (TL) was pre-computed for both seasons for thirty non-overlapping frequency bands. The bands had one-third octave spacing around center frequencies from 50 Hz to approximately 40.637 kHz. The TL was then modeled using the Navy Standard GRAB V3 propagation loss model (Keenan, 2000) with CASS v4.3, and the results were interpolated onto a variable range grid with logarithmic spacing. The increased spatial resolution near the source provided greater fidelity for estimates.

TL was calculated from the source depth to an array of output depths. The output depths were the mid-points of depth intervals matching GDEM's depth sampling. For water depths from surface to 10 m depth, the depth interval was 2 m. Between 10 m and 100 m water depth, the depth interval was 5 m. For waters greater than 100 m, the depth interval was 10 m. For the Maritime WSEP study area environment, there were thirty depths (1, 3, 5, 7, 9, 12.5, 17.5, 22.5, 27.5, 32.5, 37.5, 42.5, 47.5, 52.5, 57.5, 62.5, 67.5, 72.5, 77.5, 82.5, 87.5, 92.5, 97.5, 105, 115, 125, 135, 145, 155, 160, all in meters) representing depth-interval midpoints. The output depths represent possible locations of the animals and are used with the animal depth distribution to better estimate animal impact. The depth grid is used to make the surface-image interference correction and to capture the depth-dependence of the positive impulse threshold.

An important propagation consideration at low frequencies is the effect of surface-image interference. As either source or target approach the surface, pairs of paths that differ by a single surface reflection set up an interference pattern that ultimately causes the two paths to cancel each other when the source or target is at the surface. A fully coherent summation of the eigenrays produces such a result but also introduces extreme fluctuations that would have to be highly sampled in range and depth, and then smoothed to give meaningful results, and would be inappropriate in representing a broad one-third octave band of the spectrum. An alternative approach is to implement what is sometimes called a semi-coherent summation. A semi-coherent sum attempts to capture significant effects of surface-image interference (namely the reduction of the field due to destructive interference of reflected paths as the source or target approach the surface) without having to deal with the more rapid fluctuations associated with a fully coherent sum. The semi-coherent sum is formed by a random phase addition of paths that have already been multiplied by the expression:

$$\sin^2\left(\frac{4\pi f z_s z_a}{c^2 t}\right)$$

where f is the frequency, z_s is the source depth, z_a is the animal depth, c is the sound speed and t is the travel time from source to animal along the propagation path. For small arguments of the sine function this expression varies directly as the frequency and the two depths. It is this relationship that causes the propagation field to go to zero as the depths approach the surface or the frequency approaches zero.

A.4.2 Computing Impact Volumes

The next two sections provide a detailed description of the approach taken to compute impact volumes for explosives. The impact volume associated with a particular activity is defined as the volume of water in which some acoustic metric exceeds a specified threshold. The product of this impact volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. The acoustic metric can either be an energy term (energy flux density, either in a limited frequency band or across the full band) or a pressure term (such as peak pressure or positive impulse). The thresholds associated with each of these metrics define the levels at which half of the animals exposed will experience some degree of harassment (ranging from behavioral change to mortality).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range, which is defined as the maximum range at which a particular threshold is exceeded for a single source emission, defines the range to which marine mammal activity is monitored in order to meet mitigation requirements.

The effective energy source level is modeled directly for the sources to be used for Maritime WSEP activities at a specific location in the Gulf. The energy source level is comparable to the model used for other explosives (Arons [1954], Weston [1960], McGrath [1971], Urick [1983], Christian and Gaspin [1974]). The energy source level over a one-third octave band with a center frequency of f for a source with a net explosive weight of w pounds is given by:

$$\mathrm{ESL} = 10 \log_{10} (0.26 f) + 10 \log_{10} (\, 2\, p_{max}^{\;2} \,/\, [1/\theta^2 + 4\pi^2 f^2]\,) + 197 \ \mathrm{dB}$$

where the peak pressure for the shock wave at one meter is defined as

$$p_{max} = 21600\ (w^{1/3} / 3.28)^{1.13}\ \mathrm{psi} \qquad \text{(A-1)}$$

and the time constant is defined as:

$$\theta = [(0.058)\ (w^{1/3})\ (3.28 / w^{1/3})^{0.22}\,] / 1000\ \mathrm{sec} \qquad \text{(A-2)}$$

For each season and explosive source, the amount of energy in the water column is calculated. The propagation loss for each frequency, expressed as a pressure term, modulates the sound energy found at each point on the grid of depth (uniform spacing) and range (logarithmic spacing). If a threshold is exceeded at a point, the impact volume at an annular sector is added to the total impact volume. The impact volume at a point is calculated exactly using the depth interval, the range interval of the point, and the slice of a sphere centered where the range is zero.

A.4.3 Effects of Metrics on Impact Volumes

The impact of explosive sources on marine wildlife is measured by three different metrics, each with its own thresholds. The energy metric, the peak pressure metric, and the "modified" positive impulse metric are discussed in this section. The energy metric, using the peak one-third-octave level, is accumulated after the explosive detonation. The other two metrics, peak pressure and positive impulse, are not accumulated but rather the maximum levels are taken.

Energy Metric

The energy flux density is sampled at several frequencies in one-third-octave bands and only the peak one-third-octave level is accumulated over time. In the case of Level A calculations, the Total Energy is considered.

Peak Pressure Metric

The peak pressure metric is a simple, straightforward calculation at each range/animal depth combination. First, the transmission pressure ratio, modified by the source level in a one-third-octave band, is summed across frequency. This averaged transmission ratio is normalized by the total broadband source level. Peak pressure at that range/animal depth combination is then simply the product of:

- the square root of the normalized transmission ratio of the peak arrival,
- the peak pressure at a range of one meter (given by equation A-1), and
- the similitude correction (given by $r^{-0.13}$, where r is the slant range).

If the peak pressure for a given grid point is greater than the specified threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

"Modified" Positive Impulse Metric

The modeling of positive impulse follows the work of Goertner (Goertner, 1982). The Goertner model defines a "partial" impulse as

$$\int_{0}^{T_{min}} p(t)\,\mathrm{d}t$$

where $p(t)$ is the pressure wave from the explosive as a function of time t, defined so that $p(t) = 0$ for $t < 0$. This similitude pressure wave is modeled as

$$p(t) = p_{max}\, e^{-t/\theta}$$

where p_{max} is the peak pressure at one meter (see equation A-1), and □ is the time constant defined in equation A-2.

The upper limit of the "partial" impulse integral is

$$T_{min} = \min\ \{T_{cut}, T_{osc}\}$$

where T_{cut} is the time to cutoff and T_{osc} is a function of the animal lung oscillation period. When the upper limit is T_{cut}, the integral is the definition of positive impulse. When the upper limit is defined by T_{osc}, the integral is smaller than the positive impulse and thus is just a "partial" impulse. Switching the integral limit from T_{cut} to T_{osc} accounts for the diminished impact of the positive impulse upon the animals lungs that compress with increasing depth and leads to what is sometimes call a "modified" positive impulse metric.

The time to cutoff is modeled as the difference in travel time between the direct path and the surface-reflected path in an isovelocity environment. At a range of r, the time to cutoff for a source depth z_s and an animal depth z_a is

$$T_{cut} = 1/c\ \{\ [r^2 + (z_a + z_s)^2]^{1/2} - [r^2 + (z_a - z_s)^2]^{1/2}\ \}$$

where c is the speed of sound.

The animal lung oscillation period is a function of animal mass M and depth z_a and is modeled as

$$T_{osc} = 1.17\ M^{1/3}\ (1 + z_a/33)^{-5/6}$$

where M is the animal mass (in kg) and z_a is the animal depth (in feet).

The modified positive impulse threshold is unique among the various injury and harassment metrics in that it is a function of depth and the animal weight. So instead of the user specifying the threshold, it is computed as $K\ (M/42)^{1/3}\ (1 + z_a/33)^{1/2}$. The coefficient K depends upon the level of exposure. For the onset of slight lung injury, K is 19.7; for the onset of extensive lung hemorrhaging (1% mortality), K is 47.

Although the thresholds are a function of depth and animal weight, sometimes they are summarized as their value at the sea surface for a typical dolphin calf (with an average mass of 12.2 kg). For the onset of slight lung injury, the threshold at the surface is approximately 13 psi-msec; for the onset of extensive lung hemorrhaging (1% mortality), the threshold at the surface is approximately 31 psi-msec.

As with peak pressure, the "modified" positive impulse at each grid point is compared to the derived threshold. If the impulse is greater than that threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

A.5 ESTIMATING ANIMAL HARASSMENT

A.5.1 Distribution of Animals in the Environment

Species densities are usually reported by marine biologists as animals per square kilometer. This gives an estimate of the number of animals below the surface in a certain area, but does not provide any information about their distribution in depth. The impact volume vector specifies the volume of water ensonified above the specified threshold in each depth interval. A corresponding animal density for each of those depth intervals is required to compute the expected value of the number of exposures. The two-dimensional area densities do not contain this information, so three-dimensional densities must be constructed by using animal depth distributions to extrapolate the density at each depth.

The following bottlenose dolphin (summer profile) example demonstrates the method used to account for three-dimensional analysis by merging the depth distributions with user-specifiable surface densities. Bottlenose dolphins are distributed with:

- 19.2% in 0-10 m,
- 76.8% in 10-50 m,
- 1.7% in 50-100 m, and
- 2.3% in 100-165 m.

The impact volume vector is sampled at 30 depths over the maximally 165-m water column. Since this is a finer resolution than the depth distribution, densities are apportioned uniformly over depth intervals. For example, 19.2% of bottlenose dolphins are in the 0-10 meter interval, so approximately

- 3.84% are in 0-2 meters,
- 3.84% are in 2-4 meters,
- 3.84% are in 4-6 meters,
- 3.84% are in 6-8 meters, and
- 3.84% are in 8-10 meters.

Similarly, 76.8% are in the 10-50 m interval, so approximately

- 9.60% are in 10 - 15 meters,
- 9.60% are in 15 - 20 meters,
- 9.60% are in 20 - 25 meters,
- etc.

A.5.2 Harassment Estimates

Impact volumes for all depth intervals are scaled by their respective depth densities, divided by their depth interval widths, summed over the entire water column and finally converted to square kilometers to create impact areas. The spreadsheet allows a user-specifiable surface density in animals per square kilometer, so the product of these quantities yields expected number of animals in ensonified water where they could experience harassment.

Since the impact volume vector is the volume of water at or above a given threshold per unit operation (e.g. per detonation, or clusters of munitions explosions), the final harassment count for each animal is the unit operation harassment count multiplied by the number of units deployed.

The detonations of explosive sources are generally widely spaced in time and/or space. This implies that the impact volume for multiple firings can be easily derived by scaling the impact volume for a single detonation. Thus the typical impact volume vector for an explosive source is presented on a per-detonation basis.

The following tables (Tables A-2 through A-5) show exposure estimates from each munition/detonation scenario at the various threshold levels being analyzed for all protected species in which takes are being requested. The total exposure estimates from all Maritime WSEP activities are summed in the bottom rows for each species.

Table A-2. Loggerhead Sea Turtle Estimated Exposures from Maritime WSEP Operational Testing

Ordnance	NEW (lbs)	Burst Size	Depth (ft)	Total # Released	Behavioral		Physiological	Mortality
					182 dB SEL	23 psi	13 psi ms	30.5 psi ms
GBU-10 or GBU-24	945	1	Surface	2	2.119	0.272	0.034	0.018
GBU-12 or GBU-54	192	1	Surface	6	3.869	1.527	0.067	0.033
AGM-65	86	1	Surface	6	2.700	1.133	0.054	0.025
CBU-105	83	10	Airburst	2	0	0	0	0
GBU-39	37	1	Surface	4	1.800	0.756	0.036	0.017
AGM-114	20	1	Surface	6	1.327	0.692	0.035	0.014
AGM-175	13	1	Surface	10	2.211	1.153	0.058	0.024
2.75 Rockets	12	1	Surface	100	22.114	11.534	0.582	0.240
PGU-12 30mm	0.1	1	Surface	1,000	3.341	14.258	0.158	0
7.62 mm/ .50 cal	N/A	1	Surface	5,000	0	0	0	0
TOTAL					**39.811**	**32.040**	**1.023**	**0.371**

Table A-3. Kemp's Ridley Sea Turtle Estimated Exposures from Maritime WSEP Operational Testing

Ordnance	NEW (lbs)	Burst Size	Depth (ft)	Total # Released	Behavioral		Physiological	Mortality
					182 dB SEL	23 psi	13 psi ms	30.5 psi ms
GBU-10 or GBU-24	945	1	Surface	2	1.976	0.797	0.027	0.015
GBU-12 or GBU-54	192	1	Surface	6	3.121	1.232	0.054	0.027
AGM-65	86	1	Surface	6	2.179	0.914	0.043	0.020
CBU-105	83	10	Airburst	2	0	0	0	0
GBU-39	37	1	Surface	4	1.452	0.610	0.029	0.014
AGM-114	20	1	Surface	6	1.070	0.558	0.028	0.012
AGM-175	13	1	Surface	10	1.784	0.931	0.047	0.019
2.75 Rockets	12	1	Surface	100	17.841	9.305	0.470	0.193
PGU-12 30mm	0.1	1	Surface	1,000	2.696	11.503	0.127	0
7.62 mm/ .50 cal	N/A	1	Surface	5,000	0	0	0	0
TOTAL					**32.119**	**25.850**	**0.826**	**0.299**

Table A-4. Leatherback Sea Turtle Exposure Estimates from Maritime WSEP Operational Testing

Ordnance	NEW (lbs)	Burst Size	Depth (ft)	Total # Released	Behavioral		Physiological	Mortality
					182 dB SEL	23 psi	13 psi ms	30.5 psi ms
GBU-10 or GBU-24	945	1	Surface	2	0.680	0.802	0.015	0.009
GBU-12 or GBU-54	192	1	Surface	6	1.097	0.926	0.027	0.014
AGM-65	86	1	Surface	6	0.776	0.604	0.021	0.010
CBU-105	83	10	Airburst	2	0	0	0	0
GBU-39	37	1	Surface	4	0.517	0.403	0.014	0.006
AGM-114	20	1	Surface	6	0.377	0.303	0.012	0.005
AGM-175	13	1	Surface	10	0.628	0.504	0.020	0.008
2.75 Rockets	12	1	Surface	100	6.283	5.044	0.198	0.077
PGU-12 30mm	0.1	1	Surface	1,000	0.846	4.305	0.020	0
7.62 mm/ .50 cal	N/A	1	Surface	5,000	0	0	0	0
TOTAL					**11.204**	**12.890**	**0.327**	**0.128**

Table A-5. Green Sea Turtle Estimated Exposures from Maritime WSEP Operational Testing

Ordnance	NEW (lbs)	Burst Size	Depth (ft)	Total # Released	Behavioral		Physiological	Mortality
					182 dB SEL	23 psi	13 psi ms	30.5 psi ms
GBU-10 or GBU-24	945	1	Surface	2	0.176	0.071	0.002	0.001
GBU-12 or GBU-54	192	1	Surface	6	0.279	0.110	0.005	0.002
AGM-65	86	1	Surface	6	0.195	0.082	0.004	0.002
CBU-105	83	10	Airburst	2	0	0	0	0
GBU-39	37	1	Surface	4	0.130	0.054	0.003	0.001
AGM-114	20	1	Surface	6	0.096	0.050	0.003	0.001
AGM-175	13	1	Surface	10	0.159	0.083	0.004	0.002
2.75 Rockets	12	1	Surface	100	1.593	0.831	0.042	0.017
PGU-12 30mm	0.1	1	Surface	1,000	0.241	1.027	0.011	0
7.62 mm/ .50 cal	N/A	1	Surface	5,000	0	0	0	0
TOTAL					**2.868**	**2.308**	**0.074**	**0.027**

The following table (Table A-6) summarizes the total estimated acoustic exposures calculated by the model. The exposures are grouped by animal and threshold and are totaled for all munitions proposed to be deployed for Maritime WSEP activities. For thresholds where dual criteria are analyzed for a particular species (i.e., Behavioral), the threshold that resulted in the higher number of exposures was used for estimating takes in the analysis and are noted in the table.

Table A-6. Summary of Total Exposures by Animal and Threshold

SPECIES	Behavioral		Physiological	Mortality
	182 dB SEL	23 psi	13 psi-msec	31 psi-msec
Loggerhead sea turtle	39.811*	32.040	1.023	0.371
Kemp's ridley sea turtle	32.119*	25.850	0.826	0.299
Leatherback sea turtle	11.204	12.890*	0.327	0.128
Green sea turtle	2.868*	2.308	0.074	0.027
TOTAL	**86.002**	**73.088**	**2.25**	**0.825**

* These exposure estimates were used to calculate takes since they are the higher of the two criteria

A.6 References

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APPENDIX D

PUBLIC REVIEW

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PUBLIC NOTIFICATION

In compliance with the National Environmental Policy Act, Eglin Air Force Base (AFB) announces the availability of the *Draft Environmental Assessment for the Maritime Weapons System Evaluation Program*, and Draft Finding of No Significant Impact (FONSI), for public review.

The Air Force proposes to test the use of multiple types of live weapons against small boat targets in the Eglin Gulf Test and Training Range (Gulf of Mexico), at a location approximately 17 miles offshore from Santa Rosa Island. The weapons would be deployed from aircraft and would include various types of bombs, missiles, and 30-mm gunnery rounds. Detonations would occur above, at, and below the water surface. The tests would occur on weekdays over a period of two to three weeks in February and March 2015, with a maximum of two tests per day. A cleared zone would be established around the targets during each test to maintain the safety of recreational and commercial users of the Gulf. In addition, protection measures for marine species would be included in the action.

Your comments on this Draft Environmental Assessment (EA) are requested. Letters or other written or oral comments provided may be published in the Final EA. As required by law, comments will be addressed in the Final EA and made available to the public. Any personal information provided will be used only to identify your desire to make a statement during the public comment period or to fulfill requests for copies of the Final EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final EA. However, only the names and respective comments of respondent individuals will be disclosed. Personal home addresses and phone numbers will not be published in the Final EA.

Copies of the Draft EA and Draft FONSI may be reviewed online at www.eglin.af.mil/eglindocuments.asp from November 6, 2014 until November 19, 2014. Local libraries have Internet access, and librarians can assist in accessing this document. Comments must be received by November 22, 2014, to be included in the Final EA.

For more information or to comment on these proposed actions, contact: Mike Spaits, 96 TW Public Affairs, 101 West D Ave., Ste. 238, Eglin AFB, Florida 32542 or email: mike.spaits@eglin.af.mil. Tel: (850) 882-2836; Fax: (850) 882-4894.

Response to Comments for Draft Environmental Assessment for the Maritime Weapons System Evaluation Program at Eglin AFB, Fla., and Draft Finding of No Significant Impact, Environmental Assessment

A public notice was published in the *Northwest Florida Daily News* on Nov. 6, 2014 to disclose completion of the Draft EA, and Draft FONSI, selection of the preferred alternative, and request for comments during the 15-day pre-decisional comment period.

The 15-day comment period ended on Nov. 19, with the comments required to this office not later than Nov. 22, 2014. No comments were received during this period.

//Signed//
Amy Parr
Public Information Specialist

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

FINDING OF NO SIGNIFICANT IMPACT FOR THE ISSUANCE OF AN INCIDENTAL HARASSMENT AUTHORIZATION TO THE U.S. AIR FORCE, EGLIN AIR FORCE BASE INCIDENTAL TO THE MARITIME WEAPON SYSTEMS EVALUATION PROGRAM (WSEP) OPERATIONAL TESTING IN THE EGLIN GULF TESTING AND TRAINING RANGE (EGTTR), FLORIDA

NATIONAL MARINE FISHERIES SERVICE

National Oceanic and Atmospheric Administration Administrative Order (NAO) 216-6 (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of 'context' and 'intensity'. Each criterion listed below is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others.

The U.S. Air Force (Eglin AFB) has finalized an Environmental Assessment, titled, *Maritime Weapons System Evaluation Program, Eglin Air Force Base, Florida, Final Environmental Assessment*, which NMFS has subsequently adopted. NMFS incorporates that document here by reference. NMFS analyzed the significance of this action based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1. **Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in Fishery Management Plans (FMP)?**

   No. NMFS does not expect that the limited action of issuing an Incidental Harassment Authorization to Eglin AFB would cause substantial damage to the ocean and coastal habitats and/or essential fish habitat. The mitigation and monitoring measures required by the Authorization would not affect habitat or essential fish habitat.

   Essential Fish Habitat (EFH)and Habitat Areas of Particular Concern for a number of invertebrate and fish species managed under Fishery Management Plans occur within the project area. Eglin AFB has determined in its EA that Maritime Weapons System Evaluation Program (WSEP) operations within the EGTTR would not reduce EFH quality and/or quantity. Explosions would not occur on the seafloor and, therefore, ordnance expenditures would not result in impacts to the substrate. Underwater detonations would not result in substantial sediment displacement to the seafloor. If minor displacement occurs, water currents would redistribute sediments so that habitat alteration would be short term. Furthermore, as described in the EA, these impacts are not expected to be significant or cause substantial damage to these habitats.

2. **Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (*e.g.*, benthic productivity, predator-prey relationships, etc.)?**

   No. NMFS does not expect that the limited action of issuing an Incidental Harassment Authorization to Eglin AFB would have a substantial impact on marine life biodiversity or on the normal functioning of the nearshore or offshore Gulf ecosystems. The mitigation and monitoring measures required by the Authorization would not affect benthic productivity or predator prey relationships.

   Because of the small zones of impact and the short duration of the WSEP operations, NMFS believes that there will not be a substantial impact on marine life biodiversity or on the normal functioning of the nearshore or offshore Gulf ecosystems.

3. **Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?**

   No, NMFS does not expect this action to have a substantial impact on public health or safety. Mitigation measures incorporated by Eglin AFB will ensure that no recreational boaters or commercial shippers are within the perimeter of the detonation site. Eglin AFB personnel perform WSEP activities at least 15 miles offshore. Likewise, the extensive monitoring that is required for detecting the presence of marine mammals in the proposed action area will alert Eglin AFB personnel to the presence of humans in the action area as well. However, due to safety concerns, other activities conducted by the public (*e.g.*, commercial shipping) would not and do not occur within the EGTTR.

4. **Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?**

   This action may adversely affect endangered or threatened species, marine mammals, and other non-target species, but such effects cannot reasonably be expected to be significant.

   No critical habitat is present within the action area, so none will be affected. The proposed action will not jeopardize the continued existence of any species listed under the Endangered Species Act (ESA). Listed species that might be affected include the loggerhead, green, hawksbill, Kemp's ridley, and leatherback sea turtles. Adverse effects will be limited to short-term behavioral disturbances that may constitute harassment. NMFS' Biological Opinion (issued January 2015 per the ESA) for this action supports this determination.

   The ESA-listed West Indian manatee is under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). However, the USFWS did not issue a Biological Opinion, as the West Indian manatee is not expected to be present in the offshore waters of the EGTTR. Therefore, the species will not be affected by the WSEP operations or by the issuance of an Authorization to conduct such activities.

   Several cetacean species may be present in the action area; however, with strict mitigation and monitoring measures implemented for the proposed action, NMFS has determined that the proposed actions are unlikely to result in the mortality or serious injury of marine mammals and, would result in, at worst, a temporary modification in behavior by marine mammals. Some non-target fish and invertebrate species may be killed or injured by maritime strike operations; however, since the proposed impact area is small, NMFS has determined the adverse effects to fish and invertebrate species would be insignificant.

5. **Are significant social or economic impacts interrelated with natural or physical environmental effects?**

   No. NMFS expect that no significant social or economic effects would result from our issuance of an Authorization to Eglin AFB. the primary impacts to the natural and physical environment are expected to be acoustic and temporary in nature (and not significant), and not interrelated with significant social or economic impacts. Additionally, this action will not have a significant social or economic impact as the action is confined to military personnel and would be conducted in a limited geographic area. Therefore the Eglin AFB activity will not significantly displace other resource users.

6. **Are the effects on the quality of the human environment likely to be highly controversial?**

   No, the effects of our issuance of an Authorization for the take of marine mammals incidental to the proposed activities are not highly controversial. The effects of the Eglin AFB's proposed action are primarily related to the input of sound, resulting from WSEP operations, into the environment. The Air Force has conducted these activities for decades, and NMFS is not aware of any party characterizing their activities as controversial.

   The implementation of mitigation and monitoring measures included in NMFS's Authorization will ensure that no marine mammals are injured or killed, and that impacts to marine mammals are limited to, at most, temporary harassment. While NMFS' judgments on impact thresholds are based on somewhat limited data, enough is known for NMFS and the regulated entity (here Eglin AFB) to develop precautionary monitoring and mitigation measures to minimize the potential for significant impacts on biological resources. As such, the effects of NMFS' issuance of an Authorization are not highly uncertain, and the action does not involve unique or unknown risks.

7. **Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?**

   No, this action will not affect terrestrial ecosystems or nearshore and estuarine habitats. The location of the testing/training area is the Eglin Gulf Test and Training Range (EGTTR) in the northern Gulf of Mexico. Exercise areas would be located on continental shelf waters. No substantial or adverse impacts to essential fish habitat (EFH) are anticipated as a result of implementing the proposed action or any of the alternatives. Items and materials expended into the EGTTR would not result in any adverse impacts to the chemical or biological environments that would reduce the quality and/or quantity of EFH. The proposed activities would occasionally introduce small quantities of chemical compounds into the marine waters of the eastern Gulf, which would rapidly disperse. hese additions would be too small to adversely impact any of the EFH of the Gulf waters.

8. **Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?**

   No. As indicated in a previous response, the effects of underwater explosions and resultant sounds on marine mammals and other species are not fully known. NMFS' judgments on impact thresholds are based on limited data, yet enough is known for NMFS and the regulated entity (here Eglin AFB) to develop precautionary measures to minimize the potential for significant impacts on biological resources. The multiple mitigation and monitoring requirements required of Eglin AFB are designed to ensure the least practicable impact on the affected species or stocks of marine mammals and also to gather additional data. These measures are not likely to result in increased risk to affected marine mammal stocks. For military readiness activities (as described in the National Defense Authorization Act of 2004), a determination of least practicable adverse impacts on a species or stock includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. The protected species surveys, the ramp-up procedures, and the sea state restrictions will help reduce highly uncertain and unique and unknown risks to human life while still effecting the least practicable adverse impact on the affected species or stocks in the proposed action area.

The potential risks of training activities resulting in elevated sound levels are not unique or unknown, nor do we expect there to be significant uncertainty about impacts. We have issued numerous Authorizations to the Air Force for the same activities for decades and have conducted previous NEPA analyses on those actions. Each Authorization required marine mammal monitoring and monitoring reports, which we reviewed to ensure that activities have a negligible impact on marine mammals. In no case have impacts to marine mammals, as determined from monitoring reports, exceeded our previous determinations under the MMPA and our analyses under the NEPA. Therefore, the effects on the human environment are not likely to be highly uncertain or involve unique or unknown risks.

9. Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

No, NMFS believes that the proposed action is not related to other actions with individually insignificant, but cumulatively significant impacts. There are other military activities in the northern Gulf that result in detonations that may result in the harassment, injury, or mortality of marine mammals. However, these activities, which are described in the EA, (e.g., Precision Strike Weapons and Air-to-Surface Gunnery exercises and Naval Explosive Ordnance Disposal School activities) are separated both geographically and temporally; all are infrequent in occurrence and short-term in nature. In addition, all currently use mitigation and monitoring procedures to ensure that no marine mammals or ESA-listed species are killed or seriously injured, and measures are taken to minimize impacts to the lowest level practicable.

This area is not known for heavy ship or recreational boat traffic but is subject to some oil and gas exploration, development, and production. The area may also be subject to localized effects from the explosive removal of offshore structures. Additionally, marine mammal research and geophysical seismic survey cruises operate within the Gulf of Mexico. Monitoring reports from scientists conducting research on marine mammals in the Gulf indicate that their activities do not have more than a minimal, short-term interruption of the animals' behavior prior to the presence of the researchers. The monitoring report for a recent seismic survey in the GOM indicated that far fewer marine mammals were sighted during the study than originally anticipated. Additionally, all takes of marine mammals during the cruise were by Level B behavioral harassment. For example, the two dolphin groups that were sighted during seismic operations did not demonstrate detectable differences in observed movement or behavior from those observed during periods with no seismic activity. No deaths or detectable injuries of marine mammals were observed during the seismic program. The activities noted here are all subject to implementing mitigation and monitoring measures to reduce impacts to marine life to the greatest extent practicable.

10. **Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?**

No, the proposed action and associated WSEP operations and other programmatic mission activities within the EGTTR would not take place in any areas listed or eligible for listing in the National Register of Historic Places and would not cause loss or destruction of any significant cultural or historic resources.

11. **Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?**

No, the proposed action would not remove nor introduce any species out of or into the environment. Therefore, it would not result in the introduction or spread of non-indigenous species.

12. **Is the proposed action likely to establish a precedent for future actions with significant effects or does it represent a decision in principle about a future consideration?**

No, this action will not set a precedent for future actions with significant effects or represent a decision in principle about a future consideration. To ensure compliance with statutory and regulatory standards, NMFS' actions under section 101(a)(5)(D) of the MMPA must be considered individually and be based on the best available science, which is continuously evolving. Moreover, each action for which an incidental take authorization is sought must be considered in light of the specific circumstances surrounding the action, and mitigation and monitoring may vary depending on those circumstances. For these reasons, NMFS does not believe that issuance of an Authorization to Eglin AFB to conduct WSEP operations within the EGTTR is precedent setting.

13. **Can the proposed action reasonably be expected to violate any Federal, State, or local law or requirements imposed for the protection of the environment?**

No, the issuance of an Authorization would not result in any violation of federal, state, or local laws for environmental protection. No ESA-listed marine mammals under NMFS jurisdiction are known to occur within the action area; therefore, there is no requirement for NMFS to consult under Section 7 of the ESA on the issuance of an IHA under section 101(a)(5)(D) of the MMPA. NMFS' issuance of an Authorization is conducted in conformance with the MMPA. NMFS has made all appropriate determinations under other applicable statutes, and NMFS' action will not violate any laws or requirements.

Finally, Eglin AFB is required to obtain any additional federal, state and local permits necessary to carry out the proposed activities. Eglin AFB's WSEP operations requires issuance of multiple permits. Each agency will review Eglin AFB's action as appropriate to ensure that no federal, state, or local laws or requirements will be violated.

14. **Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?**

No, the proposed action is not reasonably expected to result in cumulative adverse effects that could have a substantial effect on target or non-target species. NMFS' issuance of an Authorization is specifically designed to reduce the effects of Eglin AFB's activities to the least practicable impact to marine mammals, through the inclusion of appropriate mitigation and monitoring measures. NMFS has no other proposed or current actions in the project area, and the issuance of an Authorization does not result in significant cumulative impacts when considered with all other past, present, and reasonably foreseeable projects.

Similarly, despite temporal overlap and the potential tor limited spatial overlap, the cumulative effects of Eglin AFB's proposed activities and other past, present, and reasonably foreseeable projects are not considered cumulatively significant. The Cumulative Impacts section of Eglin AFB's EA addresses this topic in greater detail. Implementation of the proposed action, in conjunction with other past, present, and reasonably foreseeable future actions, would not be expected to result in significant cumulative impacts to the environment. As such, the proposed action will not result in cumulative adverse effects that could have a substantial effect on species in the action area.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting EA titled, *Maritime Weapons System Evaluation Program, Eglin Air Force Base, Florida, Final Environmental Assessment*, prepared for Eglin AFB and their application for an Incidental Harassment Authorization, NMFS, has determined that issuance of an Authorization to the U.S. Air Force will not significantly impact the quality of the human environment, as described in this FONSI and in the supporting documents.

NMFS published a notice of proposed Authorization in the *Federal Register* and received no public comments on the application or the EA. NMFS considered comments solicited from the Marine Mammal Commission, which presented no new information that affects this determination. Accordingly, preparation of an environmental impact statement for this action is not necessary.

Perry Gayaldo

FEB 04 2015

Donna S. Wieting
for Director, Office of Protected Resources,
National Marine Fisheries Service

Date